Here be dragons – Challenges of geothermal projects in Hungary

Péter Juhász, PhD, CFA[1], Péter Kovács[2]

[1] EU-Fire EGS Hungary Kft., Hungary, Corvinus University of Budapest

[2] EU-Fire Kft., Hungary

peter.juhasz@eu-fire.hu

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ABSTRACT

Using seven Hungarian projects operating or under realisation as case studies a PESTEL analysis has been carried out. Main problems involve frequent changes of political decision makers and tax investigators, changing regulations, no state guarantee funds for geothermal projects, and investors considering renewable energy as one homogenous industry.

1. INTRODUCTION

While Hungary has a huge geothermal potential used by spas and baths for several hundreds of years, geothermal district heating and electricity generating projects are still rare and in experimental phase. Is this only due to historical development or is there more behind? Could geothermal energy offer a boost to local and regional development or it stays an exotic energy source mentioned in the books only?

While working for EU-Fire group, one of the few local players pushing forward geothermal industry by sponsoring various projects, we have gathered considerable experience during the recent years not only in planning and managing geothermal construction projects but also in finding investors and educating both governmental decision makers and the general public. Using the PESTEL analysis this paper does not only reveal the industry's current status but also the future potential development opportunities are identified. Our review concludes with proposals for improving business environment for geothermal projects both in Hungary and in the EU, which may help to reach green energy targets set nearly a decade ago.

2. GEOTHERMAL ENERGY IN HUNGARY

Stigka, Paravantis and Mihalakakou (2014) emphasise that in 2010 most of the EU countries were still very far from their renewable energy usage targets for 2020. It might be explained by the fact that renewable prices are still higher than that of conventional energy sources. The situation was not much better in Central Europe even in 2014. (Table 1)

From among 20 emerging countries analysed by Paramati, Ummalla, and Apergis (2016) for 1991-2012 Philippines, Korea, Hungary and Brazil display the highest average clean energy consumption. Partly due to this, but mainly because of radical structural changes in industry during the same period Hungary saw its CO_2 emission decreasing from 6.4 down to below 5.0 metric tons per capita.

At the same time, Hungary having a heavily-export dependent energy system is not standing out in the region for renewable consumption based on OECD data (see Table 1), mainly due to shortage in hydro power. (Table 2) While some form of renewables lag behind due to inadequate natural resources or governmental support, the low proportion of renewables could be increased also on the bases of current infrastructure. Sáfián (2014) calls for more careful Hungarian energy policy as according to her calculations by changing the power plant utilization and using biomass more intensively 15 percent of energy need could be covered by renewable energy even in 2009 when OECD data showed a ratio of 7.31 percent.

At the same time, the huge geothermal potential of the country has a very limited use of energy generation currently, but to reach 2020 targets the country can not neglect this resource any further. Rman et al. (2015) and Tóth et al. (2016) offer a detailed geological review on the potential thermal water sources in the western part of the Pannonian basin. With 403 geothermal installations in the region this area seems very well utilised but that picture is pretty misleading due to the high number of spas and baths. They emphasise that not only usage is very limited regarding geothermal sources but also efficiency: waste thermal water is produced at 149 sites without further usage, while electricity generation is only present in Austria in a small pilot project. The identified unused potential sums to 4.7 million m^3 per year, while legislative potential is estimated to be

approximately 58.8 million m3 per year mostly concentrated in Hungary and Slovakia.

3. INTRODUCING EU-FIRE GROUP

EU-FIRE (Finance, Investment & Renewable Energy) is a Budapest based privately owned Hungarian company established in 2001.

Although originally focusing on major real estate development projects, EU-FIRE established a separate division in 2006 dedicated to professional issues of geothermal project technology.

Today, the group is an active player in the renewable energy field involved in geothermal energy utilization and project development (district heating and power generation) in Hungary (Table 3). So, EU-FIRE is experienced in technical, legal and financial feasibility of geothermal projects as well as in cooperating with authorities, experts, local municipalities, investors and other financers.

Table 1. Renewable energy as percentage of total energy consumed (percentage)

Country	2005	2010	2011	2012	2013	2014	2020 targets
Euro area (19 countries)	6.50	9.96	10.13	11.26	12.12	12.63	n.a.
Bulgaria	5.56	8.20	7.14	8.92	10.82	10.09	16.00
Czech Republic	3.95	6.22	6.95	7.49	8.47	8.77	13.00
Estonia	10.48	13.76	13.51	14.09	12.70	12.77	25.00
Croatia	18.97	21.90	18.32	19.71	24.25	24.49	n.a.
Latvia	32.15	30.99	32.39	36.39	36.08	36.23	40.00
Lithuania	10.12	15.68	15.08	16.37	18.13	19.08	23.00
Hungary	4.31	7.60	7.54	7.54	8.22	8.41	13.00
Poland	4.86	7.22	7.87	8.82	8.74	9.11	15.00
Romania	12.60	16.37	13.86	14.69	17.12	18.97	24.00
Slovenia	10.56	15.35	14.16	15.28	17.20	18.33	25.00
Slovakia	4.25	7.42	7.43	8.14	8.29	8.78	14.00
Serbia	11.70	13.18	11.03	12.67	12.95	15.07	n.a.
Ukraine	0.93	2.06	2.08	2.16	2.76	2.67	n.a.

Source: Own calculation based on OECD nrg_100a and nrg107_7a tables (2015) and European Council Directive 2009/28/EC

Table 2. Renewable energy forms as percentage of total energy consumed (percentage, 2013)

Country	Solar	Biomass	Geothermal	Hydro	Wind
Bulgaria	7.5	65.0	1.8	19.2	6.5
Czech Republic	5.2	87.2	0.0	6.5	1.1
Estonia	0.0	95.7	0.0	0.2	4.1
Latvia	0.0	87.8	0.0	11.7	0.5
Lithuania	0.3	92.1	0.1	3.5	4.0
Hungary	0.4	90.3	5.4	0.9	3.0
Poland	0.2	91.1	0.2	2.5	6.1
Romania	0.7	68.8	0.5	23.1	7.0
Slovenia	2.6	56.7	3.6	37.0	0.0
Slovakia	3.8	67.3	0.4	28.4	0.0
Serbia	0.0	55.7	0.2	44.1	0.0

Source: Based on OECD nrg_100a and nrg107_7a tables (2015)

Table 3. Major EU-FIRE geothermal projects

Location*	Type	Total capacity	Total cost
Makó	District heating	150 000 GJ/year	4.67 million EUR
Csongrád	Cascade system	56 000 GJ/year	1.38 million EUR
Mosonmagyaróvár (in progress)	District heating	120 000 GJ/year	8.70 million EUR
Kecskemét (in progress)	District heating	477 600 GJ/year	30.37 million EUR
Eger (in progress)	District heating	148 600 GJ/year	11.30 million EUR
Kiskunhalas (in progress)	District heating	100 000 GJ/year	8.40 million EUR
South Hungarian Enhanced Geothermal System Demonstration Project, Battonya (in progress)	Enhanced geothermal system for electricity and heat production	81 000 MW/year 600 000 GJ/year	116.33 million EUR

* All locations are in Hungary.

The firm has successfully concluded a number of national and EU grant applications over the past years, including state structural fund, Intelligent Energy Europe and NER300 schemes. Based on these, EU-FIRE possesses notable experience in complying with different European or local grant schemes and subsequent project coordination.

EU-FIRE relevant services in the field of geothermal energy projects include preparation of evaluation studies, project implementation, structuring project funding, and long term operation of implemented projects. Major projects of the company are summarized in Table 3.

4. PESTEL ANALYSIS OF GEOTHERMAL PROJECTS IN HUNGARY

To summarise our empirical findings based on seven different geothermal projects used as case studies, we performed a PESTEL analysis. The main results are as follows.

Political dimension

Generally politicians are in favour for using green energy sources but usually only up to the point where renewables also offer an energy cost reduction for the voters. During the recent years, one of the key focus areas of the government policy was to push down utility expenses of households. The success of that made it even harder to promote the use of renewables requiring extra investment the payback period of what has increased significantly.

No particular priority is given to geothermal projects that are also hit by the controversial policy of the National Energy Authority setting established energy prices for district heating based on the generation costs using natural gas that enjoys a serious governmental price subvention.

As in case of swallow geothermal projects the produced heat is sold mainly to district heating systems that are operated by companies owned by local communities usually, political influence in not negligible. The full time need of developing such projects could amount to even a decade during which 2-3 local elections could take place. Even if no relevant change in long term development policy of the given city, re-educating new representatives about the project requires considerable time and processes slow down during the election years.

At the same time, our EGS project received a very strong political support by being classified as governmentally prioritised. This resulted in shorter deadlines for authorities to provide allowances, and direct contact to Ministry of National Economy that is in charge of overlooking the national NER300 application. Without that status administrative processes by now would take altogether at least a year longer, what illustrates very well the lengthy and bureaucratic processes to get all the required allowances.

Economical dimension

Analysing data from 20 emerging market economies (including Hungary) for the period 1991-2012 Paramati, Ummalla, and Apergis (2016) showed that FDI inflows and stock market developments have a considerable positive impact on clean energy uses. Hungary enjoyed a serious FDI inflow during the recent 10-15 years, and it I partly due to this that we have more and more companies considering the use of renewable energy in their operation. This for example covers using solar or geothermal energy for heating office buildings and building bio gas production sites next to animal farms.

Markandya et al. (2016) have shown that in 21 out of 27 EU countries the employment effect of economies getting greener was positive. After their results Hungary gained 55 thousand jobs in the period 1995-2009 adding 1.4 percent to the total employment rate – one of the highest number among the CEE countries. (In Western Europe no country could achieve more than 0.5 percent.) The relative advantage of the country may lay in the local scarcity of oil and coal reserves (traditional energy sector) but very good opportunities regarding renewables.

Though, Reboredo (2015) showed that there is very limited convergence across countries regarding renewable energy consumption. He concludes that individual national support schemes are inadequate to attain rapid development. This is an important issues also in Hungary as it became clear by now that no matter the natural resources available without active political involvement, subsidies and clear pressure both local communities, firms, and households have limited interest in using more of renewable energy. As an excellent regional example, Zamfir et al. (2016) describe the weaknesses of Romanian system and underline that even today one of the greatest challenges in promoting renewable energy is to make it competitive in terms of cost with traditional sources of energy.

After our experience one of the biggest economic challenges is to educate investors. Very few are ready to finance renewable energy projects due to the high risk but even those few are not aware of the main differences across project types. While solar and wind power stations are modular and need relatively low investment to prove local power generating potential, geothermal projects require close to 60-70 percent of the total capital before the power generation potential can be fairly estimated. Once potential is confirmed the risk is minimal: the power station blocks are standardised, and there are usually no changes in the output across time for the next 25-50 years unlike to the former renewable technologies, which heavily depend on the weather conditions.

Not only investors are willing to offer capital only after the potential is fully confirmed but even then they require a rate of return similar to that of solar and wind technologies, which are far riskier during the

years of operation. Unfortunatelly, this erroneous view is shared even by some EU funds and international development banks, too.

The highest risk is clearly coming from finding the right plot for the wells, but there are no risk mitigation opportunities for drilling risk. Seeing that, no bank or investor from the open market is willing to provide funding, though, the capital need of an EGS project is hard to cover without them. No insurance or guarantee is offered on a market basis, so national or international guarantee funds probably sourced from selling CO_2 emission quotas would be a huge step forward.

Social dimension

Stigka, Paravantis and Mihalakakou (2014) underline that the increasing energy need and the negative effects of fossil fuel usage boost interest in renewable energy still covering a low proportion of total usage worldwide. Though, the level of social acceptance in not the same for all forms of renewable energy. Solar energy and small hydro projects are usually preferred over wind power and biomass, while little research is done on the acceptance of any kind of geothermal technology.

Local residents usually have little trust in green projects and emphasise drawbacks while general public is in favour of those investments. The paper (Stigka, Paravantis and Mihalakakou, 2014) quotes researches proving that households are willing to pay 16.6 percent more for green energy depending on their disposable income. Individuals with lower income, living further from the projects, and focusing less on environment protection issues are usually willing to pay less, while those with higher education, who are member of environment protection organisations and more up to date in energy policy issues are ready to pay more.

In case of shallow geothermal projects researched, social interaction was very limited due to very low environmental and economic effects and risks. Power stations and wells are located at the edges of cities and towns, the short on site building works do not disturb nearby traffic and cause no serious impacts on those living nearby. Operation is noise and emission free. Usually social effects cover mostly a considerable decrease in district heating prices after the projects are realized. But, as heat is bought in all cases by the operator of the heating system and not the households directly, no immediate link between the project owner and local citizens develop.

In case of our EGS project, a stronger contact with local citizens was established. Local meetings and forums were organised during which we have not experienced exaggeration of potential risks (seismic activity, under-surface water reserves) from local citizens or decision makers contrary to what is stated in the literature, but most of participants expected a huge economic development because of the project. This result can be explained by the underdevelopment of the local economy (high unemployment, weak infrastructure), and the fact that during the last decades the Hungarian oil company, MOL performed series of drills accompanied with under-surface explosions searching for natural gas reserves in the region causing no serious harm to local buildings or water reserves.

Technological dimension

While first investigations for oil and natural gas have begun in Hungary as early as 1909, it was during the period 1950-1980 that the entire country got reviewed. The huge number of wells – sometimes as deep as 4500-5500 meters – offered a very good overview of local geological structures and even today it is an advantage when looking for good locations for potential geothermal projects. The information database is owned by MOL rather than the state, what might need further considerations.

The abandoned or unsuccessful oil wells from the last decades offer a good potential for further geothermal projects mainly in the South Eastern part of Hungary. A potential solution for technical issues emerging is covered by Templeton et al. (2014). In some cases, during the last 40-50 years test drills for oil and natural gas of MOL recovered “only” huge geothermal potential only and wells were closed without further investigation or usage. In all those cases detailed documentations are available but most of the wells are owned by MOL and as the use of them might reduce exploitable natural gas reserves nearby, access to the wells may still need several years.

Another challenge comes from the fact that up until now, the national oil company has not actively entered the geothermal market, even though the strategy of the company still emphasises the importance of diversifying the activity towards green energy sources. Due to their huge expertise and the extent of resources available, Mol entering could give a dramatic boost of the Hungarian geothermal market.

Environmental dimension

Geothermal energy has the best potential in the region to reduce CO_2 emission in heat and electricity generation. Traditional geothermal technologies involve no considerable environmental risks while geological risks of EGS technology are limited and can be well mitigated. These projects do not emit noise or destroy natural territory of wild animals, EGS systems do not even require access to water reserves. Due to that a more powerful EU and nationwide support would be needed with a preferential system even among different renewables in favour of geothermal resources where applicable.

Legal and regulatory dimension

Geothermal projects face several challenges nowadays in Hungary. Green energy production support system is currently being reviewed but only limited feedback

is taken from the geothermal market participants by the regulators.

We agree with Manolopoulos et al. (2016) emphasising that Hungary (together with Greece) is the country with the highest authorities involved in process of licencing (both development and operation) power stations using renewable energy in the whole EU. It enhances time needed and administrative costs of the projects.

Also tax investigations hinder development. During the development phase projects pay more value added tax (VAT) than what they collect so they are entitled for VAT reimbursement quarterly. Before reimbursements, Hungarian tax authority regularly starts a thorough investigation not only at the specific project company but also at the main owners and key business partners. This leads to ongoing and overlapping tax authority investigations putting a huge workload on the accounting and financial staff in charge. Also at the start of each investigation we have to re-educate tax inspectors about the industry, the project and the project owners as not the same responsible person is assigned for the re-investigations of the same project at the tax authority.

4. PROPOSALS ON PROMOTING GEOTHERMAL ENERGY USAGE

Based on our review of literature and case studies prepared we believe that a green energy program focusing particularly on geothermal power plants could significantly contribute to an upturn of the economic development of Hungary. Still in our view, some further steps are needed to promote renewables and geothermal energy in particular.

(1) To boost demand for clean energy and support investments into projects linked to this industry global and regional institutions like the United Nations or the EU should keep a close eye on country level efforts to achieve fulfilment of former national pledges on renewable energy usage.

(2) EU and international development organizations should get a more detailed understanding of differences among renewable technologies to offer a more tailor-made support scheme for the development of each.

(3) The use of renewable energy sources with lower CO_2 emission should be given priority in the (inter)national energy strategies.

(4) The Hungarian national government should review the policy of the National Energy Authority not considering price subvention of natural gas when setting the established price on energy provided for district heating systems.

(5) To ease funding problems of exploration phase for geothermal energy projects characterised by high investment need and high uncertainty, risk mitigation funds should be set up either on national, or more preferably on EU or worldwide level.

Geothermal energy is not only renewable, but it also offers an efficient way to reduce CO_2 emission without incorporating significant environmental risks. As Hungary is rich in geothermal resources, we believe that this sub-industry could be one key field for closing the development gap between our country and the old EU member states. But that needs some changes in the current rules.

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