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DGE-ROLLOUT

Investors Profiling

Who might invest in DGE?

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Timme van Melle (EBN)

Frank Strozyk (Fraunhofer IEG)

Kris Welkenhuysen (GSB)

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1 Introduction

On the pathway to decarbonisation, deep geothermal energy (DGE) is a promising potential source for sustainable heat and electricity. For the geothermal energy sector to develop, significant investments must be made. This report gives an overview of potential investors in geothermal energy and their considerations when deciding whether to invest in this technology – or not.

This report aims to serve two purposes. Firstly, it helps identify potential investors so that they can be informed about opportunities in DGE. Secondly, it provides input for policy makers to lower any hurdles that might exist which inhibit the investment in DGE.

This report starts with an inventory of potential investors for DGE and their main characteristics. Subsequently, it identifies and describes the risks that are related to an investment in geothermal energy. It then proceeds with an analysis of the level of these risks.

Subsequently, it will assess which of these risks currently are hurdles for the investment in DGE (per category of investor), and what measures could be taken to remove these hurdles. It ends with conclusions and recommendations for policy makers.

2 Categories of investors & overview of key characteristics

This chapter provides an overview of the most common types of investors that might consider investing in DGE. It will discuss the following four questions about these types of investors.

1. **Why is the investor generally interested in or investing into DGE?** – To understand the strategic considerations behind an investment helps to better understand the decision making behind those investments.
2. **What type of investment?** Different types of investments have different risk profiles. This drives the considerations behind making them. The most important types of investments to distinguish are *equity* and *debt*.
 - **Equity** implies ownership. The return for an equity investment depends on what remains as a profit after all liabilities have been met, including those related to *debt*. Equity is generally seen as high risk and high reward.
 - **Debt** is capital that is provided against an interest rate by a third party. The return depends on the interest rate, which is more certain than the profit of the overall project. This, combined with the fact that the debt provider gets paid before the equity provider, reduces the risk of a debt financier. This is offset by the fact that for a debt provider there is no upside – the return will never be higher than the interest rate agreed upon. At the same time, there is a (small) chance that (part of) the capital will not be repaid.
3. **Is this investor type already known/established in DGE?**
4. **Local/national/international investor?** – What is the geographical scope of the investor?

In the paragraphs below, we will answer these questions for a number of categories.

2.1 Energy companies

1. Why is the investor generally interested in or investing into DGE?

An energy company provides energy to a customer, be it public or private, industry or homes, and in some cases other energy companies. They have developed a business in producing or buying energy and selling it again. DGE can deliver renewable and continuous energy to a grid, and provide an additional diversification of the energy production portfolio, reducing financial risk and grid balancing issues.

2. What type of investment?

An energy company itself can provide capital from equity from e.g. its investors. Additionally, it can raise finance through debt based on its balance sheet.

3. Is this investor type already known/established in DGE?

It depends on country and region whether an energy company is experienced with DGE, but in general most energy companies have limited experience. In NWE, most renewable energy is produced using wind and solar.

4. Local/national/international investor?

Although there is an international component to the energy market, most energy companies have a national or international scope.

2.2 Banks

1. Why is the investor generally interested in or investing into DGE?

Banks are typically risk-averse, they provide debt in order to gain interest on that debt. Which investments it chooses depends mostly on the level of interest that can be asked and the chance of not being able to recuperate the full loan and interest. An investment is not made in relation to any operational activities a bank undertakes.

2. What type of investment?

A bank usually provides debt. For geothermal projects this will generally be project finance. This means that a bank does not finance a company (based on its balance sheet) but a project (based on the expectation that this particular project will be successful).

3. Is this investor type already known/established in DGE?

Not many banks are sufficiently familiar with DGE to feel comfortable investing in it. The resource (exploration) risk is a reason for them to be wary.

4. Local/national/international investor?

Most banks will have a national and some an international horizon.

2.3 (Semi-)public Energy Companies

1. Why is the investor generally interested in or investing into DGE?

Over the past few years, DGE-focused public energy companies have begun to spring up due to the recognition of geothermal energy as a valuable source of renewable, GHG reducing energy. The willingness to invest depends strongly on the local conditions (subsurface, infrastructure, etc), the (public) funding possibilities and the political pressure for GHG-reduced energy production.

2. What type of investment?

Energy companies develop their own projects for to replace or supplement their energy production, often with additional public funding and R&D partners.

3. Is this investor type already known/established in DGE?

Rather likely, but this varies strongly from country to country. For example in the U.S. these companies are familiar with DGE. Also in Germany, like in Munich, public energy companies have experience with investments in DGE.

4. Local/national/international investor?

Local to regional, mostly coupled to the range of the supply infrastructure

2.4 Development Banks

1. Why is the investor generally interested in or investing into DGE?

Only indirectly through for example the Clean Technology Fund (CTF), which has been made available to multilateral development banks (MDBs) to support upstream geothermal activities. MDBs invest in funds for international geothermal projects to mobilize concessional funding for upstream development and to de-risk geothermal fields, and in turn, catalyse significant investment across the entire value chain. Their funding experienced at least a four-fold increase in the past decade.

2. What type of investment?

Multilateral financing for upstream activities.

3. Is this investor type already known/established in DGE?

Mostly indirectly by investing into e.g. multi-lateral funds.

4. Local/national/international investor?

International. Mostly focused on Africa, East Asia and the Pacific, and Latin America and the Caribbean.

2.5 End-user

1. Why is the investor generally interested in or investing into DGE?

End users might be interested in DGE to make their energy supply renewable and sustainable. Drivers can be to meet internal or external targets, to improve their branding, and/or to reduce dependency on external energy and energy prices.

2. What type of investment?

An investment might consist of equity or a loan. An important part of the arrangement would generally be a long-term contract for the offtake of energy produced. Both from a business as an accountant perspective this is often perceived as an investment. These long-term contracts are often reflected on the balance sheet of companies.

3. Is this investor type already known/established in DGE?

Not many end-users are familiar with this technology. They will see DGE as one of many options.

4. Local/national/international investor?

An end-user will be focussing on existing or sometimes new sites. This is very location specific. Whether this is local, regional, national or international depends on the size and geographical reach of the company.

2.6 E&P/ project developer

1. Why is the investor generally interested in or investing into DGE?

Exploration and production companies are usually oil and gas companies that are interested in developing alternative sources of energy. Because these have in-house knowledge on subsurface development and large infrastructure, they will also be the project developer. These companies

develop projects with a viable business case to provide a certain return and outlook for its shareholders. These companies are market-driven, and DGE can appeal as a longer-term renewable energy product.

2. What type of investment?

An E&P company itself can provide capital from equity from e.g. its investors. Additionally, it can finance through debt with e.g. a bank loan.

3. Is this investor type already known/established in DGE?

Specific project developers for DGE are emerging, but E&P companies are experienced in dealing with deep subsurface resources. Although the economics of such projects are different, many practicalities and techniques are similar to oil and gas production.

4. Local/national/international investor?

An E&P company usually has a national to international scope. As a project developer, this scope reduces to local or regional scale.

2.7 Insurance & Pension funds

1. Why is the investor generally interested in or investing into DGE?

These funds are looking for long-term, inflation-proof revenues to meet long-term commitments to their (future) pensioners. Due to their size and risk profile they are likely to look for funds to spread the risk over multiple projects.

2. What type of investment?

Can be loans or equity. Low-risk is however important. They are likely to be interested in a portfolio of projects that have been built and have a proven production. For this they accept lower revenues.

3. Is this investor type already known/established in DGE?

These funds are becoming familiar with ubiquitous technologies like wind and solar. They do not often have experience with DGE.

4. Local/national/international investor?

These institutions have a national or even international focus. As they look for a portfolio to spread risk over multiple projects and increase predictability of revenues, these institutions need a broad reach.

2.8 (Green) funds

1. Why is the investor generally interested in or investing into DGE?

Green funds can give investors exposure to green investing opportunities in a cost efficient manner while offering broader diversification than investing in a single company. Some green ETFs focus on specific subsectors (renewable energy for example) while some will offer a number of green subsectors in one fund.

2. What type of investment?

Both, direct investment into applied projects as well as R&D on international level.

3. Is this investor type already known/established in DGE?

Green funds are often already involved with DGE on international level via multilateral distribution of investment.

4. Local/national/international investor?

Mostly national to international.

3 Summary of investment risks for DGE

There are several risks associated with investments in deep geothermal projects. These risks are taken into account by potential investors. The cumulated assessment of these risks by the investor, in conjunction with the expected return and the investor's risk aversion, will determine whether an investment will be made. A description of the most important risks is listed below.

- **Short-term geological risk** – This is the risk that, upon subsequently completing a seismic survey, the first and the second drilling, the reservoir is less economically viable than previously assumed. This could be due to layers being thin or non-existent, insufficient hydraulic connectivity, insufficient temperature and/or flow rate conditions leading to reduced productivity.
- **Long-term geological risk** – This is the risk of degradation of the geothermal reservoir over time. This can either be related to natural depletion or excessive exploitation of the source. Both circumstances can lead to an economically unprofitable exploitation. Another risk component is the content of non-condensable gases which is believed to decrease the work output of the geothermal turbine (Gökçen and Yildirim, 2008).
- **Operational and maintenance risk** – This is the risk that the well will deteriorate during the life time of an installation. The fluid chemistry and particle production can promote corrosion and scaling of the geothermal loop.
- **Environmental risk** – This is the risk that environmental damage occurs related to the DGE asset. This can result in liabilities for the investors or project, and can cause production to be suspended or even stopped entirely. Examples are the (perceived) risk of contamination of the drinking water and (perceived) risk of induced seismicity.
- **Construction risk** – This is the risk of adversities during construction. For DGE this is most importantly the risk of delays during drilling. Examples are instability of the well, deeper-than-expected reservoir or discovery of carbohydrates which have to be dealt with. Delays in the delivery of important components for the well, leading to an increase of costs for the developer, are also included in this risk.
- **Social risk** – This is the risk that lack of social acceptance leads to delays in or abandonment of the project. Generally, projects concerning the exploitation of the deeper subsurface are sensitive for citizens and are therefore prone to incur resistance. This can cause delays and additional expenses.
- **Financing risk** – This is the risk of lack of financing for the next phase, incurring a loss of the development expenditure. By nature, this is mostly a risk for the initial developer. For debt providers this is not so relevant, as the financing risk mostly ends at the moment the debt is secured.
- **Interest rate risk** – This is the risk of interest rates changing and increasing the debt servicing costs. This is relevant if a floating interest rate applies, or if the project needs to be refinanced.
- **Energy prices** – Significant changes of energy prices either in terms of buying or selling can negatively affect revenues and costs.
- **Offtake risk** – Even with a contract in place, long term stability of offtake is important to provide cash flow. For geothermal, the relationship with the client is crucial because of the geographical restriction on delivering energy/heat alternative customers.
- **Credit risk** – If a customer goes bankrupt this might result in unpaid bills and lack of (long term) revenues.
- **Regulatory risk** – This risk involves changes in the existing legal framework, regulation and/or policy. These changes could either have advantages if they focus on the implementation of more support schemes for renewable energy solutions or they could be their demise if these changes work against these technologies.
- **Permit risk** – The development of DGE entails a fair amount of permits and licences. There is a risk that the permits and licences are not awarded, or only after considerable delay and/or expense.

- **Long-term uptake** – Renewable energy investments are strongly dependent on government support. For a party to decide to become a long-term investor there is a risk that this support will diminish. This would mean that the investment in resources, knowledge and networks is lost.

4 What types of institutions are candidates for investment in DGE?

As mentioned in the introduction, the first goal of this report is to assess what investors might be candidates for DGE investment.

To identify these candidates, in this chapter we will:

- 1) For geothermal energy, make an assessment of the levels of risks as defined in chapter 3
- 2) Based on this assessment and the risk profile of the different institutions as described in chapter 2, identify which institutions can manage these risks and can accept them, taking into consideration the reward they are expecting for the investment.

4.1 Assessment of risk

Table 1 assesses to what extent the different risks apply to DGE projects, and to what extent this affects the appetite of investors. The columns have the following information:

Risk – This is the risk as described in chapter 3

Relevant for – This indicates in which phase of the project the risk exists. *Development* is the phase during which a developer initiates the project and tries to bring parties together (including financiers) to take an investment decision. *Investment* is the phase during which the project is actually built. *Operation* is the phase starting when the asset works and the resource has been proven.

Level for DGE – This indicates the level of this risk for DGE projects in general.

Risk-reward assessment – This indicates the level of the risk-reward ratio for an investor. This includes the ability of the investor to assess the risk confidently.

Table 1: Risk assessment

Risk	Relevant for			Level for DGE	Risk-reward assessment							Notes	
	Development	Investment	Operation		Project developer	Energy company	Banks	Public energy companies	Development banks	End-user	Pension funds		Green Funds
Short-term resource risk	X	X		High	+	+/-	+/-	+/-	+	+/-	-	-/+	For many investors the uncertainty around the resource makes investment in DGE less attractive. This is clearly the case for pension funds, looking for long-term steady and low-risk revenues. It has been shown however that a guarantee scheme for this risk helps to convince financiers.
Long-term geological risk			X	Medium	+	+/-	-	+/-	+	+	+/-	+	Debt providers will want their loan repaid before the long-term geological risk starts playing a role. Longer term investors will become more comfortable as experience with DGE grows and therefore the available data of performance grows. With this data and a large portfolio this risk can be ascertained and managed.
Operational and maintenance risk			X	Medium	+	+	+	+	+	+	+	+	Based on experience with wells in the oil & gas sector the operational & maintenance expense can be forecasted reasonably well. This is comparable to the risk for other renewable energy investments.
Environmental risk		X	X	Medium	+	+	+	+	+	+	+	+	Environmental risks for DGE are low as long as well design is fit-for-purpose. Public perception and political pressure might however lead to adverse circumstances (see under regulatory risk).
Construction risk		X		Medium	+	+	+	+	+	+	-	+	Based on experience with wells in the oil & gas sector the construction costs can be forecasted reasonably well, and risks around construction are well known and manageable. Pension funds usually like to step in after construction. They are satisfied with the lower, but more certain reward in the operations phase.
Social risk	X	X		Medium	+	+	+/-	+	+	+	+/-	+	With DGE being a relatively new technology for many citizens, and subsurface issues are relatively unknown, there is a concern that public pressure will lead to an early end of a DGE project, even before the seismic acquisition has taken place. More research and public information are needed to show that DGE is a safe and sustainable option.
Financing risk	X			High	+	+	NA	+	NA	+	-	NA	This risk is inherently connected to the development phase. This is an important part of the reward of developers and their partners.

Risk	Relevant for			Level for DGE	Risk-reward assessment								Notes
	Development	Investment	Operation		Project developer	Energy company	Banks	Public energy companies	Development banks	End-user	Pension funds	Green Funds	
Interest rate risk			X	Low	+	+	+	+	+	+	+	+	Investors are generally comfortable and familiar with interest rate risk, and have sufficient tools to manage this risk.
Energy prices			X	Low	+	+	+	+	+	+	+	+	As long as long-term energy purchasing agreements are in place, investors are generally comfortable with energy price risk. Banks will require the long-term agreement to last until the end of the tenure.
Offtake risk	X	X		Medium	+/-	+	+/-	+	+/-	NA	+/-	+/-	As for all projects that produce heat and not electricity, offtake risk for DGE is high. Often a network needs to be developed in parallel with the source. This causes uncertainty that is not there with the delivery of for example electricity.
Credit risk		X	X	Medium	+	+	+	+	+	+	+	+	For the same reasons as above, credit risk is relatively high as it is relatively difficult – due to the limitation in transport of heat - to find an alternative purchaser if the existing purchaser defaults. However, credit risk is a familiar risk and manageable.
Regulatory risk		X	X	Medium	+/-	+/-	+/-	+/-	+	+/-	+/-	+	DGE is a relatively new technology in the eyes of the public. As concerns of the public find their way to politics, this makes DGE relatively vulnerable for regulatory measures. It is difficult to forecast how governments will act related to DGE.
Permit risk		X		Medium	+/-	+/-	+/-	+/-	+	+/-	+/-	+/-	Uncertainty and length of the permitting procedures add costs to the development of DGE. Subsidies sometimes expire due to longer-than-expected permitting procedures. It is not always clear what requirements are around safety and environment. This is a significant risk in DGE development.
Long-term uptake			X	Medium	+/-	+/-	+/-	+/-	+	+/-	+/-	+/-	It is yet uncertain whether DGE will take off. This makes investors hesitant to build up expertise and resources.

4.2 Concluding analysis

From the table the following can be derived:

- **Short-term resource risk is the main challenge for DGE projects** – The relatively high short-term resource risk is the main distinguishing feature of DGE projects. At the same time this is the risk that most financiers are not comfortable with. This is the main hurdle for the development of DGE projects. A measure that can resolve this is the provision of government guarantees to insure this risk. This is most likely to convince debt providers to accept this risk.
- **All parties struggle with off-take risk** – For DGE to grow, more District Heating Networks and other heat infrastructure must be developed in parallel. For a DGE project to have a return, there must be demand. For a District Heating Network to provide (renewable) energy, there must be a source. Unfortunately, both developments are fraught with uncertainty and risk. The lack of certainty makes investors hesitant. More coordination and government intervention can help reduce uncertainty and provide comfort for investors.
- **Off-take risk can be mitigated by end-users** – Off-take risk is difficult to manage for many financiers. End-users are by nature fit to mitigate this risk and can, by joining a partnership and taking up an investment or even just a long-term off-take agreement, reduce this risk.
- **Environmental risks are low, but lead to social and regulatory risk** – Perceived environmental risks do lead to real financial risks. It is important that governments have clear views and assessments of environmental risks and communicate these in their policies.
- **Permitting risk is high** – Governments (and also developers) do not always have the resources and knowledge to process (and submit) permits with high quality standards within the expected timeframes. For DGE to be successful and investors to join, this must be improved.
- **Development banks and green funds can help other investors** – These parties have the mandate to help new technologies develop. By taking on more risk – in line with their role – they can stimulate investment from purely commercial investors.

PROJECT PARTNERS



PROJECT SUP-PARTNERS



MORE INFORMATION

Dr Martin Salamon (Project Manager)

Martin.Salamon@gd.nrw.de

+49 2151 897 230

www.nweurope.eu/DGE-Rollout

 @DGE-ROLLOUT

SUPPORTED BY

europiZe UG

Dr Daniel Zerweck

+49 176 6251 5841

www.europize.eu

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