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Risk Mitigation Systems in Comparison

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ABSTRACT

This paper will deal with the concepts of public risk funds established to foster the development of geothermal markets in different countries of the world.

A comparison between the models of:

- KfW, Germany
- SAF-environment, France
- Ministry for Finance, Indonesia
- Swissgrid, Switzerland
- GRMF – Geothermal Risk Management Fund for East African Rift
- ARGEO, Worldbank

will be drawn. The existing models partially base on the concepts developed by Rödl & Partner such as

- KfW – Nation-wide soft loan program in Germany
- GEOFAR – Guarantee Fund system for EU – Commission
- National Development Agency, INDONESIA (revolving fund system)
- CAF (Corporación Andina de Fomento), South America, presently being developed: GDF – Geothermal Development Facility (South America).
- GRMF, East Africa, Rödl & Partner is assigned Fund manager, client is the African Union Commission

All particular fund systems follow the same objective: to lower the necessity of venture capital placement (financed from equity) in the early stages, which consequently enables projects to be developed and due interest reduction have a decreasing effect on LCOE (levelized costs of electricity). Hence, they impact the competitiveness of geothermal power generation in relation to alternative generation technologies and enable in particular the development of projects at all. Furthermore, projects with a less advantageous risk-reward-ratio (e.g. heat supply projects on medium or low enthalpy resources) face significant financing problems during the early stages which can only be financed by venture capital.

The expected outcome or profitability of such projects - taken the connected risk into consideration - will hardly lead to a placement of venture capital. A public fund system therefore takes the burden of early stage exploration or discovery risks and stimulates the market for geothermal projects and consequently leverages the investment in geothermal based infrastructure.

1. INTRODUCTION

Rödl & Partner, through its worldwide experience and participation in the design and implementation of different risk mitigation systems for geothermal energy projects, has conducted a review of the different existing mitigation systems including a comparison according to their main characteristics.

Understanding the different country characteristics and their impact on a potential scheme can aid in the design of a new risk mitigation system. Combined with an awareness of the possible variables that influence risk mitigation systems, a funding manager or local authority is armed with the tools needed for the successful design and implementation of a mitigation system. An overview of the factors, as well as the steering variables that make up a risk mitigation system is presented in the current study.

Recommendations can be derived from the results for specific economies and countries in question. The aim of this study is to provide an overview of existing mechanisms, and therefore provide countries that wish to embark on the fostering of geothermal energy projects, with the information needed to take decisions that will best lead them to achieving their desired geothermal energy goals. Specific recommendations would have to be generated together with the specific conditions of a country or region in question.

2. RISK MITIGATION SYSTEMS BACKGROUND

Inherent to every geothermal energy project are different risks that arise at different stages along the project life cycle and can be categorized into geological risk, legal & regulatory risk, development & construction risk, economical risk and operational risk. An overview of the different risks and their occurrence throughout the project life cycle is presented below.

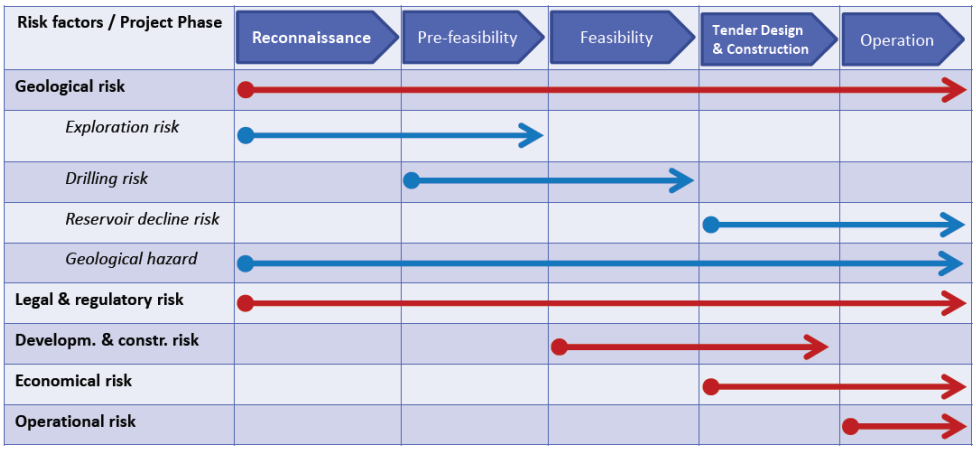

Figure 1 Risk Factors according to project phase[1]

Geological risks pose a significant financial barrier, especially since around 50% of the Capital Expenses (in case of medium enthalpy projects, 20-30% in case of high enthalpy projects) occur before geotechnical feasibility is secured. The geological risk in projects is typically the highest in the early development phases that aim to confirm the existence of a geothermal resource and give indications on the commerciality of a geothermal project. Financing the first exploration well is often a large barrier in the development of a geothermal project. It is at this point where many geothermal projects are abandoned. In Figure 2 below the qualitative development of capital employed and project risk can be observed.

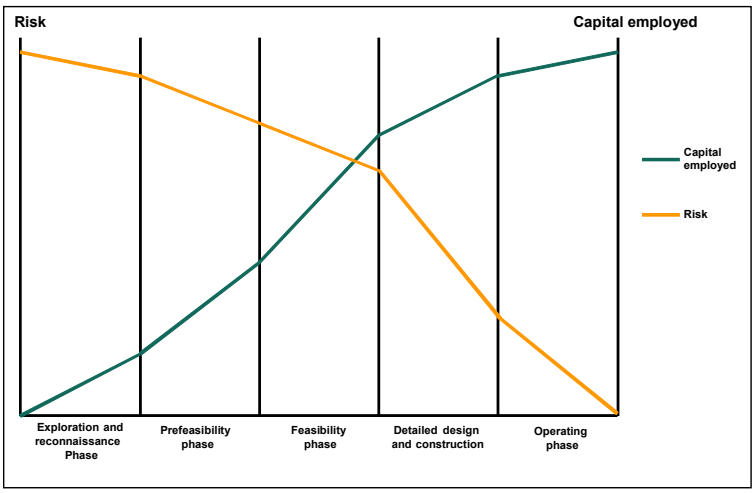

Figure 2 Development of project costs and project risks

To mitigate the exploration risk, mitigation schemes have been considered as valuable mechanisms to stimulate geothermal development. A risk mitigation scheme can have different approaches as shown above in

Figure **3**. There is the option of an insurance scheme, which will require the possibility to estimate the risk involved in the insured event, e.g. a failed exploration well. Furthermore the private sector has to be involved – it has to be avoided that a public financed scheme becomes competitive to the existing private insurance market. But also combination of both is possible, if the premium is financed by grants; however the risk appraisal will fix the amount, and so far the experience shows, that such insurances are rather expensive.

#	Possible Funding Instruments
1.	Insurance solution
2.	Grants
3.	Contingent grant
4.	Guarantee for commercial loans
5.	Concessional loans
6.	Loan with redemption grant
7.	Loan with indemnification clause

[1] Geoelec: Towards More Geothermal Electricity Generation in Europe (2014) [Online] Available at: http://www.geoelec.eu/wp-content/uploads/2014/01/GEOELEC-report-web.pdf [Accessed February 2014].

Figure 3 Possible Funding Instruments

A *grant* contributes directly to the equity financing of the project. The grant can be paid either in advance or in arrear. A grant provides the project developer with the greatest initial support, yet once the funds are depleted no more projects can be funded as the funds are not replenished through premiums or repayment. It is the most direct instrument for market stimulation, but cannot be the solution for financing the complete drilling phase.

A *contingent grant* is also a direct subsidy, yet provides for the partial replenishment of funds through a partial revolving effect. However, since a definition for drilling success is needed and the revolving effect needs to be managed, a higher administrative effort is required which in turn leads to higher costs.

Guarantees for commercial loans are given to a project developer by the public risk mitigation system in order to enable the acquisition of loans from the capital market. If the project proves unsuccessful, the risk mitigation system is responsible for the repayment of the loan.

Concessional loans and *loans with redemption clauses* are loans with subsidized interest rates or redemptions paid by a public fund. The loans should be designed in a manner, that the projects are not burdened by interests during the drilling phase; nevertheless the German system included such a system.

A *loan with an indemnification clause* is a loan given directly by the risk mitigation system to the project developer without the involvement of a third party i.e. a financial institution. These loans must not be paid back by the project developer in case the project is unsuccessful.

A fund selects the type of risk mitigation system depending on a variety of conditions intrinsic to the country(ies) in scope. These conditions are presented in the results sub-section “Recommendations for the selection of a risk mitigation system”.

4. RESULTS

The following the main results including:

- A detailed review of existing risk mitigation systems
- An analysis of existing risk mitigation systems and comparison
- Recommendations for the selection of a risk mitigation system

are provided.

4.1 Review of risk mitigation systems

In the review of risk mitigation systems, we describe existing systems in Germany[2][3], France[4][5], Switzerland[6][7], Indonesia[8][9] and East Africa[10]. An overview of the results of this section is presented below. Their main characteristics were identified and include key actors involved, sum of the funds or budget, geographical scope, program status, budget allocation and risk mitigation instruments. In several cases, the budget allocation was not done on a general basis but rather on a project-to-project basis.

[2] Federal Office of Economics and Export Control (BAFA): Federal Directive for the Promotion of Measures for the Use of Renewable Energies in the Heating Market of 20 July 2012 (2012) [Online] Available at: http://www.bafa.de/bafa/de/energie/erneuerbare_energien/vorschriften/energie_ee_richtlinie_20_07_2012.pdf [Accessed February 2014].

[3] KfW: Funds for Renewable Energy Projects (2014) [Online] Available at: https://www.kfw.de/KfW-Konzern/Service/Download-Center/F%C3%B6rderprogramme-%28Inlandsf.%29-%28D-EN%29/Merkbl%C3%A4tter/Erneuerbare-Energien/ [Accessed February 2014].

[4] S. Bézèlgues-Courtade, F. Jaudin: The French geothermal risk guarantee system (2008) [Online] Available at: https://pangea.stanford.edu/ERE/pdf/IGAstandard/GeoFund/Germany2008/Bezelgues-Courtade.pdf [Accessed May 2014].

[5] Geofar: The Geothermal Risk Guarantee System (2009) [Online] Available at: http://www.energia.gr/geofar/articlefiles/factsheets/France-Factsheet%20InsuranceMechanism.pdf [Accessed May 2014].

[6] Swiss Administration: Article 15b Energy Law 730 of 26 June 1998 (1998) [Online] Available at: http://www.admin.ch/opc/de/classified-compilation/19983485/index.html [Accessed May 2014].

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	Key Actors	Funds Sum	Geo. Scope	Program Status	Budget Allocation	Risk Mitigation Instruments
Geothermal Risk Mitigation for Eastern Africa	KfW, AUC, GEF	50M USD ▪ KfW 20M ▪ EU-ITF 30M	East African Rift Valley Countries	Application phase	Drilling Projects ▪ 20% of infrastructure costs ▪ 40% of exploration drilling costs ▪ 30% of continuation drilling costs in exceptional cases	Surface Studies ▪ 20% of infrastructure costs ▪ 80% of surface study costs
Indonesian Risk Mitigation Fund	Indonesian Finance Ministry	302M USD	Indonesia	Budget announced June 2013	To finance the geothermal exploration activities up to initial drilling exploration well(s) Target: local governments.	Revolving fund: Local governments use funds to determine successful areas, private developers shall then repay exploration costs.
German KfW Risk Mitigation Scheme	KfW, German Ministry for Developmt.	Total budget unknown, Max. 16M €/ project	Germany	Ongoing since 2007	*Model 1* ▪ 100% indemnification for up to 80% of the eligible investment costs *Model 2* ▪ 100% indemnification for up to 80% of the eligible investment costs ▪ Redemption grant in case of succesful drilling	
French Geothermal Risk Guarantee System	French Agency for Energy Mgmt.	Total budget unknown	France	Ongoing	*Short term partial risk guarantee* Up to 90% or 3M € of the total costs of the 1st well. 1.5% of max. guaranteed sum payable to fund. Indemnity as per success. *Long term partial risk guarantee* Compensates consequences of possible damage. 3.2% of max. guaranteed sum payable to fund	
Swiss Geothermal Risk Guarantee	Swiss Office of Energy, Swiss Grid Company	Max. 125M €/year	Switzerland	Ongoing	▪ Guarantee covers up to 50% of the drilling and testing costs ▪ Guarantee is financed by by an additional fee per kWh borne by the end consumer (0.08€/kWh) ▪ In case of partial success, compensation is determined by independent Brain Trust	

Table 1 Overview of risk mitigation systems[11]

4.2 Analysis and comparison of risk mitigation systems

The different risk mitigation systems presented in the previous sub-section differ in terms of the specifics of the financial instrument applied, goals, financial intensity and scope, among others. Most are national programs (Indonesia, Germany, France, Switzerland) set up with public funds with the intention of promoting development of geothermal projects through the mitigation of the initial geological risk. Only the Geothermal Risk Mitigation Facility (GRMF) [12], financed by international development funds headed by the KfW development bank began as a multi-lateral initiative covering 11 countries in the East African Rift Valley (EARs). The GRMF further differs from the other systems, in the sense that it was established with the instrument of grants, i.e. direct subsidy to encourage public and private investors to develop geothermal prospects for power development by funding surface studies and drilling programs. The success from the first application round of GRMF shows, that as market incentive this fund system works well, but is expensive due to unique use of funds.

The Indonesian fund was set up rather as a revolving fund, as funds will be provided initially to assess geothermal potential and will be then repaid by project developers upon being awarded a contract for development through a bidding process. [13][14]

What the European systems (besides France) have in common is that they concentrate on the particular discovery risks. Any further technical risks or lost-in-hole risks of the drilling phases are not covered by these funds, but have to be covered by separate technical risk insurances that are usually available on the insurance market.

The European systems also each establish their own success criteria, agreeing terms for a project to be pronounced as a failure, partial success, or success, and what proceeds in each of these cases. The German[15][16] and the French[17][18] system establish maximum

[11] Rödl & Partner: Own Table (2014)
[12] GRMF Webpage: About GRMF (2014) [Online] Available at: www.grmf-eastafrica.org [Accessed May 2014].
[13] Jakarta Globe: Indonesia Allocates 302 Million to Back Geothermal Exploration (2013) [Online] Available at: http://www.thejakartaglobe.com/business/indonesia-allocates-302-million-to-back-geothermal-exploration/n [Accessed December 2013].
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[16] KfW: Funds for Renewable Energy Projects (2014) [Online] Available at: https://www.kfw.de/KfW-Konzern/Service/Download-Center/F%C3%B6rderprogramme-%28Inlandsf.%29-%28D-EN%29/Merkbl%C3%A4tter/Erneuerbare-Energien/ [Accessed February 2014].
[17] S. Bézèlgues-Courtade, F. Jaudin: The French geothermal risk guarantee system (2008) [Online] Available at: https://pangea.stanford.edu/ERE/pdf/IGAstandard/GeoFund/Germany2008/Bezelgues-Courtade.pdf [Accessed May 2014].
[18] Geofar: The Geothermal Risk Guarantee System (2009) [Online] Available at: http://www.energia.gr/geofar/articlefiles/factsheets/France-Factsheet%20InsuranceMechanism.pdf [Accessed May 2014].

payouts per project, while the Swiss[19][20] system establishes a yearly budget. The fund system in Frances also integrated a system for operative risks insuring in this way the stable operation of the heat supply systems in the Paris basin.

4.3. Recommendations for the selection of a risk mitigation system

The question of how to select and establish the appropriate risk mitigation system to minimize the exploration drilling risk based on public funds, requires consideration of different premises that will eventually steer the decision maker into the selection of the optimum mechanism. There is the particular geological situation which is always "leading" the project.

There should not be the intention for a "design-to-target capacity" as the geology at a given location / area / region will always be the main determinant for the project size and production stability. Another key factor is the investment environment of the country in question, as it will play a major role for any investor. Political stability, legal security and economic attractiveness are the main decisive criteria. A risk mitigation scheme will not be able to compensate discrepancies in the aspects mentioned, but can be an incentive for the development of a geothermal power market and attract foreign capital.

Some of the main factors that require consideration before a risk mitigation system can be designed and implemented are depicted below in

Figure 4.

Figure 4 Risk Mitigation System influencing factors[21]

The steering variables pictured below in Figure 5 are the different influencing aspects on a risk mitigation system. In order to develop and implement a successful system it is essential that the local government, or the fund managing agency, first consider the main influencing factors that make up the characteristics of the region where the system is to be implemented, and then design the system accordingly taking into account the different variables available for the development of the system.

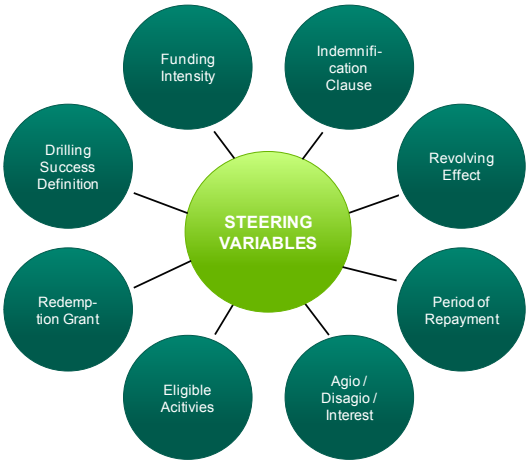

Figure 5 Steering variables during the development of a risk mitigation system[22]

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[19] Swiss Administration: Article 15b Energy Law 730 of 26 June 1998 (1998) [Online] Available at: http://www.admin.ch/opc/de/classified-compilation/19983485/index.html [Accessed May 2014].

[20] Swiss Administration: Appendix 1.6 Energy Decree 730 (1998) [Online] Available at: http://www.admin.ch/opc/de/classified-compilation/19983391/index.html [Accessed May 2014].

[21] Rödl & Partner: Own Figure (2014)

Depending on the characteristics of the specific country or region itself, different factors will carry a different weight. For example, a grant could be preferred in lesser developed markets such as East Africa, where a high incentive to bring projects into realization is required. The high impact on the market leads to best practice projects which can later be replicated. It helps to draw attention to the possibility that geothermal power generation improving the role of it in a particular energy market.

For regions with some initial exploration of potential, yet without still a small number of projects, a contingent grant could be preferred in order to secure the impact for the long term and ensure the replenishment of funds.

If a stronger revolving effect is desired, then a type of loan can be considered, where other mechanisms such as interest, agio or disagio payments may be included. In any case the detailed design and above all the subsidy intensity or interest rates have to be adapted to the particular market, bearing in mind the wished impact of the system.

In case of a loan with an indemnification clause or a contingent grant, the following challenges e.g. have to be considered:

- Drilling success needs to be defined in advance with a clear guideline concerning testing procedure; furthermore effort for the evaluation of testing results has to be integrated.
- Clear go / no-go decision has to be taken by fund manager on base of transparent criteria (regarding testing results) not allowing for discussion e.g. in case of partial discovery.
- Indemnification clause only active in case of geo-technically defined unsuccessful drillings, no other reasons such as problems with concessions, missing PPA, etc. are relevant.
- In case no project financing is possible due to non-geo-technical reasons; project developer still obliged to repay grant / loan.
- Unsuccessful drillings might still be used by project developers as indemnification clause may lead to economic feasibility in future due to changed market conditions or reduced size of power plant.
- In case of SPVs acting as project developer a comfort letter by the parent company could be obligatory to reduce risk of unpaid loans due to insolvency of SPV; problematic in case parent company is not credit-worthy – could be solved by Expression of Interest criteria.

It results, that any instrument has to be "tailor made" to a particular market and reflecting the interest of the funding party. Other aspects are certainly the administrative effort (absolute and valued monetarily) and the timeline in which such an instrument shall be operative. The complexity is high, due to the fact that financial, geological, administrative and even regulatory aspects have to be considered.

5. CONCLUSION

The comparison of existing risk mitigation systems is helpful when considering the design of a new system in a region where little or no experience in risk mitigation systems has been acquired.

A structured approach helps both the funding entity, as well as the project developers to secure to realize the maximum impact of the public money to achieve the objective of both parties: geothermal energy or power generation.

Specific recommendations can be generated on a country-by-country or regional basis, as the main influencing factors will vary strongly, mainly due to geology, but also regulatory factors, infrastructure, and power market, among others will play an import role.

Challenges will exist for any risk mitigation system, however if the risk mitigation system is designed in such a way that the initial influencing factors have been duly taken into account and allowed for, these challenges can be foreseen and handled in due time. Important lessons can be learned from the existing risk mitigation systems worldwide and should be considered together with the context of the location as well before being copied and implemented in another region of the world.

If designed properly such fund systems can lay the base for a geothermal market development where otherwise no project developing activities would take place.

6. REFERENCES

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[22] Rödl & Partner: Own Figure (2014)

GRMF Webpage: About GRMF (2014) [Online] Available at: www.grmf-eastafrica.org [Accessed May 2014].

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S. Bézèlgues-Courtade, F. Jaudin: The French geothermal risk guarantee system (2008) [Online] Available at: https://pangea.stanford.edu/ERE/pdf/IGAstandard/GeoFund/Germany2008/Bezelgues-Courtade.pdf [Accessed May 2014].

Swiss Administration: Appendix 1.6 Energy Decree 730 (1998) [Online] Available at: http://www.admin.ch/opc/de/classified-compilation/19983391/index.html [Accessed May 2014].

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