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Risk Sharing Mechanism (RSM) for Geothermal Resource Validation in Turkey – Working Processes and Experiences

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ABSTRACT

A Risk Sharing Mechanism (RSM) for Resource Validation was established in Turkey as a component of the World Bank financed Geothermal Development Project (TGDP) that became effective in March 2017. The RSM is implemented by the Development and Investment Bank of Turkey (TKYB) and is capitalized by a $38 million contingent recovery grant from the Climate Technology Fund (CTF). A consortium of technical consultants, ÅF Consult, ÍSOR, and Verkís, (RSM Consultant) was hired under the TGDP to provide technical support to TKYB and support the day to day operation of the RSM. The objective of the RSM is to increase private sector investment in geothermal exploration drilling in Turkey by providing partial coverage of exploration wells' drilling costs in case that wells drilled under an RSM-supported drilling program do not meet commercially viable power output criteria. Exploration drilling projects are selected for coverage under the RSM through a competitive application process. Developers selected for RSM coverage can get 40% or 60% cost coverage of unsuccessful wells. Projects in the less explored provinces of the country will receive 60% cost coverage whereas the coverage for the lower projects applies in areas where extensive geothermal development has already taken place and the exploration drilling risk is considered lower. This paper describes the structure and general terms of the RSM and the whole RSM process cycle, consisting of (i) marketing activities and preparation of RSM call for proposals, (ii) evaluation of proposals and negotiation with selected developers, (iii) monitoring and reporting on the exploration drilling projects. As of July 2019, the project is in stage (ii). Hence, for the phases (i) and (ii) the authors will also discuss some of the lessons learned to date, which can be of value for other project teams involved in setting up similar facilities for geothermal development in other countries.

1. INTRODUCTION

The energy policy of the Turkish government has, among others, the following priorities (i) maximizing exploitation of domestic primary energy resources and (ii) securing sufficient, reliable and affordable energy to a growing economy in an environmentally sustainable manner. In this context, the government of Turkey has put in place a supportive legal framework to facilitate geothermal development. A critical milestone was the Geothermal Law of 2007, which set out the rules and principles for effective exploration, development, production and protection of geothermal and natural mineral water resources. In 2010 an amendment to the Renewable Energy Law established a feed-in tariff of 105 USD/MWh for geothermal power, for a 10-year period from the commissioning date, with an addition up to 27 USD/MWh to reward the use of locally produced equipment, for a 5-year period from the commissioning date. The exploration activities conducted by the General Directorate of Mineral Research and Exploration of Turkey (MTA) have also been a critical driver behind geothermal development in the country. The MTA had a mandate to explore geothermal resources in Turkey for several decades and when the geothermal sector opened up for private investors after 2007 a large number of geothermal fields had already been partially de-risked by MTA's exploration drilling.

The geothermal power sector in Turkey has experienced a phenomenal boom in recent years. The installed capacity grew from some 15 MW in 2006 to 1,336 MW in 48 power plants as of May 2019 (TEIAS, 2019). Moreover, power plants with a total installed capacity of around 210 MW are currently under construction. This rapid growth has led the government to increase the target of developing 1,000 MW geothermal electric generation capacity by 2023 to a target of 4,000 MW by 2030. However, this growth has been restricted to Western Turkey, as the vast majority of the capacity development has taken place in the Menderes and Gediz valleys, the areas where MTA had carried out most of its exploration drilling in the past.

Direct application of geothermal energy is more widely spread in Turkey than power production. While most of the direct application uses also occur in the Western part of the country, significant direct applications are also found in the South-Eastern part and to some degree in the central part of the country. The total direct use of geothermal energy amounts to 3,589 MWth, which corresponds to the heating needs of 346,000 housing units, as of December 2018 (JD, 2019), while reported estimates range from

31,500 to 60,000 MWth as the total geothermal potential of the country. Direct application of geothermal energy in Turkey has not grown significantly in the last five years in contrast to the rapid growth of geothermal power production.

The Risk Sharing Mechanism for Resource Validation (RSM) is one of two components of the World Bank financed Turkey Geothermal Development Project (TGDP) that was launched in 2017 to support further development of geothermal energy in Turkey. The main objective of the RSM is to increase private sector investment in geothermal exploration drilling in Turkey, in particular in areas that have not been extensively explored to date. This will be achieved by sharing some of the resource risk with private developers. After an exploration well is properly drilled, the RSM will compensate the Beneficiary in the case the well does not meet the success criteria as defined by the conditions set forth in the Beneficiary Agreement (BA) between the RSM and the developer. Conversely, the Beneficiary will pay a success fee to the RSM when an exploration well is properly drilled and meets or exceeds the success criteria as defined in the BA. In this paper, RSM implementation is described from the view of the consultants in the "RSM Consultant JV", which provide technical and administrative support to TKYB in all stages and aspects of the establishment and implementation of the RSM. The RSM Consultant JV consists of ÅF-Consult Switzerland Ltd, ÅF-Mercados EMI Turkey, ÍSOR and Verkís supported by BBA legal, the latter three all in Iceland. ÅF-Consult acts as the joint venture leader and manages the contact with TKYB and the RSM beneficiaries through its local office in Ankara and an office in Baden/Switzerland.

2. PROJECT STATE AND ORGANISATION

The project can be divided into the three main phases listed below:

- Phase 1: Preparation period of the RSM
- Phase 2: RSM Application rounds / Agreement negotiations
- Phase 3: Monitoring and reporting

As July 2019, the project is in Phase 2. In the following section, we describe the process and the experience gained to date after the first two phases and describe the expectations for Phase 3. In Phase 3, the consultants will support TKYB in all aspects with respect to administration and technical implementation of the selected geothermal projects.

3. PHASE 1: PREPARATION OF THE RSM

The key task for Phase 1 was to facilitate the preparation of the first RSM application round and raise the attention of potential beneficiaries of the RSM to ensure a sufficient number of applications for resource risk coverage.

The activities during the preparation period consisted of finalizing the terms of the RSM and preparing a Beneficiary Manual for the program. The Beneficiary Manual summarizes all information needed for the preparation of an application for coverage under the RSM and is available for download on the project website http://rsmgeoturkey.com (RSM, 2018). The document describes the terms of the RSM, presents detailed information on the requirements for coverage under the program, lists all information and documents that need to be included in an RSM application and outlines the evaluation and selection process for successful applications.

Applicants to the RSM were required to submit the following information as a part of their application:

1. Certificate of incorporation as evidence that the Applicant exists as a legal entity. In the case of joint ventures, all partners need to submit certificates of incorporation.
2. Surface exploration information which meets base RSM requirement for participation in the program
3. Conceptual model and resource capacity evaluation
4. A professionally prepared business plan showing how the geothermal energy will be utilized and geothermal resource energy requirements necessary to meet such plan
5. A professionally prepared drilling and testing program, including cost estimates, for the exploration wells
6. The financials and governing documents of the legal entity that will be the Beneficiary of RSM funds as well as clarification of any liabilities facing the legal entity
7. Proof of necessary permits, licenses (including exploration licenses) and unobstructed rights to the concession
8. Applicable environmental and social impact studies and management plans
9. A well-documented statement of technical capacity of the legal entity as it pertains to the successful management of the project, including key personnel and references

The list shows that for the development of the Beneficiary Manual and the evaluation of the applications received an interdisciplinary team is required, which can cover the topics of geothermal subsurface characterizations, ecological, socio-economical, economic & financial, as well as legal aspects.

A key lesson from Phase 1 of the RSM program is that face to face meetings are essential for raising awareness among the potential beneficiaries of the program. The RSM consultant has found that meeting with geothermal developers and operators, TKYB clients, other local stakeholders such as consultants, suppliers, specialized media, business associations and chambers of commerce has been the most efficient marketing method for the RSM. Geothermal conferences also provided a good opportunity to introduce the RSM, to get into an exchange and discussions with potential investors and furthermore to understand the challenges and needs of the investors and adjust the RSM design accordingly. A very important factor for the success of this market outreach particularly and for efficient support to the RSM generally is the local presence of the RSM Consultant JV.

4. PHASE 2: RSM APPLICATION ROUNDS / AGREEMENT NEGOTIATIONS

In the first part of this section the evaluation procedure of the applications is explained and in the second part the negotiation process is described.

4.1 Evaluation procedure

For the evaluation a three-stage analysis procedure was applied. The whole evaluation process is shown in Figure 1, whereby stage 3 "Further evaluation and ranking" is further explained in Figure 2.

In the first stage of the evaluation process, applications were screened for completeness, including availability of licenses, permits and certificates. In the case of missing or inadequate information, the applicant was notified before rejection for clarifications or in case the applicant had not delivered the required data by mistake.

The second stage of the evaluation process was used to assess whether the surface exploration data and the resulting conceptual models indicated a viable resource to support the needs of the applicant's business plan. The surface exploration data were reviewed to confirm a positive indication of the presence of a viable geothermal resource in the license area. This stage of the evaluation process focused on two main aspects of the application, which include: a) the credibility of the conceptual models based on the surface exploration data and b) the intended use of the geothermal energy as described in the business model. Applications for which the geoscientific exploration data did not support the existence of a viable resource that would meet the intended use identified in the business plan were rejected at this stage. The question whether a geothermal resource is viable is a very complex issue and requires a large number of investigation reports, which had to be provided by the applicants and evaluated by the geothermal experts of the RSM Consultant JV. More specifically, each applicant had to provide geological, geophysical, and geochemical exploration data, as well as the description of a conceptual model (e.g. likely reservoir temperature, expected size and thickness of the reservoir, geological, hydrogeological, and chemical conditions and finally a resource assessment).

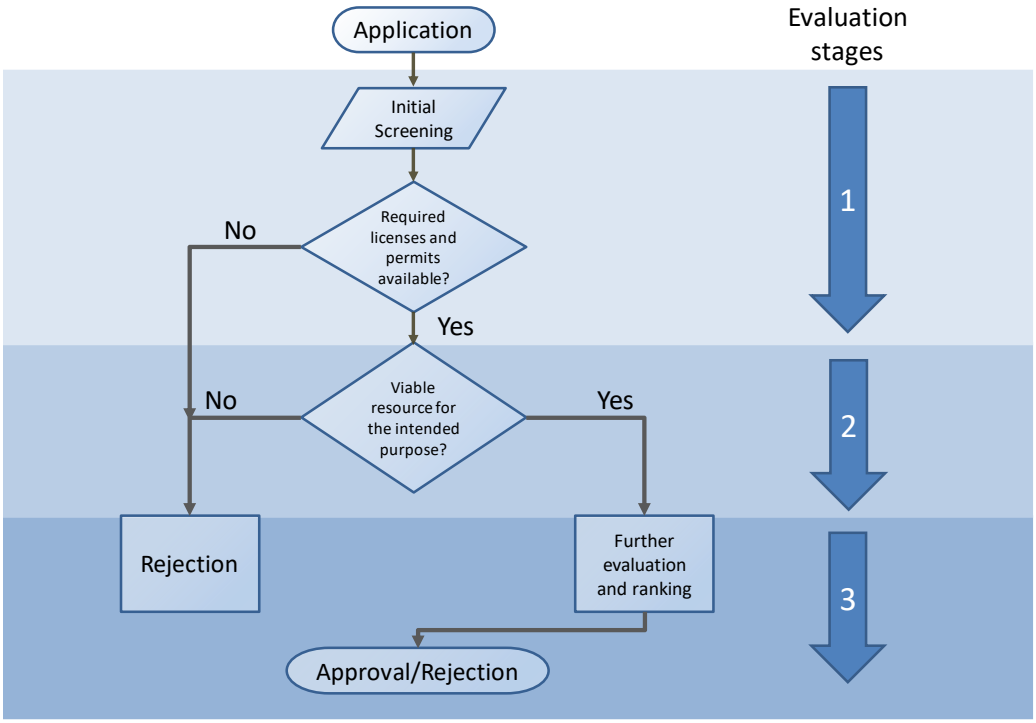

Figure 1: Flowchart showing the evaluation process for RSM applications.

If the applicant provided data indicating the existence of a viable geothermal source that would meet the intended utilization identified in its business plan, the application moved into the third stage of the evaluation. The procedure for the third stage is shown in Figure 2. In this stage, applications were scored for the five following categories. The weight of each category in the evaluation process is given in brackets:

- Quality of geoscientific exploration data and the resulting conceptual model (30%)
- Completeness and appropriateness of drilling programs and well designs (20%)
- Geothermal experience of the Beneficiaries or its consultants (20%)
- Quality and completeness of the business plan, including financial- and cost estimates (25%)
- Location (5%)

Applications were then ranked in priority order with highest priority being given to the application with the highest total score. A minimum score of 70 points out of 100 was required for further consideration.

In addition to the description of the geothermal exploration results, the planned use of the resource and a solid business plan, the applications also had to include an Environmental and Social Management Framework (ESMF) including, as relevant, the

following: Environmental and Social Management Plan, Stakeholder Engagement Plan, Cultural Heritage Management Plan and Change Find Procedure, Occupational Health and Safety Management Plan, Resettlement Action Plan, Road Safety Plan, Waste Management Plan, Effluent Management Plan, and Hazardous Material Management Plan.

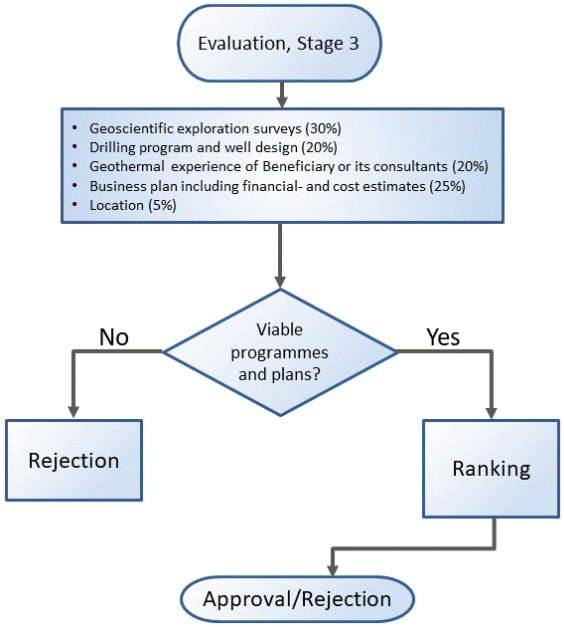

Figure 2: Stage 3 of the evaluation process.

Within the first application round, 21 applications were received, which was considered as a success given the novelty of the RSM program. The geographical distribution of the applications is shown in Figure 3. The figure shows also that the compensation for acceptable well costs in the case of an unsuccessful well differ from region to region as previously explained. For regions where extensive geothermal exploration has taken place maximum compensation is 40% (selected regions in Aydin, Denizli, Manisa), and for less explored regions the compensation is 60%.

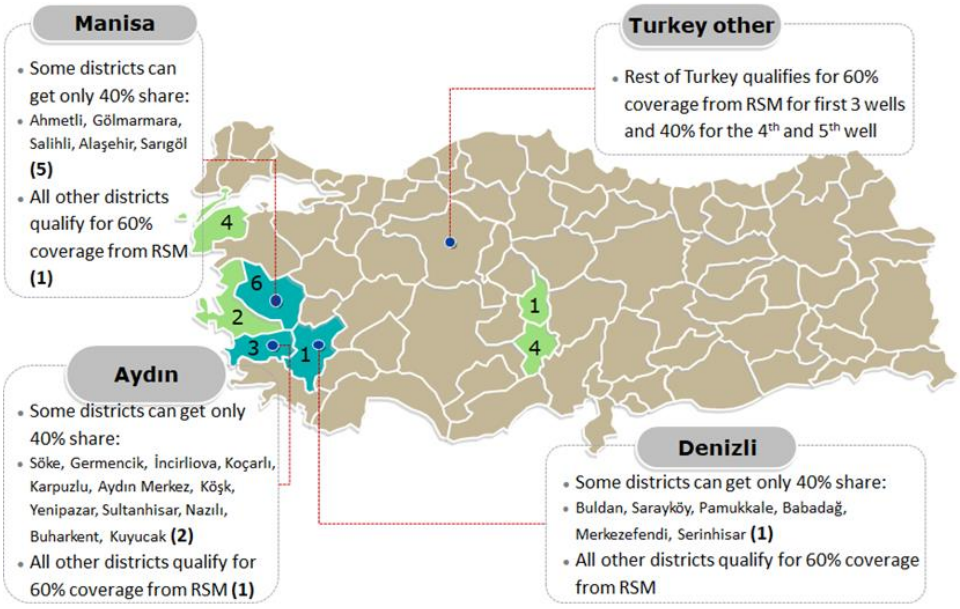

Figure 3: Geographical spread of the fields for which firms have applied for the RSM.

From the first round of applications, the RSM Consultant JV gained hands-on experience in the process of inviting applicants and reviewing the applications received. For a potential second round, the RSM Consultant JV suggest preparing more clearly defined online forms leading the applicant through the application procedure. This will comprise templates to ensure that all key information is covered and presented clearly with respect to the geoscientific exploration as well as the business plan. It is expected that such online forms would be of great help for the investors to prepare solid applications. Beyond this, the gathered experiences have shown that 1-on-1 meetings between the potential beneficiaries and the TKYB and RSM Consultant JV are an important tool for optimizing the application procedure.

4.2 Negotiation procedure

After projects have passed the evaluation and ranking a Beneficiary Agreement (BA) between the RSM and the Beneficiary needs to be prepared and signed by both parties. The key component of the BA is the definition of the Success Criteria for the exploration wells to be drilled. The Success Criteria for the exploration wells drilled under RSM coverage are based on the business model for the development of the geothermal resource. In short, the success criteria, for the exploration wells, is to be defined as equal to or greater than the minimum average well output for the project to be economically viable. The benchmark established by TKYB for economic viability of the projects is 8% IRR.

The Success Criteria for wells intended for power production is defined in terms of well power output (MWe) at a minimum well discharge enthalpy (or temperature) and maximum drawdown or minimum well head pressure. The well power output is determined from well test results and parameters that are specific for the planned power plant. The flow test will provide information on the enthalpy of the fluid discharge from the well, the flow rate that can be obtained under stabilized or semi stabilized well conditions (in terms of drawdown or well head pressure) at maximum flow rate. In addition to the well test results, the RSM and the Beneficiary will need to agree on the conversion efficiency factor for the planned power plant. Simple and clear definition of the Success Criteria is crucial for successful negotiations between the RSM and the Beneficiary.

5. CONCLUSIONS AND OUTLOOK

The key lessons learned from the RSM so far, i.e. during phase 1 *Preparation period of the RSM* and phase 2 *RSM Application rounds / Agreement negotiations* can be summarized as follows*:*

- Close communication with potential investors prior and during the application period is key to attract investors and to receive qualified applications. Therefore, an interdisciplinary team with local presence is a prerequisite.
- Properly defined Beneficiary Manual, leading the investor through the whole RSM process is key.
- The key to successful negotiation between RSM and Beneficiary are simple and properly defined Success Criteria
- Clearly communicating the relationship between the Success Criteria in terms of well output and the economic viability of the project to future applicants to the RSM is also of critical importance

After a successful negotiation between the RSM and the Beneficiary the Beneficiary Agreement is signed between the RSM, represented by TKYB, and the Beneficiary. The next project phase will consist of monitoring the activities of the Beneficiaries' geothermal exploration projects under the umbrella of the RSM. The RSM Consultant will actively monitor the exploration drilling carried out for the projects supported by the RSM. The RSM Consultant will receive and store financial information and technical data collected during drilling and testing of wells. Compliance with applications, plans and procedures will be verified through inspections during field visits. Drilling progress and well testing activities will be monitored and associated costs will be compared to financial plans during site visits. Review of reports will focus on compliance with agreements, adequate data and interpretation of results. Site visits will, in particular, be needed during the flow testing in order to ascertain that key data for calculating the well output are collected in accordance with the agreed well testing plan. Based on experience gained to date the RSM team feels that the RSM has significant potential to facilitate private sector investment in geothermal exploration drilling in Turkey. For readers who are interested in the implementation of the RSM in Turkey, we would like to refer to our homepage, which is currently updated with latest developments: http://rsmgeoturkey.com.

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