



Rwanda Geothermal Policy Support

Action Plan for Geothermal Development

Brief



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Brief

In 2013 the Government of Rwanda expected to develop 700 MW of geothermal power. This was revised to less than 100 MW as a result of dry exploration drillings in Karisimbi prospect in 2013/2014.

In Rwanda 6 potential fields are currently under investigation for geothermal energy generation, based on JICA's Geothermal Development Plan. This Action Plan splits these fields in two priority groups:

- First priority fields: Kinigi field, Bugarama (Mashyuza) hot springs and Gisenyi hot springs;
- Second priority fields: Karago hot springs, Iriba cold springs and Mufumba cone, Bize hot springs.

Except for Kinigi field (32.6-58.6 MW¹) and Bugarama (Mashyuza) hot springs (6.6-15.1 MW¹) the resource expectations for the other four fields are in the range of 2 to 7 MW each, which is considered small by international standards. Low to medium resource temperatures between 100 to 220°C are expected, however uncertainty level of these estimates is high, as none of the fields is proven by test drillings yet.

The Rwanda Energy Policy (REP) targets the involvement of the **private sector** for the development of the geothermal sector. According to the REP the Government shall enhance attractiveness for private developers by substantially reducing the risk of test drilling to external partners.

The main objective of the Action Plan is to identify the most suitable business model for geothermal development in Rwanda and to define the actions to remove obstacles to realize the recommended business model. The Action Plan rolls out the required actions for the next 3 years, with an outlook until 2025. Due to the uncertainties involved, the Action Plan shall be updated annually.

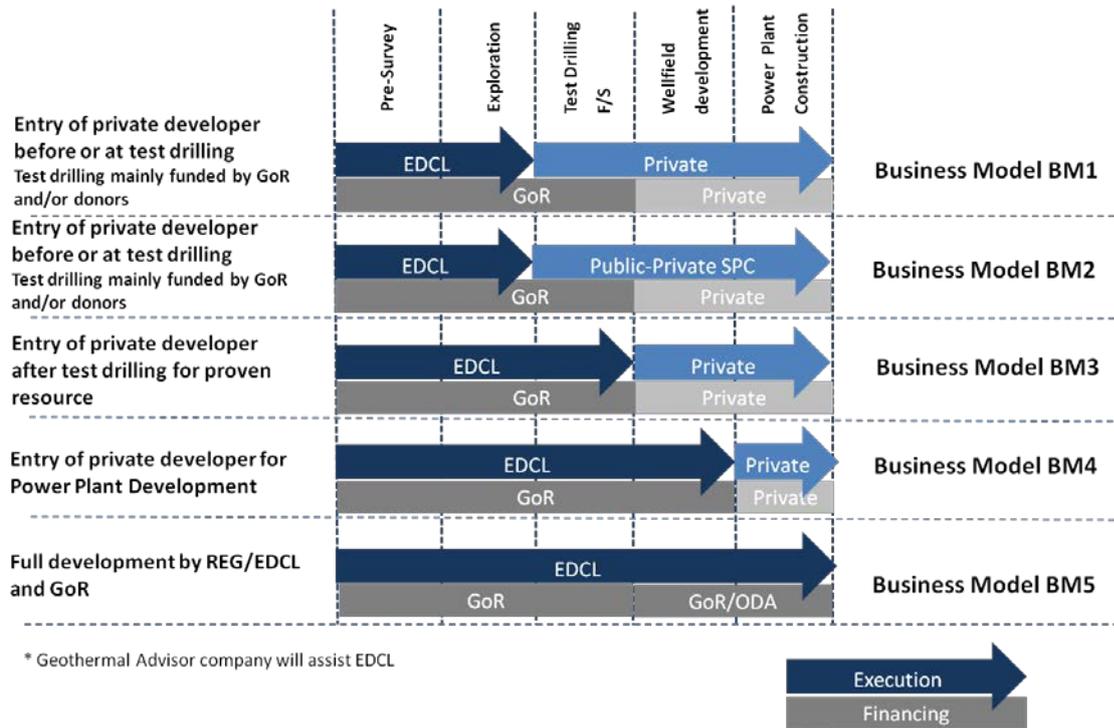
Business models

Five business models have been assessed, characterized by different roles for the private sector, for the Government and for REG/EDCL in financing and executing the activities in the project life cycle. The overview of the Business Models is provided in Figure 1 below. The decision on the business model will depend on the preferences of the Government of Rwanda ("GoR"), the availability of concessional funding, and the outcomes from market soundings.

¹ Confidence intervals of 80% and 50% likelihood, based on Monte Carlo simulations, carried out in the JICA Geothermal Development Plan.

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Figure 1: Possible Business Models for Geothermal Development and their Financing



Business Model BM2 is recommended as first choice, as it would leverage implementation efficiency while reducing the financial exposure from the private developer at the same time. The model is based on a joint venture company, pairing EDCL's knowledge of the context in Rwanda with international best practice experience of a private developer. The joint venture company shall take over the development of all fields in Rwanda, as long as the sector remains, as expected, of limited size.

Business Model BM5 is attractive economically if it will be possible to access concessional lending but will require a major effort in capacity building in EDCL. Under this Model EDCL will have to develop the complete value chain through test drilling, construction and operation. This model should be chosen if:

- private developers clearly state in the market sounding that they have no interest to enter the sector, or
- during tendering for Business Model BM2 no private developer can be found.
- GoR targets using a highly concessional ODA loan, or
- GoR intends to develop a geothermal pilot plant, or

Finally, **Business Model BM3** may be chosen as a transitional solution to Business Model BM2, if market sounding reveals that private developers expect at least one proven field in Rwanda as a condition before investing any resource.

Key recommended actions

The most important actions are due during the next 24 months. Therefore the following table enumerates the key actions due until the middle of 2017:

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Action	Date due	Funds needed
EDCL shall finish surface exploration studies for first priority fields; EDCL to identify additionally needed funds.	Until end 2016	1,000,000 USD
EDCL/MININFRA shall conduct market sounding for <ul style="list-style-type: none"> • Private Developer interest, • DP preparedness for funding, and • The availability of ODA loans 	2016	20,000 USD
EDCL together with international experts shall carry out a peer review and ranking of the first priority fields for test drilling after finishing the surface exploration studies, taking into account technical and economic criteria, including an estimation of the range of tariff which can be achieved from geothermal power plants.	Q4 2016	40,000-60,000 USD
Identify potential sources of funds from GoR or DPs for de-risking the test-drilling of fields. Without a substantial reduction of the risks, private developers will not conduct exploration drillings.	Q2/Q3 2017	<ul style="list-style-type: none"> • 20-40 mUSD/field if drilling to 2,000 to 3,000 m and • 15-20 mUSD/field if drilling to 1,000 to 2,000 m
EDCL shall engage a Geothermal Advisor company (GA) to support the geothermal unit. The GA will assist in all activities of management and development of geothermal resource and capacity building in EDCL mainly through training on the job. EDCL to identify required funding.	identify funds in 2015; tendering and contract: Q1/Q2 2016	<ul style="list-style-type: none"> • Business Model BM2: 700,000 USD • Business Model BM5: 2.2-7mUSD, depending on number of fields being developed.
GoR/REG shall decide the future Business Model.	At the time of ranking the first priority fields - Q1 2017	n.a.
MININFRA shall appoint a geothermal officer and set up a training program. The officer should remain responsible for the medium term at least.	ASAP in 2015	20,000 USD
No geothermal law is needed presently. Private developer participation could be realized using "Regulation by Contract".	n.a.	n.a.
The concession for exploration, test drilling and exploitation could be issued by MINIRENA under the mining law.	n.a.	n.a.

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