GEOTHERMAL DEVELOPMENT BY PUBLIC PRIVATE PARTNERSHIP - A CASE STUDY OF MENENGAI 105 MW PROJECT

November 3, 2016

Proceedings, 6th African Rift Geothermal Conference
Addis Ababa, Ethiopia, 2nd – 4th November 2016

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PRESENTATION OUTLINE

- Introduction
- Project Overview
- Project Outcome
- Project Business Model
- Project Structure
- Payment Structure
- Project Risk Allocation
- Key Challenges
Main mandate of GDC is to accelerate Geothermal development in Kenya by de-risking geothermal projects through undertaking the steam field development and inviting the private sector for power plant development.

The annual average growth in Kenya electricity consumption is forecasted to grow at a rate of 7.3% while the annual peak load at more than quadruple from 1600MW in 2015 to 6700MW in 2035 with the implementation of Kenya’s flagship projects.
• Part of GoK 5000+ MW Program
• Part of 460 MW Menengai project of which Phase I entails developing 105 MW

• Three IPPs selected through competitive tender to finance, design, and build, own and operate 35MW geothermal power plants at its Menengai Geothermal Field.

• Overall objective is to increase the national electricity generation capacity by 105MW using geothermal resources.
PROJECT OVERVIEW

105MW Project

35MW x 3 units

BOO model 25 years

(Plant O&M=IPP, Steam Reservoir O&M=GDC)

Project Tariff Structure

Energy Tariff payable to IPP and Steam
Tariff Payable to GDC
<table>
<thead>
<tr>
<th>PROJECT COMPANY</th>
<th>OWNED BY/ AFFILIATE OF</th>
<th>COUNTRY</th>
</tr>
</thead>
<tbody>
<tr>
<td>QPEA GT Menengai Limited</td>
<td>Quantum Power East Africa B.V.</td>
<td>Netherlands</td>
</tr>
<tr>
<td>Sosian-Menengai Geothermal Power Limited</td>
<td>Sosian Energy</td>
<td>Kenya</td>
</tr>
<tr>
<td>OrPower Twenty Two Limited</td>
<td>Ormat International Inc. (51%) Symbion Power (24.5%)</td>
<td>USA</td>
</tr>
<tr>
<td></td>
<td>Ci Limited (24.5%)</td>
<td>Kenya</td>
</tr>
</tbody>
</table>
**PROJECT OUTCOME**

### Tariff
- Achieve an overall tariff which is competitive compared to what private investors would request for a Greenfield project. This is the benefit of de-risking by GDC while still supporting Government in mobilizing private sector capital.

### Capital Mobilization
- Relieving the government a substantial burden of having to take debt to achieve geothermal power projects. For this project, the IPPs are going to raise about US$ 210 million (Ksh 21 billion).

### Steam Availability
- Reduce GDC dependency on exchequer through revenue generation thus raising capital for further geothermal development.
Business model for the Menengai 105 MW is based on the need for private sector capital mobilization, de-risking of geothermal projects and revenues for GDC for further geothermal development in the Country.
PROJECT STATUS

- Evacuation Facilities
- Power Plant Development
- Steam Gathering System
- Feasibility Study
- Drilling Works
- Major Procurement
- Capital Mobilisation
- Project Preparation Activities...
PAYMENT STRUCTURE

GDC

KPLC

IPP

STEAM PAYMENT

ENERGY CONVERSION

PARASITIC LOAD
<table>
<thead>
<tr>
<th>RISK</th>
<th>GDC</th>
<th>IPP</th>
<th>KPLC</th>
<th>GoK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel Risk (Steam)</td>
<td>Deemed Payment Obligation to the IPP/Termination payment</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Market Risk</td>
<td>N/A</td>
<td>N/A</td>
<td>Deemed Payment obligation to the IPP/Termination payment</td>
<td>N/A</td>
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<tr>
<td>Foreign Exchange Risk</td>
<td>N/A</td>
<td>N/A</td>
<td>Pass through cost to Consumer</td>
<td>N/A</td>
</tr>
<tr>
<td>Financing risk due to the long lead time (time lag) between the initial investment and the start of revenues</td>
<td>Exploration, drilling and steam gathering system</td>
<td>Development costs and interest during construction</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Termination Risk before Financial close</td>
<td>Cost incurred</td>
<td>Cost incurred</td>
<td>Cost incurred</td>
<td>N/A</td>
</tr>
<tr>
<td>Termination Risk after Financial close</td>
<td>Related to fuel</td>
<td>Related to Generation</td>
<td>Related to evacuation/demand</td>
<td>Termination due to a political event</td>
</tr>
<tr>
<td>RISK</td>
<td>GDC</td>
<td>IPP</td>
<td>KPLC</td>
<td>GoK</td>
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<tr>
<td>---------------------------</td>
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<td>-------------------------------------------</td>
</tr>
<tr>
<td>Permits and Authorization</td>
<td>Related to steamfield</td>
<td>Related to power plant</td>
<td>Related to power offtake</td>
<td>Related to timely issuance</td>
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<tr>
<td>Construction delay risk</td>
<td>Steam Gathering</td>
<td>Power Plant</td>
<td>Evacuation Facilities</td>
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<tr>
<td>Technological Risk</td>
<td>Steam Gathering</td>
<td>Power Plant</td>
<td>Evacuation Facilities</td>
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<tr>
<td>Operations and Maintenance</td>
<td>Steam Gathering</td>
<td>Power Plant</td>
<td>Evacuation Facilities</td>
<td>N/A</td>
</tr>
</tbody>
</table>
KEY CHALLENGES

- Project Transaction Documents
- IPP Financing Structure
- GDC financial creditworthiness
- Long term field testing
- Feasibility Study
- Short term payment guarantees
- Termination risk
- Land access rights
For geothermal projects, the reservoir capacity numerical simulation is used to estimate the size and sustainability of the reservoir for the period of operation of the power plant.

In order to give the IPP lenders comfort and enable them to commit to the project, a worst case scenario simulation of the reservoir capacity was developed.

The results of the simulation were used to propose a market adjustment mechanism.
Tariff vs Capacity for a 35MW Plant

\[ y = 175x^{-1} \]
In order to give comfort to the IPPs/lenders for short term payment obligations, a partial risk guarantee facility from the African Development Bank.
One of the major risks to the IPPs and their lenders in the project is termination due to default by GDC or KPLC.

Termination as a result of catastrophic reservoir underperformance and evacuation default is covered in the PISSA and PPA respectively.

Termination due to political events will be covered under the GoK letter of support.
TERMINATION RISK ANALYSIS

Termination cost over time for 35MW Plant

- Termination Cost
- Cumulative DGE Payments

Years

Amount (USD)
TERMINATION RISK MITIGATION

- Development of a drilling program to realise the 105 MW and additional steam to cushion against initial drawdown.

- Development of a drilling program to expand the current proven resource area.

- Development of a reservoir management strategy
TERMINATION RISK INSTRUMENTS PROVIDERS

- Multilateral Investment Guarantee Agency (MIGA).
- African Trade Insurance (ATI)
- Swedish International Development Cooperation Agency (SIDA)
Most of the geothermal fields in Kenya are located in public land or community land.

The Project area for the Menengai 105 MW project is a forest reserve which is public land held by the Kenya Forest Service (KFS).

Due to the nature of the land and past experience, KFS do not allow charging of the land. In order to give reassurance to the IPPs lenders

GDC, KFS and the IPPs are in deliberations with a view of incorporating provisions for automatic step-in rights by the IPPs lenders.
THANK YOU