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

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ABSTRACT

Geothermal Development Company (GDC) was formed by the Government of Kenya to accelerate geothermal development in Kenya. To achieve this, GDC undertakes exploration, appraisal and production drilling in geothermal fields and prospects in Kenya in order to mitigate upfront risks associated with geothermal development that deter private sector participation in the sector. GDC is also mandated to lower the cost of electric power by providing fuel (steam) to power generators-KenGen and Independent Power Producers (IPPs). This will ensure that electricity is readily available to help meet the country's increasing demand for power by producing indigenous, clean, and inexpensive geothermal power. GDC is currently developing the geothermal resources of various fields including its flagship project; the Menengai geothermal field. The first 105 MW project for Menengai geothermal field is being implemented by GDC under a public private partnership (PPP) arrangement. Under this arrangement, GDC is the steam supplier, Kenya Power (KPLC) is the off-taker, and Kenya Transmission Company (KETRACO) is in charge of the evacuation facilities while three IPPs are to build three power plants generating 35 MW each. The project is in advanced stages of power plant implementation with most of the other components complete. In order to successfully develop the power plant under a PPP basis using project finance, the IPP lenders who carry more risk require a level of comfort before committing to the project. The model adopted by GDC for the Menengai 105 MW project faced challenges related to Project Transaction Documents, Feasibility Study, GDC Financial Creditworthiness, Short Term Payment Guarantees, Termination Risk, Long Term Field Testing and Land Access Rights. Various innovative mitigation measures are being explored in order to successfully complete the project. This will enable Kenya raise required private capital on a public-private partnership basis to meet Kenya's projected energy base load demand growth. This will help in achieving the countries energy targets as indicated in vision 2030.

1. INTRODUCTION

There is a forecasted growth in Kenya's electricity consumption. The annual average growth 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.

On average, 250 MW of capacity (plus reserve) will require to be added each year in order to serve the growing peak load in the country. For base load power production (with high capacity factors), geothermal power plants are ranked best in terms of generation costs according to Ministry of Energy and Petroleum, Development of a Power Generation and Transmission Master Plan for the years 2015-2035 (May, 2016)

Scenario		Unit	Growth LTP	2015[1]	2016	2020	2025	2030	2035
Refer-ence with flagship projects	Consumption gross	GWh	7.3%	9,453[1]	10,093	13,367	19,240	27,366	38,478
	Growth	%		5.4%	7%	8%	9%	8%	7%
	Peak load	MW	7.5%	1,570[1]	1,679	2,2259	3,282	4,732	6,683
	Growth	%		4%	7%	8%	9%	10%	7%
		MW		58	109	169	260	412	462
Vision with flagship projects	Consumption gross	GWh	9.6%		10,592	16,665	25,469	39,260	58,679
	Growth	%			12%	13%	10%	11%	8%
	Peak load	MW	9.8%		1,770	2,845	4,431	6,833	10,219
	Growth	%			13%	13%	12%	11%	8%
		MW			200	330	478	689	786
Low without flagship projects	Consumption gross	GWh	5.6%		10,035	12,632	16,427	21,375	28,153
	Growth	%			6%	6%	5%	6%	6%
	Peak load	GWh	5.7%		1,669	2,116	2,769	3,618	4,788
	Growth	%			6%	6%	5%	5%	6%

Figure 1: Electricity consumption and peak load forecast – reference, vision, low scenarios,(Ministry of Energy and Petroleum, 2016).

In order to meet the projected electricity demand by 2035, an overall investment of USD 35 billion is required to successfully carry out the expansion plan.

As part of the strategy to raise part of the required investment, the Government of Kenya (GOK) formed the Geothermal Development Company (GDC) with the mandate of accelerating geothermal development in the country by de-risking geothermal projects through undertaking the steam field development and inviting the private sector for power plant development.

As part of executing its mandate under the Government of Kenya's 5,000 MW+ program, GDC is implementing the 460 MW Menengai project of which Phase I entails developing 105 MW, 200 MW Baringo-Silali project and 150 MW Suswa project.

The Menengai 105MW project is currently at the advanced stage. The IPPs lenders are currently carrying out due diligence with a target of achieving financial close on a project finance basis.

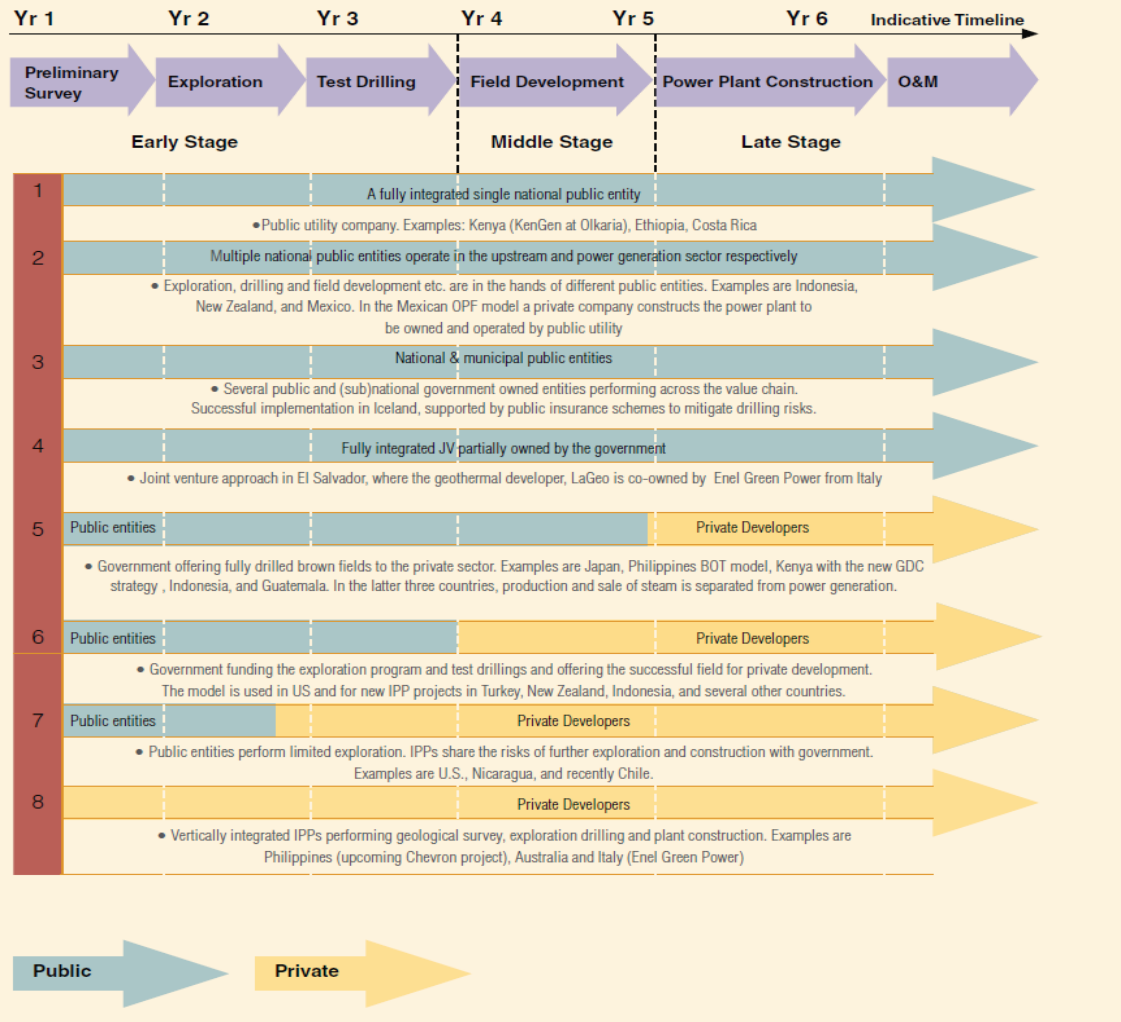

Figure 2: Models of geothermal power development in international practice (Source: Gehringer and Loksha 2012)

2. MENENGAI 105 MW PROJECT BUSINESS MODEL

International experience shows that there has been no single model for development of geothermal resources (ESMAP Geothermal Handbook). The figure below shows eight different models that have been utilized in the international practice of geothermal power development. As the figure shows, the upstream phases of geothermal project development rely heavily on public sector investments, while private developers tend to enter the project at more mature phases. The project development cycle (and sometimes the broader geothermal market structure) may be vertically integrated or separated (unbundled) into different phases of the supply chain.

The structure of GDC 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. The business model is as shown option 5 in Figure 3 and as shown in Figure 4 below. The model allocates the high risk resource development activities to Government through GDC but involves private sector in the high capital intensive but low risk generation phase.

The success of Menengai 105 MW project will achieve the following that is essential for the development of geothermal in the country:

i. 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).
ii. 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.
iii. Reduce GDC dependency on exchequer through revenue generation thus raising capital for further geothermal development.

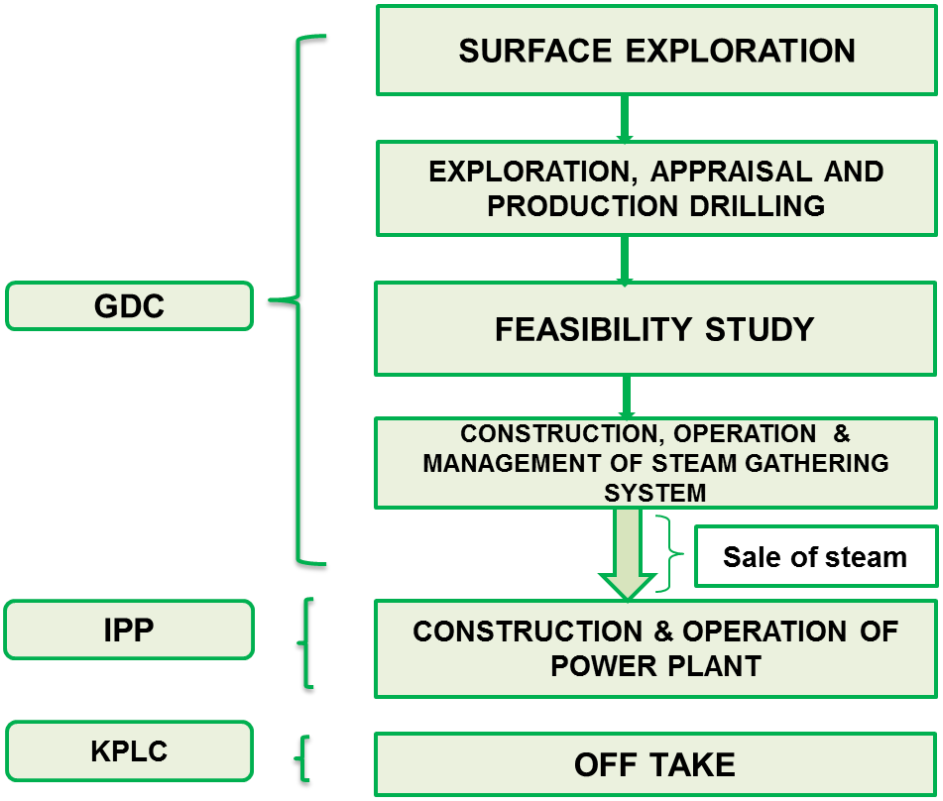

Figure 3: Menengai 105MW Business Model

2.1. Selected Independent Power Producers

In line with the GoK 5000MW+ program, GDC selected three Independent Power Producers (IPPs) through competitive bidding to each finance, design, build, own and operate 35 MW geothermal power plants for the Menengai 105 MW geothermal project. The Project has a conversion tariff payable to the IPPs and a steam tariff payable to GDC for a period of 25 years. The investment from the private investors for construction of the power plants shall be approximately US$ 210 million on equity and debt basis of 25% to 75%.

The following Independent Power Producers were selected under a competitive bidding process to undertake the power generation for the project.

PROJECT COMPANY	OWNED BY/ AFFILIATE OF	COUNTRY
QPEA GT Menengai Limited	Quantum Power East Africa B.V. (100%)	Netherlands
Sosian-Menengai Geothermal Power Limited	Sosian Energy Ltd (100%)	Kenya
OrPower Twenty Two Limited	Ormat International Inc. (51%) Symbion Power (24.5%) LLC	USA
	Civicon Limited (24.5%)	Kenya

Figure 4-Selected IPPs for Menengai 105MW Project

3. PROJECT STATUS

The project power plant development is currently at the due diligence stage by the IPP with the aim of achieving financial close. The statuses of the components entailed in the project are given below;

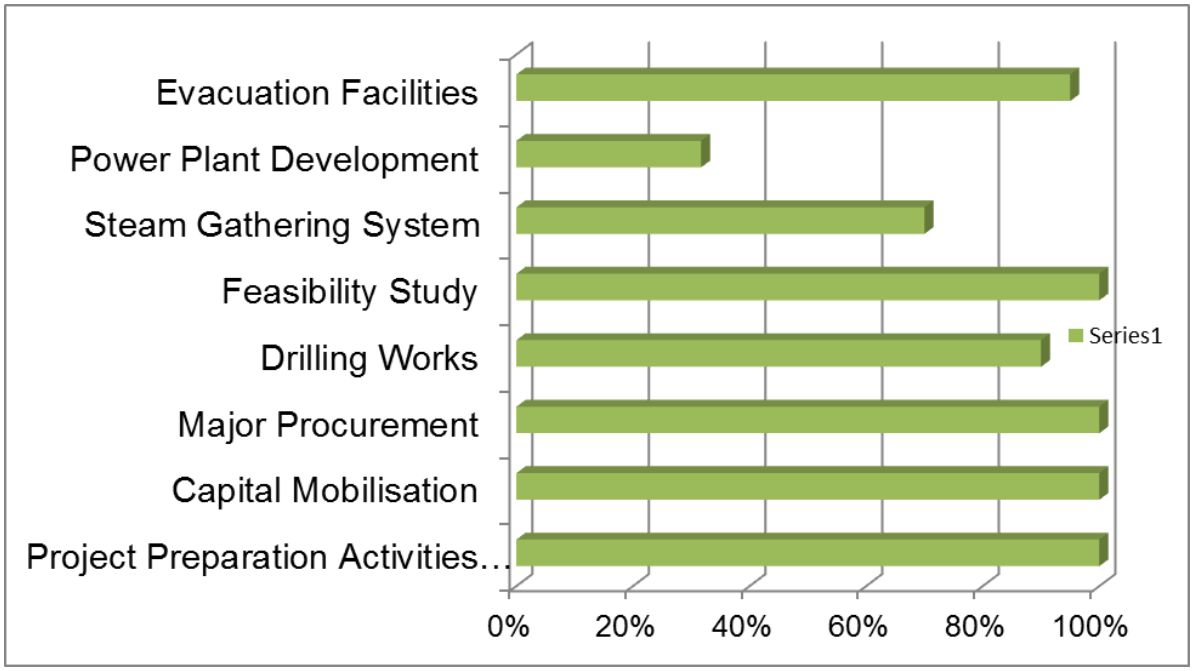

Figure 5: Project Status for the Menengai 105MW Project (July 2016)

The construction of the power plant is scheduled to take about 18–24 months. The power plant construction is in principle the major pending issue before the full project can be realized.

4. PROJECT STRUCTURE

The figure below shows the project structure main agreements;

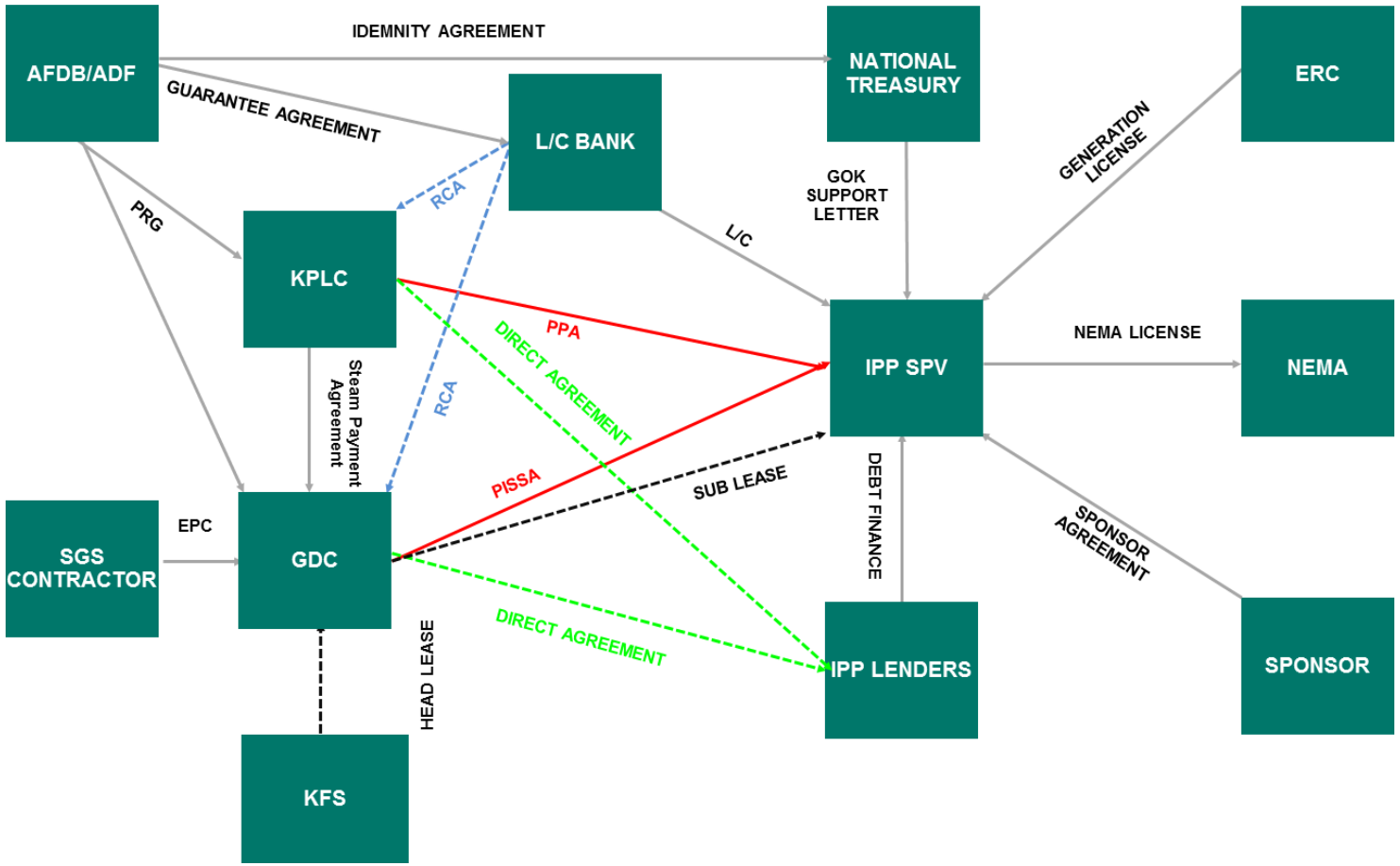

Figure 6- Menengai 105MW Project Structure

KEY

PISSA- Project Implementation and Steam Supply Agreement.

PPA- Power Purchase Agreement

AfDB- African Development Bank

PRG- Partial Risk Guarantee

RCA-Reimbursement and Credit Agreement

L/C- Letter of Credit

SGS-Steam Gathering System

EPC- Engineering Procurement and Construction

KPLC- Kenya Power

GDC- Geothermal Development Company

KFS- Kenya Forest Service

IPP- Independent Power Producer

SPV- Special Purpose Vehicle

ERC- Energy Regulatory Commission

NEMA- National Environment Management Authority

5. PAYMENT STRUCTURE

The payment structure for the model is that the IPP is paid by Kenya Power (off-taker) for energy conversion for every kWh delivered to the grid and GDC is paid directly by Kenya Power for the steam for every kWh delivered to the grid. The IPP further pays GDC directly for steam used for parasitic load. The structure is as shown below.

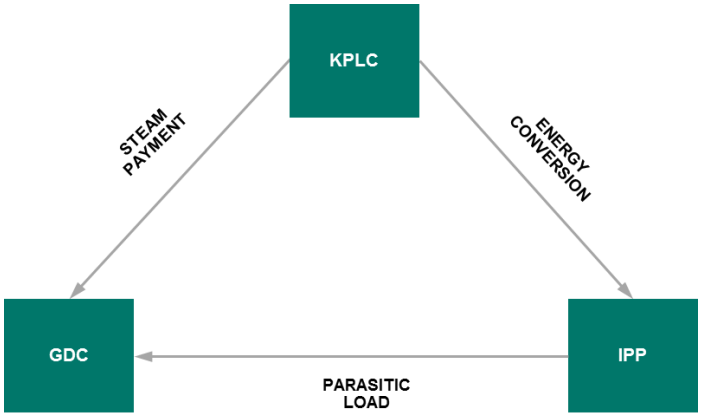

Figure 7- Menengai 105MW Payment Structure

6. PROJECT RISK ALOCATION

Many of the risks of geothermal development are essentially the same as in any grid-connected power generation project: completion or delay risk, off-take risk, market demand or price risk, operational risk, and regulatory risk. The elevated level of financing risk due to high upfront costs is common for most other renewable energy technologies. However, there are additional risks specific to geothermal. The upstream/exploration phases can be considered the riskiest parts of geothermal project development. Significant investment is required before knowing whether the geothermal resource has enough potential to recover the costs. As the figure below shows, test drilling can account for up to 15 % of the overall capital cost, which is required at a point when the risk of project failure is still high, Gehringer and Loksha (2012).

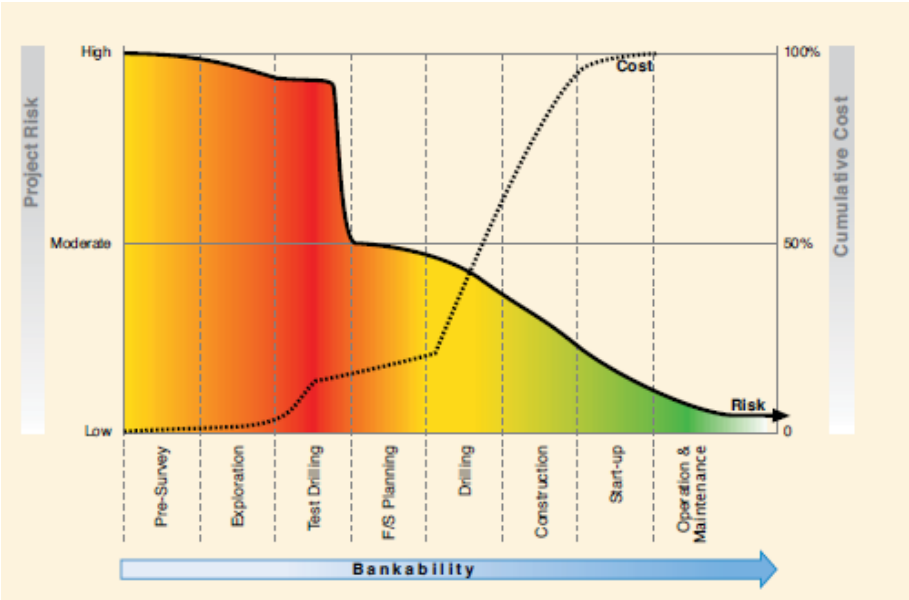

Figure 8: Project Cost and Risk Profile at Various Stages of Development, Source: Gehringer and Loksha (2012)

For the Menengai 105 MW Project, the risk allocation between the different parties is as shown below;

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

Figure 9:Risk Allocation for Menengai 105MW Project

7. KEY CHALLENGES

7.1. Project Transaction Documents

The model adopted for the Menengai 105 MW project has three different entities; the steam supplier, power developer and a different off-taker. It is the first of its kind worldwide and therefore there were no reference project transaction documents. All the transaction documents including the procurement documents had to be developed *ab initio.* This led to long negotiations period and transaction

documents' preparation. However, moving forward, the project transaction documents from the project will be improved and used for future projects. Furthermore, having been successfully used for this project, the transaction documents will be more bankable and easier to implement in the future.

7.2. IPP Financing Structure

IPP power projects are usually financed through project financing structure that involves the raising of funds through a mixture of debt and equity on a limited-recourse or non-recourse basis to finance an economically separable capital investment project. The providers of the funds primarily depend on the cash flow from the project as the source of funds for servicing their loans and providing returns on their equity invested in the project.

This structure, unlike balance sheet financing, subjects the lenders and not the project sponsor to the greatest risk. Since the lender utilizes public/third party savings and contributes between 75%-80% of the project capital cost, they are therefore more averse to risk especially where the tariff allowed for the IPPs is not sufficient to adequately cover the resource risk exposure in the case of an adverse event**.** This type of project financing structure takes longer to reach financial close. however, going forward, GDC will prepare in advance all the possible lender requirements from conceptualization of the project.

7.3. Feasibility Study

One of the key requirements for project financing is a technical and financial project feasibility study carried out by an independent and reputable consultant. 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. However, the simulation is an estimate and will always require updating as drilling continues by integrating new drilling and geoscience data. This creates an uncertainty is normal for geothermal projects and partly comprises the resource risk for which GDC was formed to assume.

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. In the mechanism, a tariff adjustment provision was proposed as a pass through cost in the event of a reservoir underperformance with the Kenyan Feed in Tariff for Geothermal Power Plants as the ceiling as illustrated below.

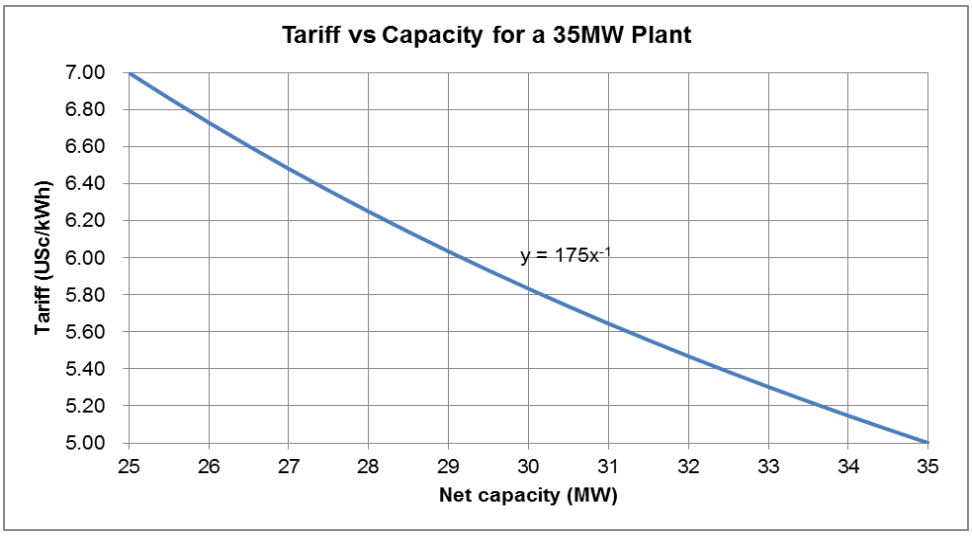

Figure 10: Illustration of Tariff Vs Capacity for a 35 MW Plant

7.4. GDC Financial Creditworthiness

Creditworthiness of a project developer is key in enhancing the bankability of the project. Currently, GDC gets revenue from steam sales from the 280MW Olkaria I and IV project. It also gets budgetary allocations from the National Treasury to cover its operational costs and expansion of geothermal development in the country. This project is the first to be undertaken by GDC and therefore GDC as a company does not have a track record of successfully operating such power projects.
Projects previously undertaken by Kengen in the Olkaria Field have been financed through the Government of Kenya, Development Finance Institutions and local capital markets using balance sheet financing or loans on lent from GoK. Under the Menengai 105 MW project model, the steam guarantee is to be provided by GDC under the Project Implementation and Steam Supply Agreement (PISSA). The question of GDC financial credit worthiness to backstop the risk is coming to the fore on account of its balance sheet size and revenues.

7.5. Short Term Payment Guarantees

In order to give comfort to the IPPs/lenders for short term payment obligations, a partial risk guarantee facility from the African Development Bank was put in place. The facility will cover short term payment obligations of KPLC and GDC. The cover was based on three months revenue to the IPPs.

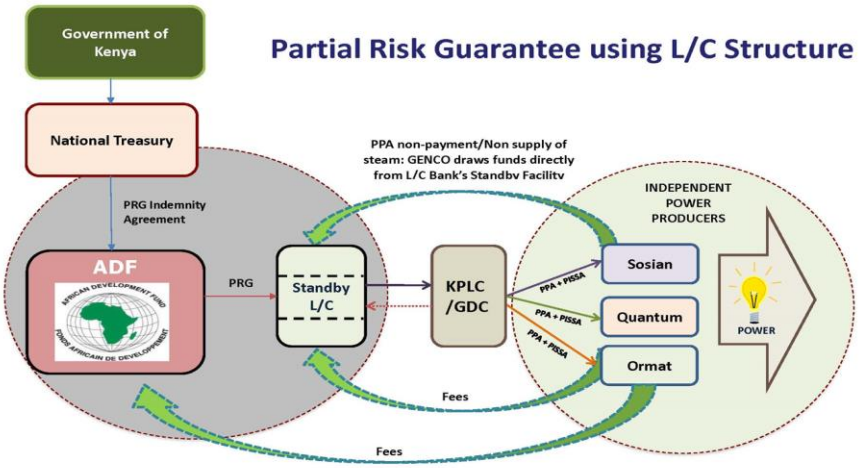

Figure 11: ADF Partial Risk Guarantee using L/C Structure. (AfDB, 2013)

7.6. Termination Risk

One of the major risks to the IPPs and their lenders in the project is termination due to default by GDC or KPLC. The investors require assurance that in the unlikely event there is a termination, GDC or KPLC would be able to pay the termination amount due to the IPPs. Under the project, 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.

The tariff adjustment mechanism to cater for deemed generation payments in the unlikely event that the reservoir underperforms during the operation phase have the following advantages when incorporated;

i. Prevents early project termination.
ii. Accord GDC adequate time to remedy the shortfall.
iii. In the event the shortfall cannot be remedied, it allows the power plant to operate for longer periods before termination occurs; this has the effect of reducing the termination cost as

illustrated in Figure 12. The mechanism is also expected to cover the debt period of between 12-15 years therefore giving further comfort to the IPPs.

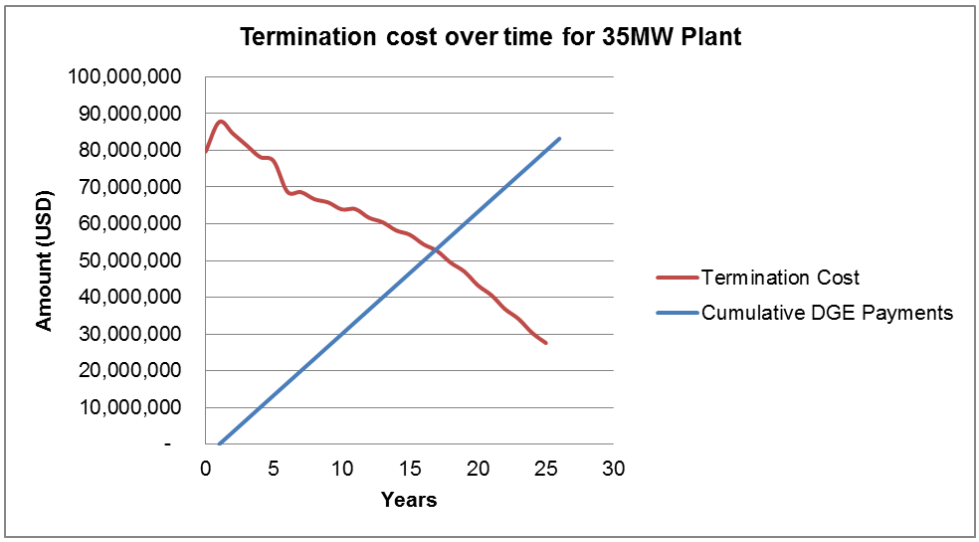

Figure 12: Illustration of Termination Cost over time Vs Deemed Generation Payments.

In order to mitigate this risk, GDC is undertaking the following;

i. Development of a drilling program to realise the 105 MW and additional steam to cushion against initial drawdown.
ii. Development of a drilling program to expand the current proven resource area.
iii. Development of a reservoir management strategy

The ADF/AfDB Partial Risk Guarantee cover taken for the project only included cover for short term payment obligations of GDC and KPLC. In order to cover the termination risk going forward, the following instruments could be explored;

7.6.1. Multilateral Investment Guarantee Agency (MIGA)

The Multilateral Investment Guarantee Agency (MIGA) is a member of the World Bank Group. Its mandate is to promote foreign direct investment (FDI) in developing countries by providing guarantees (political risk insurance and credit enhancement) to investors and lenders (MIGA Website). Projects currently supported by MIGA in Kenya include Triumph Power Generating Company Limited 83-megawatt heavy fuel oil plant, Thika Power Limited and Olkaria III, Kenya's first geothermal IPP (MIGA Press Release, July 2, 2013). Through its lending and guarantee instruments, the World Bank Group is helping to mobilize the nearly US$1 billion in financing required to add 600 megawatts to the grid through IPPs.

7.6.2. African Trade Insurance (ATI)

The African Trade Insurance Agency is an African owned International Financial Institution. It was formed in 2001 by African states with the financial and technical support of The World Bank Group. ATI promotes trade and investment in Africa and reduces the cost of doing business by helping investors mitigate against risk. Specifically, ATI provides political risk insurance protecting against risks such as currency inconvertibility, expropriation, war and civil disturbance. Through public and private partnerships, ATI facilitates access and encourages the support and use of co-insurance and reinsurance, guarantees and other financial instruments within Africa.
ATI provides reinsurance to the Multilateral Investment Guarantee Agency, a member of the World Bank Group, to help protect the investor against the risks of Currency Transfer Restrictions, Expropriation and War and Civil Disturbance by providing Political Risk Insurance for Equity to the tune of US$ 5 million, (ATI Website).

7.6.3. Swedish International Development Cooperation Agency (SIDA)

The Swedish International Development Cooperation Agency is a government agency working on behalf of the Swedish parliament and government, with the mission to reduce poverty in the world (SIDA website). SIDA offers a guarantee instrument designed to absorb risks in order to unlock capital and promote development in the countries where SIDA participates in development cooperation. This is a flexible and effective instrument that addresses the constraints related to access to finance. SIDA is able to guarantee a variety of risks, such as credit risks and political risks, as well as more innovative structures where risk is absorbed by the guarantee (e.g. an advanced market commitment).

7.7. Long Term Field Testing

Menengai resource has not been subjected to long and continuous steam field production tests. The 105 MW project power plant will be the first generation facility to be installed in the Menengai field. To attain this long term steam field production tests, going forward, GDC may consider well head generation facilities before constructing power plants.

7.8. Land Access Rights

Most of the geothermal fields in Kenya are located in public land or community land.

The Olkaria geothermal field is located in a national park reserve which is forest land and held by Kenya Wildlife service. Currently, Kengen is the sole investor in Olkaria and the project financing structure does not require the land to be charged as security for the lenders as the project loans are guaranteed by both GoK and/or Kengen balance sheets.

The Project area for the Menengai 105 MW project is a forest reserve which is public land held by the Kenya Forest Service (KFS). As part of their security requirements, lenders traditionally require to charge the land especially on the project finance structure. This is required in order to give them assurance that the project will be operated for the debt period without necessitating relocation of the project due to factors beyond their control. Furthermore, the charge gives the lenders the ability to step into the project in the event continued default of the IPP project company which affects revenue and loan repayment.

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. This is aimed at giving comfort to the IPPs lenders that in the event of non-performance of the project due to negligence of the IPP Project Company, the IPPs lenders will be able to step in and remedy the default. This will ensure power plant operations continue to provide revenue to cater for debt repayment.

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