

## Kengen Financing Mechanisms for Geothermal Projects in Kenya

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### ABSTRACT

Development of geothermal power is highly capital intensive and extremely risky especially at the beginning before resources are proven. It takes large upfront investment to drill a prospect, and once proven, long lead times are required before generation commences. Early geothermal development in Kenya was achieved with the most financing from the World Bank and internal sources. Typically, like the case for Olkaria 1 and 2, KenGen would employ its own internal finance for training and developing capacity for the requisite professionals, carry out surface exploration activities and then secure external financing at the time for exploration drilling going forward. However, in the early nineties, most development partners pulled-out due to the prevailing political situation in the country. This led to pressure on local finance sources already strained by other economic pressure. Development of vast geothermal resources in the country then stagnated for over a decade. Except for surface exploration activities funded by government, no major activities were achieved towards development of the resources already proven at Olkaria. The reforms in both the political and energy environment in the country, led to the return of development financial institutions' involvement in Kenya's power sector. Other international commercial and project finance banks like Exim Bank later made significant contributions into the geothermal space. KenGen has leveraged on these and the widening local capital market to finance its accelerated geothermal programme. Besides, we have explored joint venturing as another option for financing future projects. Here, we present an analogy of our experience in securing finances for projects ranging from small wellhead units of 2-5 MWe to geothermal plants of conventional size. Different project finance options are compared and possible impacts to project cost, schedule and execution complexity are discussed.

### 1. INTRODUCTION

Please be very careful to use styles throughout the document, so that all the papers will have a similar appearance. Exploration of geothermal resources in Kenya started in the 1950's with two exploration wells that were never successful. These wells were shallow, only reaching depths of few hundred meters. The wells were mainly located in areas with intense surface manifestations exhibited. Geo-scientific studies were then carried out and continued through to Kenya's independence a decade later. In the early post independence period, the newly formed government entered into an agreement with the UNDP to extensively undertake geothermal resource assessment in the expansive Great Rift Valley. By the year 1971, a decision was made to concentrate further efforts on the more plausible Olkaria area covering some eighty square kilometers. In the next five years or so drilling activities commenced and six exploration wells were drilled with positive results. The wells proved the existence of exploitable resources in the area. However, only a small fraction of the area was explored. With these encouraging results, drilling was accelerated for production wells and eventually 23 of them were drilled providing steam enough for a 45Mw plant. The Olkaria 1 power station was then built by the Kenya Power Company (predecessor of KenGen) in the year 1981 (Unit 1 and 2) and 1985 (Unit 3). Each of these was 15MWe condensing units. The plant has since operated with more than 90% availability. The well field providing steam for this power plant is relatively small covering only about 3 km<sup>2</sup>.

After the success at the Olkaria East field (Olkaria 1), drilling efforts were then focused in the Olkaria north east field immediately north of the Olkaria 1 field. Between 1986 and 2003 thirty wells were drilled most of which were successful. At this time, funding was not secured immediately to connect the wells due to the prevailing political and economic situation. The donor community had pulled out of the country and the local economy could not support such development. The wells were therefore shut in for a long time pending development of a power station. The power station was finally developed by KenGen and commissioned in 2003 as Olkaria 2 with 2x35MWe condensing type turbines. The station was later extended by addition of a third unit commissioned in 2010 to bring the current install capacity to 105MWe.

Drilling activities have been ongoing since this last development. In 2012 an additional 140Mwe was constructed at Olkaria East Production field adjacent to the first Plant. The plant utilizes the expanded well field with wells drilled much deeper. The Olkaria field has been gradually expanded in all directions. The Olkaria Domes field to the South covers a larger area (>10km<sup>2</sup>) and greater resources have been proven there. To begin with, a 140MWe plant was constructed in 2012 to be commissioned in 2014 as Olkaria IV. Since drilling has practically continued alongside the construction of this plant, a further 70MWe is planned to extend this plant in the near future, a well head plant is installed at OW-914 for a total capacity of about 30MWe as well as another 140MWe plant at Olkaria V in the north eastern sector of the field. An additional 28MWe is also in the pipeline in the area from additional wellhead units. Drilling activities for the required steam in this field are ongoing with great results being reported.

Geothermal development generally requires a long lead-time. As evident in the history discussed above, there were wells drilled in the late eighties that were shut in until a plant was constructed around the turn of the century. The wells at the Domes were drilled almost 10 years before the plant was constructed. A decision was made to connect some of these wells to mobile wellhead generators to produce as soon as they are drilled pending construction of conventional power plants. The first of these plants were

constructed at Olkaria in 2012 and since a series of them have been constructed at several sites at Olkaria and one at Eburru field further north.

Some of the challenges that resulted into long lead-times between drilling and final connection of wells were financial. These financial challenges had to do with political and sometimes economic situations in the country. Over KenGen's experience several mechanisms were applied to secure funding for exploration, drilling and development purposes. Experimenting on these has led to a solid understanding of sources of project finance. This paper presents financing approaches applied by KenGen to develop geothermal resources and presents an analogy of their advantages and disadvantages in our experience.

### **1.1 Project Finance at KenGen**

Traditional sources of financing for geothermal development at KenGen have been mainly government grants (MoE budgetary allocation for capital development) and Development financial institutions (DFIs). KPC a wholly owned government vehicle was formed as a special purpose vehicle to receive, manage and expend DFI monies given for power development. Since it was re-branded as KenGen, it has explored wider and innovative ways to raise additional capital for its projects range. While maintaining the traditional capital sources, KenGen has most recently explored the local capital market Commercial/International project finance banks as sources for funding its project portfolio. It is spearheading the newly incorporated PPP approach to secure funding for its immediate future projects.

### **1.2 Government Grants**

The GoK has consistently allocated funds through the Ministry of Energy on various projects which were implemented by KPC and later KenGen. These funds have mainly been used on initial exploration costs, costs incurred on feasibility studies and in funding highly risky capital intensive drilling activity. Typically exploration drilling is tied with surface exploration and therefore is implemented through GoK financing. The grants are helpful in cushioning the public of pass-through-costs usually included in the negotiations for PPAs.

### **1.3 DFIs**

These have mainly been through sovereign credits to the state which then employs the funds in the sector of the economy for which they are granted or through non-sovereign credits to KenGen. This model of financing is not only slow in securing sign offs but also strains borrowing institutions through stringent financial demands associated with DFIs. The DFI funds are almost all the time used for less risky business where direct revenues are not only foreseeable but also tangible. In this respect, KenGen has mostly employed these funds for power plant constructions at the strengths of resource availability reports, feasibility studies and PPA agreements.

### **1.4 Local Capital Markets**

Equity and fixed income instruments were not considered for financing KenGen's expansion programme until almost a decade ago. The partial privatization of KenGen in 2006 was the first attempt to raise funds in the local stock market. The IPO offered by KenGen stimulated the local and regional market unexpectedly stirring the local investor to participate in the local market. As a result, the number of CDSC accounts opened increased significantly.

These amounts were not sufficient to meet the demands of an accelerated development program to meet demand and offer security of supply for the future. The PIBO was then offered attracting 12.5% p.a tax exempt fixed rate with a ten year maturity.

### **1.5 Project Finance Banks**

In the recent past, KenGen has secured financing for drilling of its 560MW expansion plans of Olkaria through international project finance banks. A first of these kind of financing is the loan granted by Exim Bank of China financing drilling activities at Olkaria. In this arrangement, long and bureaucratic sovereign loans and DFI processes are avoided and the institutions engage directly in negotiations with the foreseen PPA and the books of the company acting as security. This process is much faster and does not impose strict covenants on the borrowing entity.

#### *Olkaria 1*

The funding for exploration, drilling and development of this power plant was secured from the World Bank and European Investment Bank through the GoK in 1977-81. Under this credit facility, development of local human capacity in geothermal exploration and utilization was a key component. Expatriates were employed to work alongside locals as an avenue for training. Newly recruited staffs were also sent abroad for specialized training. It is this group that would soon take over operations of Olkaria from the foreign expatriates. After exploration studies were completed, the same funds from the IBRD and EIB were used for drilling production wells and later to develop the first 3 x 15MWe power station at Olkaria 1. These funds were channeled through KPC, a GoK owned facility meant primarily for execution of foreign funded energy projects and managed by the Kenya Power and Lighting Company. The drilling rigs used to drill these wells were contracted with this credit and later one rig was acquired permanently with the same funds.

Table 1 shows the funding sources for the development of Olkaria I.

	<b>Financier Description</b>	<b>Year of disbursement</b>	<b>Original Currency</b>	<b>Amount</b>	<b>USD Equivalent</b>	<b>Total USD Equivalent</b>
Olkaria I	IBRD 1799KE	1977-1981	US\$	38,704,960.00	38,704,960.00	
	IBRD 2237KE	1977-1981	US\$	7,456,757.00	7,456,757.00	
	EIB	1977-1981	ECU	478,589.60	420,709.56	
	EIB	1977-1981	FF	4,847,146.23	836,497.98	
	EIB	1977-1981	GBP	79,898.20	135,201.78	
	EIB	1977-1981	ITL	956,249,842.00	566,013.88	
	EIB	1977-1981	BF	162,875,894.00	4,578,738.24	
	EIB	1977-1981	DUTCG FLORIN	1,987,016.82	1,019,420.62	
	EIB	1977-1981	DRACHMAS	90,915,738.00	332,955.18	
	EIB	1977-1981	US\$	405,746.35	405,746.35	
	EIB	1977-1981	JPY	293,242,671.00	2,348,048.06	56,805,048.66

**Table 1: Financing sources for Olkaria I**

### *Olkaria 2*

Drilling for all the wells required for the 105Mwe power station was completed by 1990. After drilling was completed for these wells, the international donor community suspended funding to Kenya due to the prevailing political environment in the run up to multi party democracy in Kenya. It was not until 1997 when such funding was resumed. After the resumption of support to the GoK, the project initially conceptualized was prioritized and discussions about the funding of the project were resumed. The funds were obtained through credits from World Bank, EIB and KfW negotiated and disbursed between 1997 and 2003. The funding was secured for construction of the steam field and power plant for the 2x35 initial units for the Project.

The KenGen G2G transformation programme gave rise to new financing mechanism where KenGen was to be privatized in part to raise public participation in the energy sector and secondly to have access to a wider source of funding for its projects. The PIBO and the Listing of KenGen shares through an IPO at the Nairobi stock exchange were expected to raise capital to an ambitious development programme. Olkaria II unit 3 was one of the beneficiaries of these funds obtained and committed in 2007. It would later take about 3 years to construct and commission the new 35MW units.

Table 2 shows the financing for the project

	<b>Financier Description</b>	<b>Year of disbursement</b>	<b>Original Currency</b>	<b>Amount</b>	<b>USD Equivalent</b>	<b>Total USD Equivalent</b>
Olkaria II Unit 1 & 2	IDA 2966KE	1997-2003	US\$	125,000,000.00	125,000,000.00	
	EIB	1997-2003	Euro	41,000,000.00	41,000,000.00	
	KfW	1997-2003	Euro	12,782,000.00	11,734,880.00	
	KENGEN	1997-2003	KSH	2,785,421,295.39	37,138,950.61	214,873,830.61
Olkaria II Unit 3	IDA 3958KE	2007-2010	US\$	27,600,000.00	27,600,000.00	
	EIB	2007-2010	US\$	50,000,000.00	50,000,000.00	
	KfW	2007-2010	Euro	20,000,000.00	25,200,000.00	
	KENGEN	2007-2010	KSH	1,554,735,000.00	18,291,000.00	121,091,000.00

**Table 2: Financing sources for Olkaria II**

To a great extent, this development was completed with far greater lessons than the challenge of a bigger geothermal power plant at Olkaria. It took about seven years from completion of drilling to disbursement of funds to construct the first two units of the power plant, six years to complete and commission the plant and a further seven years to actually commission the third unit. These problems were not under the control of the developers as they were politically influenced and no one had control of the process.

### *Eburru*

Eburru geothermal field was developed by first drilling of 6 exploration wells between the years (1988-1991). The funding for this project was obtained from Government of Kenya and the World Bank through Credit No. IDA 1973 KE.

After drilling was completed only 3 of the wells discharged with only EW-1 successful. The field was not therefore developed until 2011 when a wellhead plant was installed on this productive well. The plant has been running since at 2.4MWe. The funding for development of this wellhead plant was obtained from KenGen's PIBO offering. Further exploration activities at the field are currently ongoing.

#### *Olkaria 3 drilling (1983-1990)*

The Olkaria West development was achieved through government funding and the World Bank. The drilling of these wells was part of exploration costs towards appraising the Olkaria area. After analysis of well test results it emerged that the field was suitable for binary power plants. It was then decided by the government to give a concession to Ormat plc which had expressed interest to develop the field. The field has since been developed and further drilling activities has been performed by the operator.

#### *Olkaria 1 AU and Olkaria 4*

The funding of this project popularly known as the 280MWe project was a complex affair partly because of the structure of the financing but also because of its total cost. The project attracted five DFIs, the government of Kenya and KenGen. The different closure requirements further complicate the financing plan. Table 3 shows the summary of the costs and sources for the Olkaria IV and I additional units.

Project Component	Financier (Million USD)							Total (USD)
	GOK	KenGen	JICA	WB	AfD	EIB	KfW	
Drilling Costs	313						15	328
Steamfield Development			7		107		54	168
Power Plants			35	323		210	135	703
Transmission	3.4					32		35
Consultancy Services							30	30
Admin & Local Inf.			29		12			41
RAP			10					10
BoC					1			1
IDC			57					57
<b>TOTAL</b>	<b>316.4</b>	<b>138</b>	<b>323</b>	<b>120</b>	<b>210</b>	<b>167</b>	<b>99</b>	<b>1,373</b>

**Table 3: Financing sources for the 280Mw project**

#### *Wellheads/Early Generation*

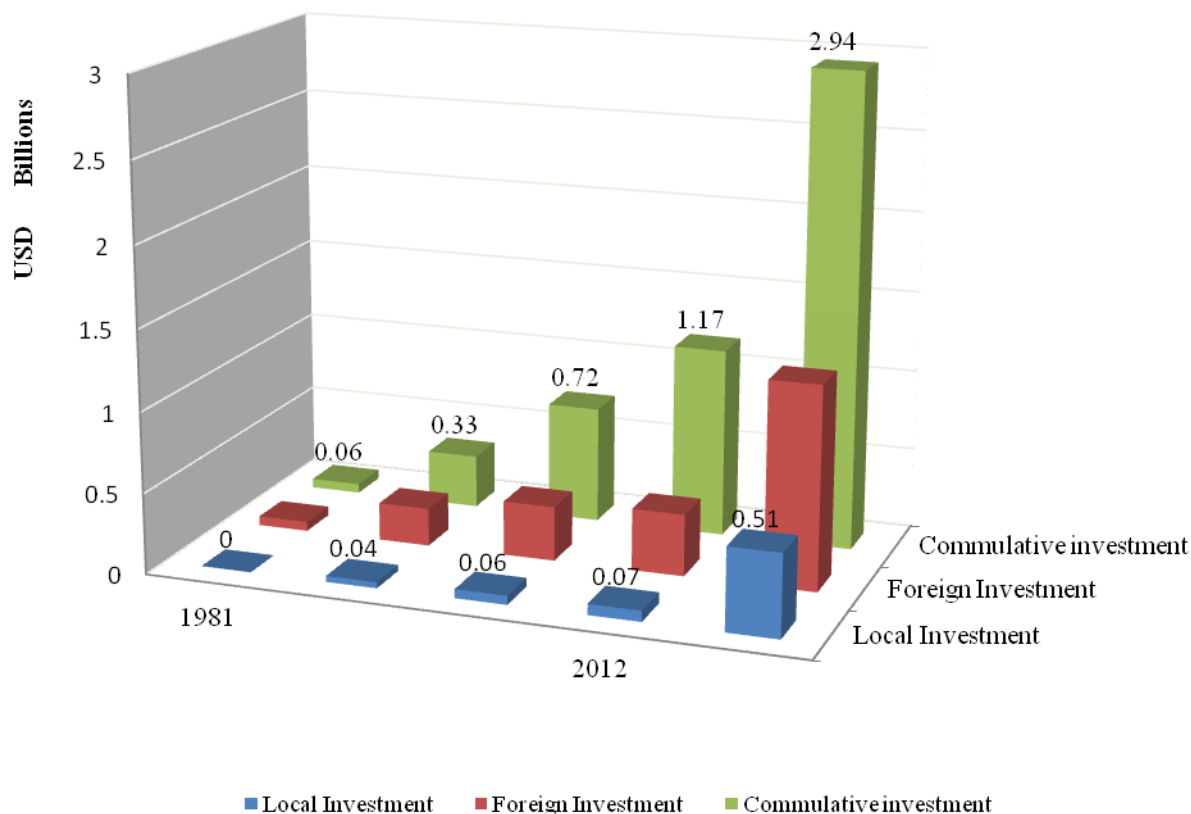
KenGen pioneered in installing small wellhead units for a total of 75MWe at Olkaria and an additional 2.4MWe at Eburru. The main idea here is to install generating units as soon as wells have been drilled to avoid leaving wells shut in for a long time and to gain revenue ahead of connecting wells into conventional power plants. The main financing for this project was obtained from KenGen's internal sources.

#### *Drilling for 560MWe*

This project commenced late 2012 with the drilling of 80 wells under a single contract. The drilling activities are accelerated with five rigs expected to drill for a period of 3 years. This is by far the most intensive drilling activity at Olkaria especially since a parallel drilling activity by the operator is also underway with three rigs drilling. The financing for the 80 wells contract took a different approach. Exim Bank of China, financed the project by a loan to the government of Kenya for onward lending to KenGen.

### **1.6 Investment History**

Figure 1 shows a summarized investment history in geothermal development since the first development at Olkaria. Local investment has mainly been in drilling services and lately in development of small power generating units while foreign loans have dominated the scene largely because of the scale of investment involved. The growth in local participation is remarkable in the recent past.



**Figure 1: Kenya's investments history into geothermal development**

## 2. ALTERNATIVE FINANCING OPTIONS

### 1. Concessionary Financing (boot, bot –Build Own –Operate- Transfer/)

Here, investors may be invited to develop and own a generating unit for a period allowing them to recover costs and thereafter transfer the plants to the government or other entity for the remaining life of the plant. The burden of sourcing for finance is therefore transferred and the balance sheets of existing local players are at an advantage. On the other hand, investors eliminate the risk of default in their loans and take a direct participation in protection of their investment. The necessary legal framework is in process to facilitate these options. However, the experience of traditional investors in operating power plants is almost non-existent. These therefore poses challenge in acquisition of competent operators without involving local or foreign parties.

### 2. JVS (Joint Ventures)

Another alternative is for local players to invite an investor to jointly build, own and operate and plant for the entire life of the plant. This arrangement ensures the interests of both parties are protected throughout the venture.

### 3. PPP (Public Private Partnerships)

This is a similar arrangement with joint ventures only unique in the fact that a Kenyan public entity is involved as a partner. A legal framework exists now in Kenya to facilitate public entities to enter into such agreements with potential financing entities.

## 3. CHALLENGES AND EXPERIENCE

### 1. Minimal Risk Ventures

Most DFIs and related organizations are less risk averse and therefore would not finance ventures they consider risky. A good example of this is drilling activities. While a few like the WB may finance capacity development and surface exploration costs, it is extremely uncommon for them to finance exploration and even production drilling. These are mainly because it is an extremely expensive business and risky in the sense that results are not guaranteed.

### 2. Time taken to financial closure

In most of our experience in dealing with DFI's the time taken for financial closure was extremely long. The bureaucratic nature of most of funding organizations cuts across the different organizations. This adds into long lead times required in resource development stage.

### 3. Government-to-Government

Large lending organizations such as DFIs would not consider lending to non-governmental organizations. Developers who may be funded have to go through their governments for these loans to be negotiated between lending organizations and them. This adds an extra burden in time consumptions in negotiations and closures.

### 4. Government guarantees

Government guarantees are required by DFIs to secure financing for projects in their countries. In many developing nations, demands for development assistance call for governments to prioritize assistance to the different sectors of the economy. It is often the case that the national debt ratio limits both the amount that can be borrowed.

### 5. Covenants

In addition to government guarantees, the DFIs impose further restrictions on the balance sheets of implementing/borrowing organizations with quite stringent financial covenants. These include covenants on liquidity/debt ratio, debt coverage ratio that further limit organizations to explore other sources of project finance.

## 3.1 Reasons for Joint Ventures

### 1. To solve the financing issues raised by debt covenants

KenGen maintains its ambitious growth plan. In this plan some of its projects would be financed by Public Private Partnerships. This is a new concept that helps address the challenges with financing future projects. With PPP, project finances can be obtained without affecting the covenants imposed by DFIs on prior projects.

### 2. PPP law enacted

An enabling environment has been created already in Kenya with the recent enactment of the Public Private Partnership Act (2013). In the Act, public entities may engage in PPP arrangements to assist in securing large upfront capital necessary in such ventures. Profit sharing is more likely to attract investors in the sector in collaborations with local/public companies.

### 3. Opportunities for Investment exist

In developing economies like that of Kenya, electricity supply is more often a driver of economic growth. Unfortunately supply of electricity takes long lead-times and therefore the need to build capacity ahead of demand. Lucrative Feed-in tariffs exists for small power plants that may be attractive ventures for investors in the electricity sector.

With PPP arrangements more investment opportunities exist for local and foreign investments in the energy sector.

## 4. CONCLUSIONS

The Kenyan success formula is largely based on an acceleration and consistent self funding approach. For Kenya, self funds only acted as a stimulus for further foreign investments into the energy sector. Without it, the story of geothermal development in the country would have been very different. However, significant foreign funding has been witnessed lately as the developments reach critical stages where large upfront investments are required. Still, mere risk mitigation is not enough to attract foreign cash inflows but rather government's role in financing the risky phases of development punctuate the Kenyan geothermal success story. It was a lot easier to attract foreign cash inflows in the later project stages where results had been proved and therefore less risky ventures. In the recent past foreign borrowing has proved a preferred option for large scale risky ventures such as drilling. Government support in these ventures is quite essential. Part of the critical success factors for Kenya is government's commitment and involvement in the geothermal sector. Developers in geothermal fields have to cope with stringent financial covenants in any schemes involving international finance.