



# ***Geothermal Risk Mitigation Facility for Eastern Africa***



## **PROJECTS OVERVIEW AND ACTIVITIES**

With financial support from the



Federal Ministry  
for Economic Cooperation  
and Development



**KFW**



**Geothermal energy offers Africa significant opportunities to enhance access to modern and sustainable energy services in addition to providing significant mitigation benefits in the energy sector.**

*H.E. Dr. Elham M.A. Ibrahim, Commissioner for  
Infrastructure and Energy, African Union Commission*

African Union Commission  
Department of Infrastructure and Energy  
Roosevelt Street, W21K19  
P.O. Box 3243  
Addis Ababa, Ethiopia  
Phone: (251) 11 518 2432

Dear Reader,

One of the major priorities for the African Union Commission (AUC) to address barriers in the African energy sector is to mobilise financial resources from both the public and private sectors. The Geothermal Risk Mitigation Facility (GRMF) offers opportunities to leverage funds from public and private developers through the provision of grants for partial financing of surface studies, drilling and infrastructure development for geothermal energy projects.

Since its launch in 2012, the GRMF programme now covers eleven countries in Eastern Africa and has already completed three application rounds for geothermal energy developers. The programme has awarded grants totalling 16.9 million, 10.4 million, and 28.8 million U.S. dollars in the first, second and third application rounds, respectively, to public and private developers. There is a potential to award further grants of 18.1 million U.S. dollars to developers as continuation premium depending on the needs.

Now in its fourth application round process, the GRMF programme has proven to be an effective tool to mitigate the risks associated with geothermal resources exploration and unlock investments in this sector. As more countries and developers are beginning to participate in this programme, the GRMF programme will also include capacity building and training on project development and management for both public and private developers.

Our vision at the Department of Infrastructure and Energy (DIE) of the African Union Commission is to extend the successful model of the GRMF to address the risks associated with the development of other renewable energy resources including solar, wind, biomass, and hydro.

The African Union Commission wishes to acknowledge the efforts of all the stakeholders involved in the success of the GRMF programme, including our financiers and implementing partners, specifically the German Federal Ministry for Economic Co-operation and Development (BMZ), the EU-Africa Infrastructure Trust Fund (EU Africa ITF), KfW Development Bank (KfW), the UK Department for International Development (DFID), and the Member States of the Eastern Africa region.



H.E. Dr. Elham M.A. Ibrahim  
*Commissioner for Infrastructure and Energy*





**GRMF is playing a pivotal role in addressing the challenges and removing barriers for geothermal development in Eastern Africa by mitigating financial and technical risk.**

*Mr. Aoubakari Baba Moussa, Director of the Infrastructure and Energy Department, African Union Commission*

**The GRMF is a tool that will greatly benefit the geothermal development of Eastern Africa and has encouraged private investors like Reykjavik Geothermal to initiate development of geothermal prospects in Eastern Africa.**

*Thorleifur Finnsson, Head of Project Development, Reykjavik Geothermal, Iceland*



**The rigorous process facilitated Olsuswa Energy Limited (Kenya) to develop a robust data base and surface study planning program, which, under the GRMF framework, assists in project planning and execution.**

*Mugwe Manga, Commercial Director, Olsuswa Energy Limited, Kenya*

**GRMF bridges a financial gap for Africa to exploit its abundant, clean geothermal resources. Power Africa sees the GRMF as a critical tool to advance real deals to provide sustainable power to millions of people.**

*Mr. Andrew M. Herscowitz, Coordinator for Power Africa, U.S. Embassy*



**While Djibouti struggles for energy, GRMF has opened up a way for geothermal development.**

*Abdou Mohamed Houmed, General Manager of ODDEG, Djibouti*



## ELIGIBLE COUNTRIES AND APPLICATION ROUND RESULTS

The following map shows the eleven eligible countries, as well as surface studies and drilling programmes that were awarded grants in the respective application rounds. You can find more information on the funded projects beginning on page 9 of this booklet.



1 <sup>st</sup> Application Round	2 <sup>nd</sup> Application Round	3 <sup>rd</sup> Application Round
● Drilling Programmes	● Drilling Programmes	● Drilling Programmes
■ Surface Studies	■ Surface Studies	■ Surface Studies

So far, a total of 56.1 million U.S. dollars has been awarded to surface studies and drilling programmes in the three completed application rounds. In addition to this, there is a potential to award further grants of 18.1 million U.S. dollars to developers as continuation premium.

## ELIGIBLE ACTIVITIES AND FINANCIAL SUPPORT

### SURFACE STUDIES

Financial support is available for surface studies to determine the optimal location for reservoir confirmation wells at geothermal prospects that have previously been studied extensively. Eligible activities for surface studies are geophysical surveys (e.g. seismic, gravity, magnetic, or magnetotelluric) as well as supplementary geological, hydrogeological, and geochemical surveys. The GRMF funds up to 80 % of approved eligible cost (excluding infrastructure cost).

### DRILLING PROGRAMMES

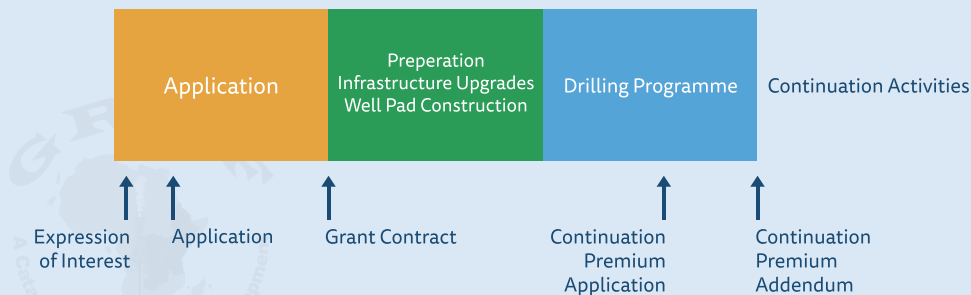
Exploration drilling and testing programmes are eligible for funding once the optimal locations of reservoir confirmation wells have been determined. Such a programme may consist of up to two full-size reservoir confirmation wells, three slim-hole wells, or a combination of two slim-hole and one full-size reservoir confirmation well. The GRMF funds up to 40 % of approved eligible cost (excluding infrastructure cost).

### INFRASTRUCTURE UPGRADES

Infrastructure upgrades required for eligible surface studies or eligible drilling and testing programmes (e.g. access roads, water supply, etc.) can also receive GRMF funding. The infrastructure grant covers up to 20 % of approved eligible cost. It is only available in conjunction with a surface study or drilling programme grant.

### CONTINUATION PREMIUM

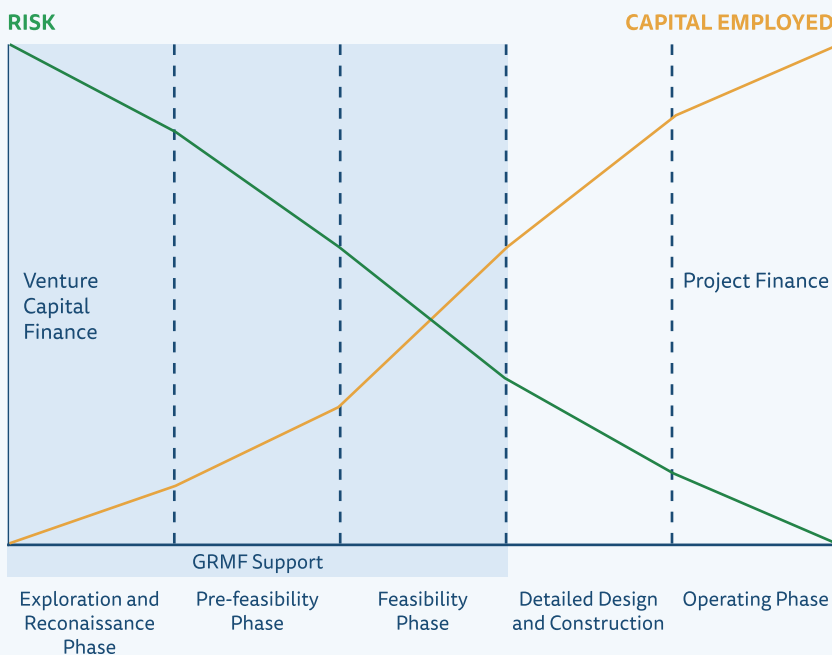
A continuation premium is available to beneficiaries who successfully complete a GRMF-funded drilling programme and fulfilled the original grant contract obligations. The continuation premium may be applied towards an additional full size well, long term discharge testing, a reservoir evaluation update, and a field development plan. The maximum amount of the continuation premium is capped at the lower of either 30 % of eligible continuation activity cost, or at 30 % of the developer's share in the cost of the preceding drilling programme.



## OBJECTIVE AND FINANCIERS

The Geothermal Risk Mitigation Facility (GRMF) was established to fund, facilitate, and accelerate geothermal development in eleven partner countries in the Eastern African Rift region. It is hosted and managed by the African Union Commission (AUC). Funding is provided by the German Federal Ministry for Economic Cooperation and Development (BMZ), the EU-Africa Infrastructure Trust Fund (EU Africa ITF), and the UK Department for International Development (DFID) - all via KfW Development Bank (KfW).

The GRMF was launched in 2012. It conducts a series of application rounds to identify eligible projects and determine appropriate project funding levels. The third application round was finalised in 2015 and will be followed by a fourth application round in 2016. The GRMF programme has a total funding volume of approximately 115 million U.S. dollars, which may be increased at the donors' discretion.



The overall objective of the GRMF is to encourage public and private sector investment into geothermal power generation. This is achieved by providing financial support to mitigate the early stage exploration risk associated with geothermal power projects in order to improve project bankability and secure external financing. The GRMF therefore acts as a catalyst in establishing geothermal energy as a strategic option for power generation capacity expansion in the partner countries.

## APPLICATION PROCEDURE

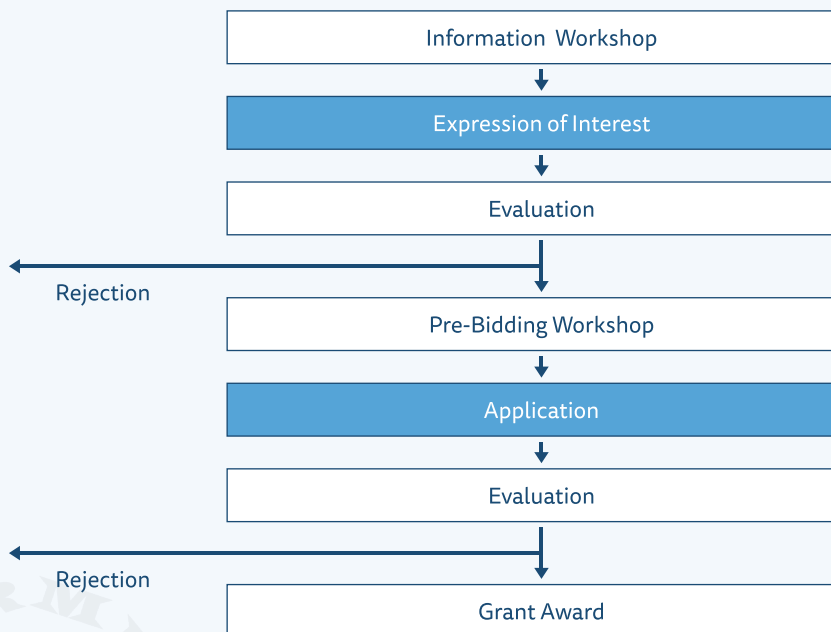
The GRMF provides grants to developers by means of a competitive, transparent, and rigorous two-stage application process:

### PRE-QUALIFICATION PHASE

The first stage of the application procedure is an open pre-qualification process. Potential applicants are invited to submit their expressions of interest (EoIs). EoIs for eligible activities scoring above a certain threshold successfully pass pre-qualification will be invited to participate in a pre-bidding workshop, and to submit a full application.

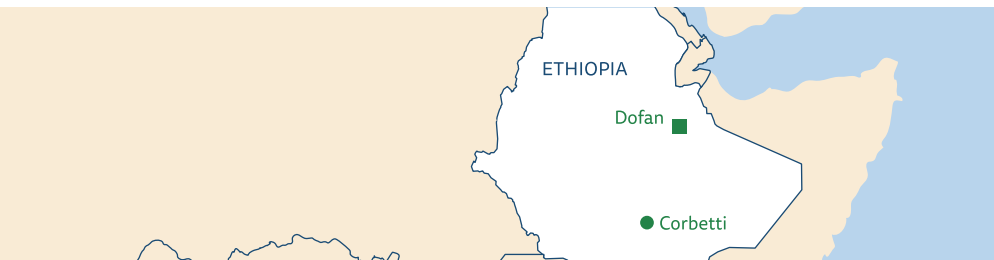
### APPLICATION PHASE

In the second stage, applicants with pre-qualified EoIs must submit a full application. Applications that score above a certain threshold will be offered a grant contract by the AUC upon approval of the GRMF Oversight Committee.



# ETHIOPIA

## FIRST APPLICATION ROUND | PROJECT BRIEFING



### GEOTHERMAL SURFACE STUDY AT DOFAN GEOTHERMAL PROSPECT

#### ■ Surface Study

Beneficiary	Geological Survey of Ethiopia
Location	Dofan, Oromia
Planned Completion of Surface Study	2017
Grant awarded in	2014
Grant Volume	\$ 976,872

### CORBETTI GEOTHERMAL PROJECT

#### ● Drilling Programme

Beneficiary	Reykjavik Geothermal
Location	Corbetti, Oromia
Estimated Resource Potential	500-1,000 MW <sub>th</sub>
Planned Plant Capacity	250 MW <sub>e</sub>
(Estimated) Commissioning of Plant	2017/ 2019/ 2022/ 2024
Grant awarded in	2014
Grant Volume	\$ 7,990,000
Planned Investment Volume	\$ 2,000,000,000

The total capacity of the project will be reached in four stages of 20 MW<sub>e</sub>, 50 MW<sub>e</sub>, 200 MW<sub>e</sub>, and 250 MW<sub>e</sub>.

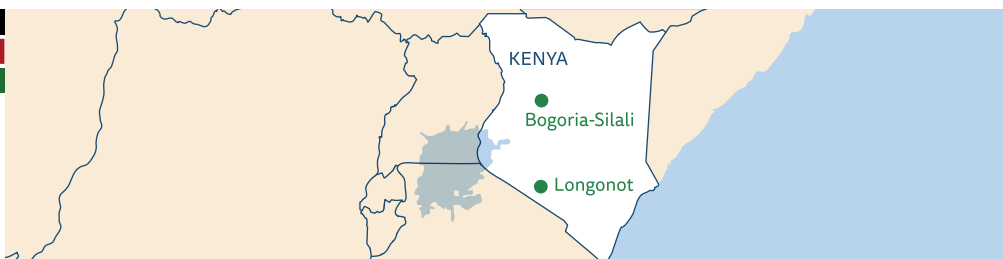
The concession is located in a densely populated area with good road access. It is at the heart of the national electrical grid.





## KENYA

### FIRST APPLICATION ROUND | PROJECT BRIEFING



#### SILALI GEOTHERMAL PROJECT

##### ● Drilling Programme

Beneficiary	Geothermal Development Company
Location	Silali, Baringo and Turkana Counties
Estimated Resource Potential	800 MW <sub>e</sub>
Planned Plant Capacity	800 MW <sub>e</sub>
(Estimated) Commissioning of Plant	2019
Grant awarded in	2014
Grant Volume	\$ 6,026, 786
Planned Investment Volume	\$ 3,303,600,000

The first phase is to develop a capacity of 200 MW<sub>e</sub>. Other phases are yet to be determined.

Besides agricultural applications in food processing and leather manufacturing, this project is also supposed to spur existing eco tourism by expanding the number and quality of available activities, which are currently limited to one spa and boat rides on Lake Bogoria.

#### LONGONOT GEOTHERMAL PROJECT

##### ● Drilling Programme

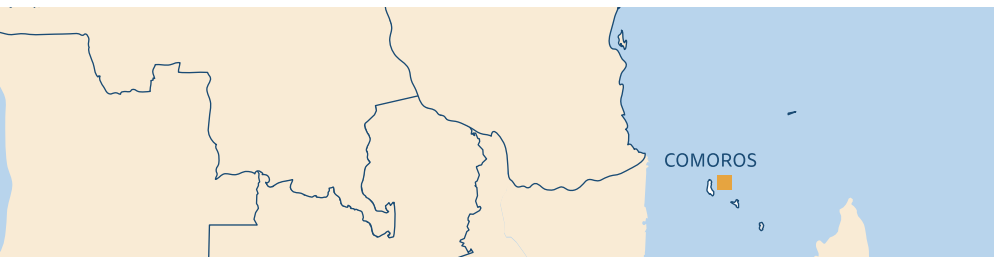
Beneficiary	Africa Geothermal International (Kenya) Limited
Location	Mount Longonot, Nakuru County
Estimated Resource Potential	580 MW <sub>e</sub>
Planned Plant Capacity	140 MW <sub>e</sub>
(Estimated) Commissioning of Plant	2020/ 2021
Grant awarded in	2013
Grant Volume	\$ 8,437,024
Planned Investment Volume	\$ 600,000,000

The first unit with a capacity of 70 MW<sub>e</sub> is scheduled for commissioning in 2020, the second unit with identical capacity for 2021. The planned investment volume is \$ 310,000,000 and \$ 290,000,000 for the first and second stage, respectively.

Direct residual heat use for geothermal brine spas, low temperature binary units, and process heat for industrial parks is an option.

# COMOROS

## SECOND APPLICATION ROUND | PROJECT BRIEFING



### GEOHERMAL SURFACE EXPLORATION OF **GRANDE COMORE**

#### ■ Surface Study

Beneficiary	Ministère de la Production, de l'Environnement, de l'Energie de l'Industrie et de l'Artisanat Bureau Géologique des Comores (BGC)
Location	Karthala Volcano, Grande Comore
Completion of Surface Study	2015
Grant awarded in	2015
Grant Volume	\$ 844,680

A thorough surface exploration programme of the geothermal resources associated with the Karthala volcano was the result of successful collaboration between the Governments of Comoros and New Zealand, the United Nations Development Programme (UNDP), and the GRMF.

Technical expertise was provided by the New Zealand Government, logistics by UNDP, and local assistance by the BGC.



# ETHIOPIA

## SECOND APPLICATION ROUND | PROJECT BRIEFING



### FANTALE GEOTHERMAL DEVELOPMENT PROJECT

#### ■ Surface Study

Beneficiary	Cluff Geothermal Limited
Location	Metehara, Oromia
Completion of Surface Study	2016
Grant awarded in	2016
Grant Volume	\$ 862,000

The Fantale site is named after the Fantale volcano at its centre. The license area is close to the main road and rail link between Addis Ababa and Djibouti. A high voltage power distribution line runs through the license area, which also covers parts of the Awash National Park. Even though no future drilling is planned within the national park, developer and park administrator worked together closely throughout the project.

### TULU-MOYE GEOTHERMAL PROJECT

#### ■ Surface Study

Beneficiary	Reykjavik Geothermal
Location	Iteya, Oromia
Completion of Surface Study	2015
Grant awarded in	2015
Grant Volume	\$ 1,314,000

Based on the results of the surface study a location for a first exploration well has been proposed. The following drilling programme is expected to start by the end of 2016 and will culminate in the development of 500 MW<sub>e</sub> of generation capacity.

Reykjavik Geothermal currently estimates the size of the high-enthalpy resource area to be greater than 200 km<sup>2</sup>.

# KENYA

## SECOND APPLICATION ROUND | PROJECT BRIEFING



### AKIIRA GEOTHERMAL PROJECT

#### ● Drilling Programme

Beneficiary	Akiira Geothermal Limited
Location	Naivasha Town, Nakuru County
Estimated Resource Potential	205 MW <sub>e</sub>
Planned Plant Capacity	140 MW <sub>e</sub>
(Estimated) Commissioning of Plant	2018/ 2020
Grant awarded in	2015
Grant Volume	\$ 1,373,877
Planned Investment Volume	\$ 700,000,000

The planned plant capacity will reach 140 MW<sub>e</sub> in two stages of 70 MW<sub>e</sub> each. Both implementation stages are valued at 350,000,000 U.S. Dollars each.

The project covers 15 wells on three drill pads. Two vertical wells have already been completed on two separate pads and have yielded promising results. A third directional well will utilize the existing first well pad. Direct heat use is under consideration, but is currently not included in the project plan. A power purchase agreement for the first stage of the project is in place already.

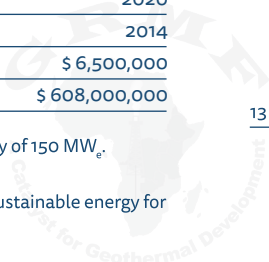
### SUSWA PHASE GEOTHERMAL PROJECT

#### ● Drilling Programme

Beneficiary	Geothermal Development Company
Location	Suswa Prospect, Narok and Kajiado Counties
Estimated Resource Potential	750 MW <sub>e</sub>
Planned Plant Capacity	600 MW <sub>e</sub>
(Estimated) Commissioning of Plant	2020
Grant awarded in	2014
Grant Volume	\$ 6,500,000
Planned Investment Volume	\$ 608,000,000

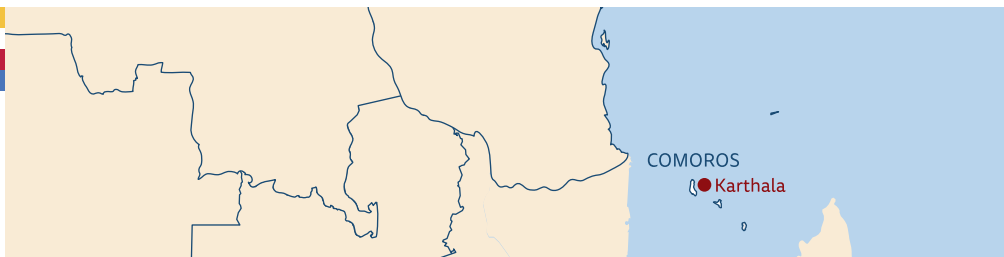
The first and second stages of the Suswa Geothermal Project both target a capacity of 150 MW<sub>e</sub>. The GRMF grant was awarded for the first phase.

Residual heat will benefit the local cattle raising business, providing reliable and sustainable energy for the production of leather, fertilizers, feeds, soap, glue, and animal fats.



## COMOROS

### THIRD APPLICATION ROUND | PROJECT BRIEFING



### KARTHALA GEOTHERMAL PROJECT

#### ● Drilling Programme

Beneficiary	Ministère de la Production, de l'Environnement, de l'Energie de l'Industrie et de l'Artisanat Bureau Géologique des Comores (BGC)
Location	Karthala Volcano, Grande Comore
Estimated Resource Potential	43 MW <sub>e</sub>
Planned Plant Capacity	10 MW <sub>e</sub>
(Estimated) Commissioning of Plant	2022
Grant awarded in	2016
Grant Volume	\$ 8,328,856
Planned Investment Volume	\$ 120,000,000

Union Comoros is heavily dependent on imported fossil fuel for electricity generation. Geothermal development offers the opportunity to shift from biomass (wood and charcoal) and energy imports to indigenous, sustainable energy production. This will lower greenhouse gas emissions and contain deforestation.

The insufficient and unreliable electricity supply hampers economic growth and leads to brain drain as highly educated youth leave the Comoros, primarily towards France.

This drilling programme is the direct result of the GRMF-financed surface study from the second application round. It was completed in the same year that the grant was awarded.



DJIBOUTI

THIRD APPLICATION ROUND | PROJECT BRIEFING



GEOTHERMAL ENERGY DEVELOPMENT IN ARTA

GEOTHERMAL PROSPECT

■ Surface Study

Beneficiary	l'Office Djiboutien de Développement de l'Energie Géothermique (ODDEG)
Location	Arta Town, Arta District
Planned Completion of Surface Study	2017
Grant awarded in	2016
Grant Volume	\$ 928,007

The surface study funded by the GRMF is part of a larger campaign of geothermal development conducted by ODEGG, also in cooperation with further international development agencies.



# ETHIOPIA

## THIRD APPLICATION ROUND | PROJECT BRIEFING



### BUTAJIRA GEOTHERMAL DEVELOPMENT PROJECT

#### ■ Surface Study

Beneficiary	Cluff Geothermal Limited
Location	Butajira, Southern Nations, Nationalities, and People's Region
Grant awarded in	2016

### FANTALE GEOTHERMAL DEVELOPMENT PROJECT

#### ● Drilling Programme

Beneficiary	Cluff Geothermal Limited
Location	Metehara, Oromia
Estimated Resource Potential	750 MW <sub>e</sub>
Planned Plant Capacity	30 MW <sub>e</sub>
Grant awarded in	2016

The planned plant capacity covers the first stage of the project only.

This drilling programme is the direct result of the GRMF-financed surface study from the second application round.

KENYA

THIRD APPLICATION ROUND | PROJECT BRIEFING



BARRIER GEOTHERMAL PROJECT

■ Surface Study

Beneficiary	Olsuswa Energy Limited
Location	Barrier Volcanic Complex, Turkana County
Planned Completion of Surface Study	2016
Grant awarded in	2016
Grant Volume	\$ 980,568

Previous reconnaissance studies at the Barrier Volcanic Complex in 2011 indicate a potential of 750MW<sub>e</sub>.

Upon confirmation of the estimated potential, the first phase of the subsequent drilling programme aims at the development of a 140 MW<sub>e</sub> power plant.



# KENYA

## THIRD APPLICATION ROUND | PROJECT BRIEFING



### KOROSI GEOTHERMAL PROJECT

#### ● Drilling Programme

Beneficiary	Geothermal Development Company
Location	Korosi, Baringo County
Estimated Resource Potential	450 MW <sub>e</sub>
Planned Plant Capacity	350 MW <sub>e</sub>
(Estimated) Commissioning of Plant	2019
Grant awarded in	2016
Grant Volume	\$ 4,565,259
Planned Investment Volume	\$ 463,000,000

The project will be implemented in several stages. The first stage, for which planning is complete, will have a capacity of 100 MW<sub>e</sub>.

The geothermal development project sponsored by the GRMF will also benefit other development projects: Aloe Vera is grown in Marigat under an EU sponsored project and has proven a reliable crop in this arid region. Residual heat can be used for further processing. Further agricultural applications for honey and meat processing are envisioned.

Suitable geothermal effluents could be used for irrigation purposes.

### PAKA GEOTHERMAL PROJECT

#### ● Drilling Programme

Beneficiary	Geothermal Development Company
Location	Paka, Baringo County
Estimated Resource Potential	450 MWe
Planned Plant Capacity	350 MWe
(Estimated) Commissioning of Plant	2019
Grant awarded in	2016
Grant Volume	\$ 5,162,910
Planned Investment Volume	\$ 466,000,000

The Paka Geothermal Project is located only 20 km away from the Korosi project, wherefore the benefits to the local economy are identical.

The implementation of this project is staged. The first stage will reach a capacity of 100 MW<sub>e</sub>.

# RWANDA

## THIRD APPLICATION ROUND | PROJECT BRIEFING



### KINIGI GEOTHERMAL EXPLORATION DRILLING PROJECT

#### ● Drilling Programme

Beneficiary	Energy Development Corporation Ltd (EDCL)
Location	Kinigi, Musanze District, Northern Province
Estimated Resource Potential	192 MWth
Planned Plant Capacity	20 MWe
(Estimated) Commissioning of Plant	2021
Grant awarded in	2016
Grant Volume	\$ 4,439,444
Planned Investment Volume	\$ 21,175,130
(Estimated) Commissioning of Plant	2021

After the exploration drilling period, field development and power plant construction is scheduled to begin in 2018.

The residual heat can be employed for drying applications in the important agriculture sector of the Kinigi area.

In addition there is potential for a geothermal spa to expand the existing tourism business in Kinigi.







## **Geothermal Risk Mitigation Facility for Eastern Africa**

For more information and updates  
please visit the GRMF online:  
[www.grmf-eastafrica.org](http://www.grmf-eastafrica.org)

For general queries concerning the GRMF  
please contact us via email:  
[abdallahr@africa-union.org](mailto:abdallahr@africa-union.org)  
[grmf@roedl.com](mailto:grmf@roedl.com)

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Addis Ababa, Ethiopia  
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