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DEVELOPMENT OF A RISK MITIGATION MECHANISM FOR GEOTHERMAL DEVELOPMENT IN EAST AFRICA

for
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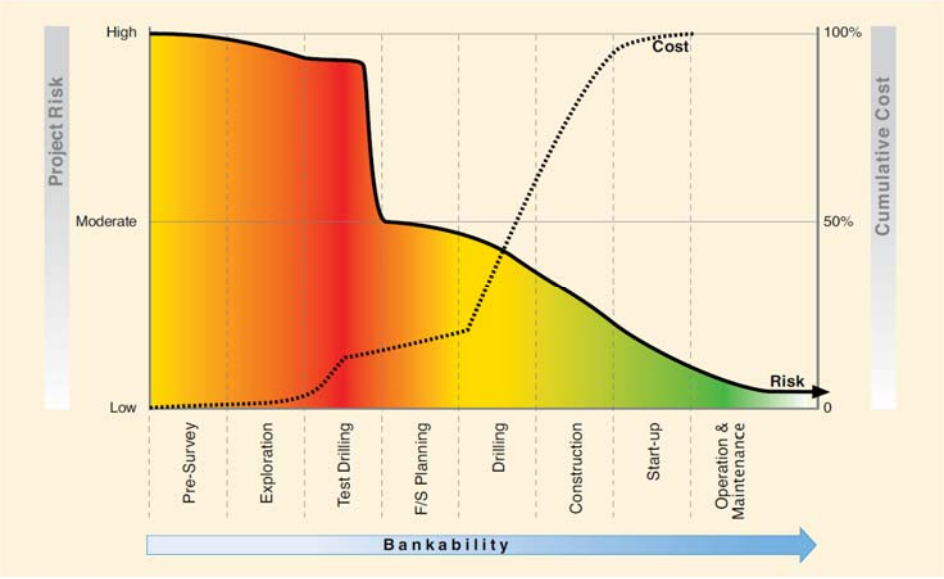
1. INTRODUCTION

1.1 Summary of Risks in Geothermal Projects

1.1.1 Types of Risks

As in nearly all projects and undertakings, there is a wide variety of risks associated with geothermal projects, including political, financial, legal/regulatory, environmental/social, infrastructural and technical. The last risk category is most closely related to uncertainties about the geothermal resource, including location, size / capacity and the optimal exploitation scheme. As wells are drilled and tested, resource uncertainty decreases, as does the overall project risk; this is why resource risk is nearly always addressed by geothermal risk mitigation schemes, many of which specifically address the high resource risk at the early stages of geothermal projects, as demonstrated by the figure below (from ESMAP, 2012, Geothermal Handbook: Planning and Financing Power Generation, Energy Sector Management Assistance Program, Technical Report 002/12).



In addition, there may be a lack of in-country technical expertise to implement geothermal projects. However, other risk categories mentioned above can also delay and even prevent geothermal projects from reaching completion; for example:

- A lack of infrastructure can prevent access to the geothermal resource and access of geothermal power to the market.
- Environmental restrictions and/or social issues can eliminate the ability to develop land that may be attractive for geothermal development.
- The lack of a robust and transparent legal and regulatory framework can cause uncertainties about development rights, leading to legal disputes and/or project delays.

Separately and in combination, these risk factors can impact the geothermal investment climate, increasing the cost of capital for geothermal projects – an increase that might not be reflected in the price paid for geothermal power.

1.1.2 Typical Geothermal Project Development Stages

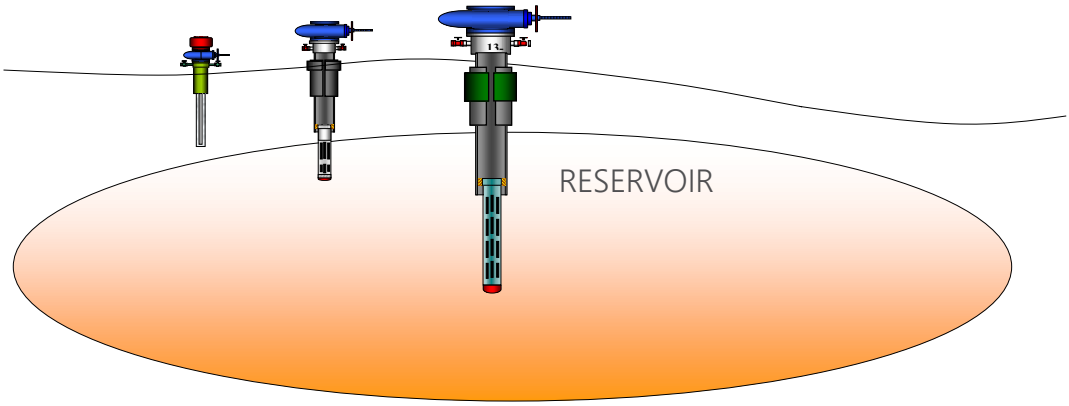
Risks can vary by project stage, therefore a brief discussion of these stages is warranted. All geothermal projects pass through a common set of development stages:

Reconnaissance Exploration. During this stage, exploration data (geological, geochemical, geophysical) are collected and analyzed to begin defining the resource, with the goal of convincing the developer that an exploitable resource exists, providing the impetus to proceed further. The first conceptual model is developed at this stage, describing the likely area underlain by the geothermal resources, and its temperature (from chemical geothermometry).

Pre-Feasibility. In this stage the exploration work becomes more focused, and often includes additional geophysical surveys (resistivity, gravity and magnetic are common methods and are used to image the subsurface). In addition, temperature-gradient surveys are often undertaken at this stage. Although a temperature gradient survey involves drilling some simply constructed, shallow wells, it is properly characterized as a geophysical method because it investigates the temperature field in the shallow subsurface (*i.e.*, the "temperature halo" above a geothermal reservoir). The results of these activities are used to update the conceptual model, which is used to select the locations and drilling targets for the first few deep exploration wells.

Feasibility. This is the most critical stage for most geothermal projects, because the ante is significantly increased (hence the focus on this stage by many risk mitigation instruments). The combined costs of reconnaissance and pre-feasibility exploration typically range from a few hundred thousand dollars to perhaps $ 1-2 million, whereas full-diameter wells cost several million dollars each (a typical average is about $ 7 million for a ~2,500 m well, although this varies considerably by geography). In addition, infrastructure development is often required (road building to reach the drilling areas and water supply for drilling are the main elements). Some developers choose to begin their drilling campaigns with less expensive alternatives to interrogate the subsurface such as core holes, which can sometimes reach the top of a geothermal reservoir, allowing the resource temperature to be measured, and perhaps a limited testing opportunity. Slim holes have more options for logging and testing than core holes. They are drilled with the same equipment as full-diameter wells, but are completed with smaller diameters to save costs; however, the cost savings are not huge (perhaps 30% of the cost of a full-diameter well). The typical "reach" of the various

types of wells discussed above is shown schematically in the figure below (temperature gradient holes on the left, core holes or slim-diameter wells in the middle, and full-diameter wells on the right). The optimistic developer will choose full-diameter wells, betting that the well will be successful, and therefore useful in the project.



The first deep wells are typically referred to as exploration wells. After there has been some drilling success, additional "appraisal wells" (confirmation wells) are drilled to further delineate the resource. Successful wells enable the resource to be characterized to a significant degree, including any factors that could affect the operation of the wellfield or the power plant (scaling, corrosion, non-condensable gases, etc.). The number of wells required to sufficiently characterize the resource and conduct a full Feasibility Study varies between projects, and depends on the drilling success rate and the intended project size. An initial program of 3 wells followed by another 6 wells is not uncommon. Of these, at least 2 or 3 and perhaps as many as 4 or 5 may be unsuccessful. If the overall drilling success rate for these wells was 60%, between 5 and 6 of the 9 wells would be successful. If these are drilled over a sufficiently large area and if the (once again updated) conceptual model provides a

rational basis to explain the drilling successes and failures, there is a basis for establishing the feasibility of a project of a specific size.

The Feasibility Study provides a robust resource capacity estimate, a field development plan and fluid gathering system layout, a basic power plant design, an estimate of capital costs for completing the development (including the interconnection costs to get power to the grid), details of the Power Purchase Agreement (PPA), and a financial model to demonstrate the economic viability of a project of a specific size and type. With such a Study in hand, a commitment for project finance can be obtained.

Project costs up to this point are typically borne by the project developer and its equity partners, sometimes with support from governments and/or geothermal risk mitigation instruments.

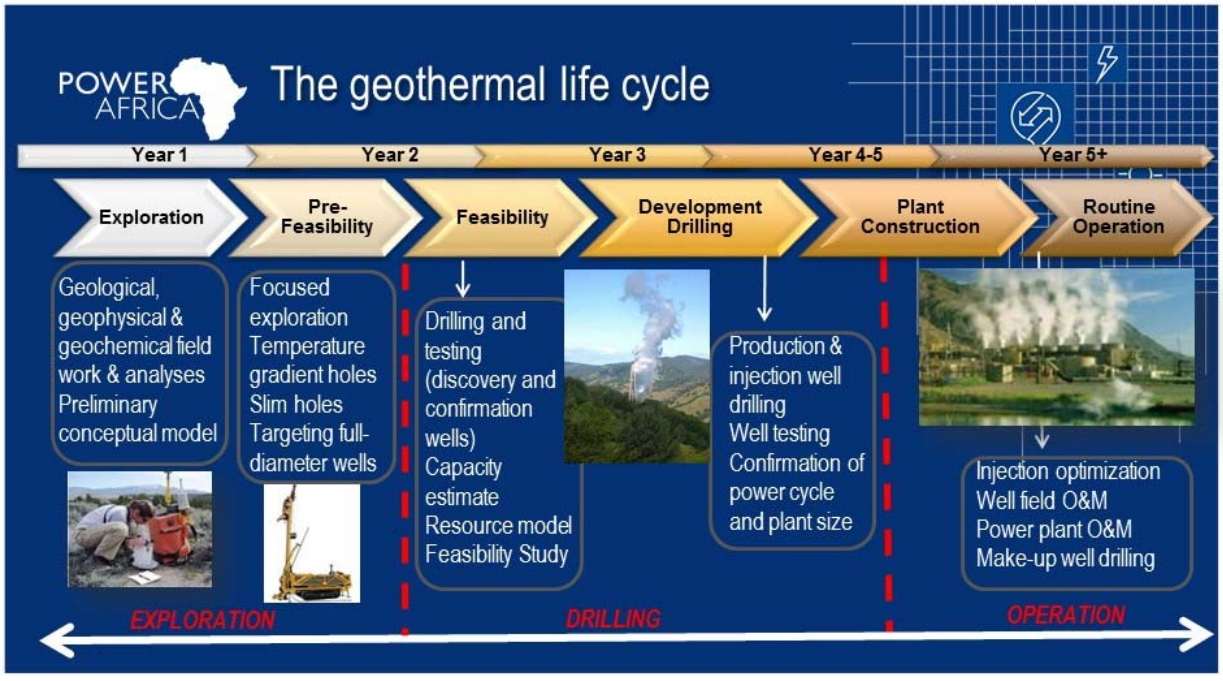
Detailed Design and Construction. At this point, the civil works related to wellfield and power plant construction are undertaken, detailed designs are prepared for the power plant and gathering system and bid out to an EPC contractor and construction activities begin, the remaining wells are drilled and tested (typically 15% excess capacity is available at start-up to account for the initial decline that is common when production begins), the transmission interconnect is constructed, and the system is tested and commissioned.

Operation Phase. This is the phase of routine operation of the new facility and the initiation of a revenue stream. Data from the wellfield and power plant are routinely collected and analyzed to understand how the reservoir is responding to production, and how the power plant is operating. This phase can last for 30 years or significantly longer, during which time the resource gradually declines, requiring the periodic

drilling of "make-up" wells to maintain power plant output. Sometimes an adjustment to the production/injection scheme is needed (for example, one or two additional injection wells might be drilled to better distribute injection into the reservoir, or one or two additional production wells might be drilled to minimize non-condensable gas production). These types of adjustments help balance production and injection and optimize power plant operations.

Expansion Phase. Many projects have an opportunity for expansion, particularly those that begin with a relatively modest increment of capacity, such as was the case at the Olkaria field. Not every project can expand as much as Olkaria has, but many go through the stages described above (typically without reconnaissance exploration, since it was already undertaken before developing the first project) more than once, adding new increments of power.

A diagram summarizing the typical activities at each phase is presented below.



1.1.3 Geothermal Risk Matrix

To provide context for the development of a new USAID-sponsored geothermal risk mitigation facility for East Africa - the GeoFutures Facility – a risk matrix has been developed to more fully describe the risks discussed above, and when they occur relative to the stage of geothermal development (Table 1.1). This table is organized according to major risk categories, which we have defined as Country Risk, Financial Risk and Project Implementation Risk. The first two categories are largely non-technical in nature, and the last is mostly technical (although there are a few non-technical risks noted that also affect project implementation). The Project Implementation Risks are broken down according to development stage, which has been simplified from the description above into Pre-Feasibility (which includes the Reconnaissance Exploration stage), Feasibility, Development and Operation.

Table 1.1 describes individual risks and presents possible interventions that can mitigate each. Developed with the East Africa context in mind, the table includes risks that are common for geothermal projects in developing countries, although many of the risks presented exist in all geothermal projects, regardless of location.

A few phrases have been highlighted in the "Possible Interventions" column of Table 1.1 to demonstrate their importance. The first and by far the most common is the word "advisory." This refers to expertise provided by outside parties for a variety of purposes, all designed to advance the state of geothermal development by helping to create an enabling environment and build expertise in geothermal project implementation, thus increasing the ability of local geothermal professionals to deliver more geothermal projects. Various type of outside parties typically provide this expertise and/or provide the financial means to deliver it, including agencies of other governments (such as USAID),

multilateral development banks, universities, research organizations, humanitarian or philanthropic organizations, and consultants. As can be seen in Table 1.1., "advisory" interventions are needed in every risk category and at every stage of project implementation, leading to the conclusion that a Technical Assistance window is a critical part of the GeoFutures Facility.

Not surprisingly, the second most common of the interventions are those related to drilling. Cost-shared drilling and well productivity insurance – two different ways to support drilling that will be discussed in more detail within this report - are sometimes the only solution that will allow project to reach the feasibility stage and move into the development stage. Drilling is also needed in the operational stage, and it may be possible for a risk mitigation facility to support this if the project's own cash flow cannot. Thus, drilling is an important element of the GeoFutures Facility.

A third category of risks that is reasonably common is related to the lack of infrastructure. A project that cannot be accessed by road can only be drilled with a heli-portable rig. This is suggested in Table 1.1 as an intervention to determine if a resource actually exists in a remote, roadless area before going to the expense of building significant infrastructure, particularly in steep terrain. The lack of road access can hold back geothermal development for years or even decades. The lack of water supply for drilling is another infrastructure risk, one that is typically solved by piping water in from distant areas and storing it in tanks on site. The source may be one that is already developed (for example, by a local community) and has excess capacity, or one that is developed specifically for the project using surface waters (*e.g.*, extraction from a nearby river) or groundwater wells. For remote projects, the most challenging infrastructure need is the ability to evacuate power to the market (*i.e.*, transmission access). Major infrastructure like high-voltage

transmission lines requires a coordinated effort between energy developers and grid system operators, and substantial funding. Although activities such as road building and water supply could be part of the GeoFutures Facility, major grid system development would not be appropriate.

1.2 Purpose and Scope of this Study

Introducing the risks that are common to geothermal development highlights the underlying challenges of geothermal development, and frames the purpose of this study: to help define a new risk mitigation facility for East Africa and to suggest how to fund it. It is intended that GeoFutures will be implemented initially in Kenya and Ethiopia, followed by other geothermal countries in the region. The scope of work developed by the United States Energy Association (USEA), which has implemented the study on behalf of USAID and its Power Africa initiative, includes 3 main tasks, as described below.

Task 1: Proposal for Risk Mitigation Mechanism and Implementation Plan

Task 1.1: Analysis of Existing Geothermal Risk Mitigation Mechanisms

Based on its own experience and a search of information in the public domain, GeothermEx and Parhelion have summarized and analyzed several geothermal risk mitigation facilities that been set up and implemented by various entities for projects in different countries and regions. This was achieved by studying the websites and publications related to the various facilities, and conducting interviews with the people who manage the facilities and/or were involved in their creation. The purpose of these interviews was to understand the details of their respective programs and obtain insights on which aspects of the programs have been successful and which have been less so. Interviews were held with numerous parties involved in such schemes, including:

- the German development bank Kreditanstalt für Wiederaufbau (KfW), to discuss the East Africa Geothermal Risk Mitigation Facility (GRMF);
- the Interamerican Development Bank (IDB), to discuss the Chile risk mitigation instrument (MiRiG) and the Mexico Partial Risk Guarantee scheme developed together with Mexico's internal development bank (Nacional Financiera or "NaFin") and Mexico's Energy Secretariat (SENER); and
- the Dewhurst Group, which is co-managing the Geothermal Development Facility for Latin America (GDF LAC), a facility that was recently set up and is soon to issue its first call for proposals.

Other interviews were held either in person by phone with numerous parties involved in geothermal risk mitigation schemes or that have other initiatives that support geothermal projects, including World Bank, International Finance Corporation, US Trade Development Agency (USTDA), US Export-Import Bank (ExIm), US Overseas Private Investment Corporation (OPIC), USAID's Development Credit Authority (DCA) and the Climate Investment Funds, which provides funds to several of the risk mitigation schemes.

GeothermEx and Parhelion identified 9 schemes that were considered to be particularly relevant to the development of the GeoFutures Facility. For each, information was obtained regarding:

- The structure of the program and its key features
- The geographic extent of its application
- Strong and weak points of the program
- The origin(s) of support for the program, and the approximate magnitude of support provided
- The operational and management aspects of the program, such as:

- How projects are selected for funding
- Funding criteria and disbursement triggers
- Options for recovering and "recycling" funds after completion of the supported activities (exploration, drilling and confirmation of resources)

The benefits and drawbacks of each basic type of approach were evaluated by comparing various schemes or assessing the outcomes of individual schemes, with the goal of learning from the positive and negative aspects of each. Chapter 2 presents a summary describing the most important points of each scheme, and concludes with a list of characteristics from various schemes that would be suitable for the GeoFutures Facility.

Task 1.2: Analysis of Regional Risk Factors

GeothermEx and Parhelion have reviewed the risk factors that are specified to the region, with a focus on Kenya and Ethiopia (where geothermal development is the most advanced), but a view toward risks that are likely in other geothermal countries in the region. The risk factors considered include:

- typical obstacles to resource development in the region;
- private sector appetite for participation in geothermal development;
- socio-political climate and attitudes towards geothermal development;
- legislative structure in each relevant country;
- interventions that are likely to be needed; and
- other factors that could impact the cost, schedule and outcome of resource development (including logistical / infrastructural factors and environmental restrictions).

This task included a series of face to face meetings and discussions in Nairobi and Addis Ababa with numerous parties, including:

- private-sector and public-sector geothermal developers who may be interested in applying to the GeoFutures Facility and/or have applied to or received funds from other risk mitigation facilities;
- private-sector financial entities;
- government ministries and departments;
- local electric utilities;
- international aid agencies; and
- a variety of other players that have a stake in geothermal development in the region.

Together with the analysis of regional risks, these interviews helped to understand the challenges facing geothermal developers and others (from both the public and private sectors) involved in geothermal development. Our analysis is presented in Chapter 3, and summary notes from interviews are included in the Appendix.

Task 1.3: Design of Risk Mitigation Mechanism and Implementation Plan

Using the results of the first two tasks, GeothermEx and Parhelion developed a draft plan and recommendations for the activities that the GeoFutures Facility may cover to make it an appropriate and effective risk-mitigation program for the region. Potential funding partners, private sector partners, project developers, and other regional stakeholders were consulted in person and remotely to help frame an approach that effectively addresses the geothermal risks faced in Kenya, Ethiopia and the East Africa region in general, borrowing concepts from other risk mitigation schemes that could help to maximize the effectiveness and longevity of the new facility.

Suggestions are made regarding the basic design of the facility, how to keep it simple yet robust, what risks it addresses (and at what stages of geothermal project development),

the funding required to initiate the facility, how funds could be partially recovered to enable re-deployment in other projects, what combination of public and private funding might be appropriate, and identify barriers or obstacles that might lessen the effectiveness of the facility. The study also considered:

- Responsibility of the operator to provide documentation regarding project planning and technical details (for example, well locations and targets, drilling plans, contractor information, and progress reports as work proceeds).
- Criteria for determining success or failure of individual wells, and (if relevant to the mechanism) of the project as a whole.
- Requirements that may be imposed by the insurer or lender as to remedial procedures (re-drilling, stimulation or other remedies to drilling failures).
- Requirements for monitoring and evaluation by consultants.
- Procedures for dispute resolution.

Chapter 4 presents the draft plan for the GeoFutures Facility, and Chapter 5 presents a summary of all Task 1 results.

Task 2: Stakeholder Workshop

In close consultation with the United States Energy Association (USEA) and Power Africa, GeothermEx and Parhelion held a discussion of the findings of the Draft Report among all consulted stakeholders, developers, and financiers. GeothermEx and Parhelion presented the results of Task 1 in a Stakeholder Workshop convened by Power Africa and EAGP on 23 March 2017 at the Radisson Blu Hotel in Upper Hill (Nairobi). Open discussion was fostered and feedback was collected from the attendees. The Workshop was followed by one-on-one meetings with stakeholders interested in having a more complete discussion in private.

Task 3: Vetting and Adoption of Stakeholder Comments and Final Report

Comments from the Stakeholder Workshop were solicited and received during the Workshop, and additional feedback is requested after Stakeholders have reviewed this draft report. After the feedback period, GeothermEx and Parhelion will finalize the report, incorporating comments and recommendations as appropriate, and documenting the Workshop activities.

1.3 Initial Interviews

In preparation for developing its concept for the GeoFutures Facility, GeothermEx and Parhelion met with numerous entities. These interview, held in Washington DC in December 2016 and in Nairpobi and Addis Ababa in January 2017, significantly influenced our thinking. We gratefully acknowledge the time and input from the many parties listed in the table on the following page.

A list of attendees at the Stakeholder Workshop will be included in the Final Report.

WASHINGTON MEETINGS	KENYA MEETINGS
US Department of State	Power Africa
US Department of Energy	OPIC
US Energy Association	USAID
Overseas Private Investment Corporation (OPIC)	Stanbic Bank
Interamerican Development Bank	Olsuswa Energy
World Bank – IDA	EAGER
Geothermal Energy Association	KenGen
Climate Investment Funds	Tetra Tech
Export-Import Bank of the United States (US ExIm)	Embassy of Sweden
US Trade Development Agency (USTDA)	Geothermal Development Corporation (GDC)
US Agency for International Development's Development Credit Authority (USAID DCA)	Ministry of Energy and Petroleum (MoEP), Government of Kenya
International Finance Corporation (IFC)	Energy Regulatory Commission (ERC), Kenya
Addis Ababa Meetings	Corbetti Geothermal
Africa Union Commission (AUC, implementing agency for GRMF)	Africa Trade Indemnity (ATI)
Geological Survey of Ethiopia (GSE)	International Finance Corporation (IFC)
Japan International Cooperation Agency (JICA)	Frontier Investment Management
Ministry of Finance and Economic Cooperation (MFEC)	Agence Française de Dévéloppement (AFD)
Ethiopian Electric Power Corporation (EEPC)	Akiira One Geothermal Ltd.
Ministry of Water, Irrigation and Energy (MWIE)	Japan International Cooperation Agency (JICA)
Reykjavik Geothermal (RG)	Kreditanstalt fur Wiederaufbau (KfW)
Meridian Private Equity	UNEP
OTHER MEETINGS AND DISCUSSIONS: International Renewable Energy Agency (IRENA) / Global Geothermal Alliance (GGA) Cluff Geothermal, London	

1.4 List of Abbreviations

Many organizations and facilities have been discussed in this report; the table below is a list of abbreviations that have been used herein.

ADFD	Abu Dhabi Fund for Development
AFD	Agence Française de Dévéloppement (French aid agency)
ATI	Africa Trade Indemnity
AUC	Africa Union Commission
AWC	Anticipated Well Cost
BGR	German Federal Institute for Geosciences and Natural Resources
BMZ	German Federal Ministry for Economic Cooperation Development
CABEI	Central American Bank for Economic Integration
CAF	Andean Development Corporation – Development Bank of Latin America
CFE	Comisión Federal de Electricidad (Mexico state electric utility)
CFP	Call for Proposals
CIF	Climate Investment Funds
CP	Continuation Premium
CTF	Clean Technology Fund
DFID	Department for International Development
EAGER	East Africa Geothermal Energy Facility
EAGP	US-East Africa Geothermal Partnership
EARS	East Africa Rift System
EBRD	European Bank for Reconstruction and Development
EEPC	Ethiopian Electric Power Corporation
EIB	European Investment Bank
EOI	expressions of interest
EPC	Engineering, Procurement, Construction
ERC	Energy Regulatory Commission, Kenya
ESIA	Environmental, Social Impact Assessments
ESMAP	Energy Sector Management Assistance Program (World Bank)
EU-Africa ITF	EU-Africa Infrastructure Trust Fund
EU-LAIF	European Union through the Latin America Investment Facility
EWSA	Energy Water and Sanitation Authority, Rwanda
FOTEASE/Sener	Mexico Energy Secretariat
GDC	Geothermal Development Corporation
GDF LAC	Geothermal Development Facility for Latin America
GFF	GeoFutures Facility
GGA	Global Geothermal Alliance (organized by IRENA)
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (German aid agency)

GPP	Geothermal Power Plant
GRMF	Geothermal Risk Mitigation Facility for Eastern Africa
GSE	Geological Survey of Ethiopia
ICEIDA	Icelandic International Development Agency
ICF	International Climate Fund
IDB	Interamerican Development Bank
IFC	International Finance Corporation
IRENA	International Renewable Energy Agency
JICA	Japan International Cooperation Agency
KenGen	Kenya Electricity Generating Company
KfW	Kreditanstalt für Wiederaufbau (German Credit Authority for Reconstruction)
KPLC	Kenya Power and Lighting Company
MFEC	Ministry of Finance and Economic Cooperation
MiRiG	Chile Geothermal Risk Mitigation Program
MoENR	Ministry of Energy and Natural Resources, Turkey
MoEP	Ministry of Energy and Petroleum, Government of Kenya
MWIE	Ministry of Water, Irrigation and Energy
NAFIN	Nacional Financiera S.N.C
NDF	Nordic Development Fund
ODA	Office of Development Assistance
ODDEG	Djiboutian Office of Geothermal Energy Development
OECD	Organization for Economic Co-operation and Development
OPIC	Overseas Private Investment Corporation
PIU	Project Implementation Unit
PLUTO	Turkey Early Stage Geothermal Development Framework
PPA	Power Purchase Agreement
PPP	Public-Private Partnership
PRG	Partial Risk Guarantee
RG	Reykjavik Geothermal
TA	Technical Assistance
TGDC	Tanzania Geothermal Development Company
UAE	United Arab Emirates
UNEP	United Nations Environment Programme
US ExIm	Export-Import Bank of the United States
USAID	US Agency for International Development
USAID DCA	US Agency for International Development's Development Credit Authority
USEA	United States Energy Association
USTDA	US Trade Development Agency
WB	World Bank

1.5 Acknowledgements

GeothermEx and Parhelion kindly acknowledge the support and input from many parties, including the Power Africa team in Nairobi. We would like to particularly thank Hans Jaoko for his support and feedback throughout the process. Our sincere thanks are also extended to the United States Energy Association (USEA), including Andrew Palmateer, Scena Nayak and Caity Smith. Finally, we gratefully acknowledge the entities and individuals who contributed to this work, including those we interviewed in person or via telephone, and those who took the time to attend and actively participate in the Stakeholder Workshop in Nairobi in March 2017. To all we extend our sincere thanks for their input to the process of developing the strategy for the GeoFutures Facility – a new risk mitigation facility for geothermal development in East Africa.

2. EXISTING GEOTHERMAL RISK MITIGATION FACILITIES

To aid in the development of individual resources and scale up the aggregate geothermal capacity of a nation or region, a wide range of risks must be addressed (see Table 1.1). Recognizing this issue, several geothermal risk mitigation mechanisms have been developed by various organizations and have been implemented throughout the world. To develop a successful new mechanism – the GeoFutures Facility – an examination of existing risk mitigation mechanisms is warranted to understand the structures, successes and failures of these mechanisms, thus identifying best practices using risk mitigation instruments and how the GeoFutures Facility could best support geothermal development in East Africa.

This section of the report focuses on existing risk mitigation instruments or programs that help geothermal developers reach project feasibility. To the extent possible, the following are analyzed and described for each mitigation program or mechanism:

- Key features (structure, activities supported, how funding is allocated, etc.)
- Geographic extent of its application
- Strong and weak points based on its operation to date
- The origin(s) of support for the program, and the approximate magnitude of support provided
- Indications of whether and how the program has affected the pace geothermal power development in the applicable region
- The operational and management aspects of the program, such as:
  - the criteria used to select which developers and projects to support typical criteria and triggers for disbursement of funds

- requirements for monitoring, reporting and evaluation of results
- back-stopping requirements (required advisory services, supervision and support)

• The financial impact on stakeholders, in terms of:
- liquidity and availability of risk capital
- options for recovering funds after completion of the supported activities (exploration, drilling and confirmation of resources)
- who pays the bill / holds the risk (*i.e.*, who underwrites the costs in cases where geothermal projects are not realized)

The findings of the evaluation have been distilled into summary tables for each mechanism that describe the above-mentioned points, and the most important points about each of 9 mechanisms examined are summarized below.

2.1 Geothermal Risk Mitigation Facility for Eastern Africa (GRMF)

Facility Description

The Geothermal Risk Mitigation Facility for Eastern Africa (GRMF) was established in 2012 in cooperation with the German Federal Ministry for Economic Cooperation and Development (BGZ) by Kreditanstalt für Wiederaufbau (Credit Authority for Reconstruction – the German development bank - abbreviated KfW), the African Union Commission (AUC), the, and the EU-Africa Infrastructure Trust Fund. Operation and management of the program is shared between the African Union Commission and a German accounting and business consulting firm (Rödl & Partner).

The objective of the Facility is to encourage public and private investors and public-private partnerships (PPPs) to advance geothermal prospects in East Africa toward the goal of

geothermal power generation. This is achieved by providing grants for two types of activity: surface studies and drilling and testing of early exploration and confirmation wells. The GRMF began in early 2012 and is expected to continue for 7 years. It is currently in its fourth round of applications, and it is expected that the next (fifth) round will be the last. There is no requirement to repay any of the GRMF grants. The total facility size is said to be approximately € 115 million.

Initially, the GRMF only supported geothermal activities in the following countries: Ethiopia, Kenya, Rwanda, Tanzania and Uganda. Based on the mandate of the African Union Commission for a much wider range of countries than the original five pilot countries, and interest from additional countries to join GRMF, from the second application round onwards, projects from the following six additional East African countries became eligible under the GRMF: Burundi, Comoros, Djibouti, Democratic Republic of Congo, Eritrea, and Zambia.

Eligible grant activities include:

- Infrastructure upgrades: Upgrades required for eligible surface studies or eligible drilling and testing programs (*e.g.*, access roads, water supply, etc.). The infrastructure grant covers up to 20 % of approved eligible cost.
- Surface studies: Geophysical surveys (*e.g.*, seismic, gravity, magnetic or magnetotelluric surveys) including supplementary geological, hydrogeological and/or geochemical surveys if necessary for siting reservoir confirmation wells. These grants cover 80% of approved allowable costs (excluding infrastructure costs).
- Drilling projects: Exploration drilling program for funding by the Facility may comprise up to two full size reservoir confirmation wells (≥ 5" diameter of the

last casing or liner) or up to three slim hole wells (< 5" diameter of last casing or liner) or a combination of two slim holes and one full size reservoir confirmation well. Furthermore, a drilling program may incorporate a feasibility study that has the explicit aim of securing finance for subsequent reservoir confirmation wells. Drilling grants cover 40% of approved allowable costs for the exploration drilling and testing program for reservoir confirmation wells (excluding infrastructure costs).

The GRMF has a feature that allows follow-on activities to be funded after the initial grant funding: the Continuation Premium (CP). Eligible activities for the CP – which must be undertaken at the same site as the initial drilling and testing program - include an additional full size well, the installation of wellhead generation unit(s), long-term discharge testing (minimum six months), reservoir evaluation updates, and Feasibility Studies. These grants cover up to 30% of the approved eligible and expended costs of continuation activities.

About $ 60 million has been awarded so far, although most of the funds have yet to be disbursed. Some projects have been completed, particularly surface studies, which have led to drilling programs in two countries (Comoros and Ethiopia). No geothermal power plant has been commissioned since the beginning of the GRMF. Details of the GRMF are summarized in Table 2.1.

Facility Pros and Cons

Pros:

- Addresses one of the most crucial stages of geothermal project development (*i.e.*, surface studies and exploration wells).

- Imposes a high level of rigor on the project developers to understand and present their projects in a comprehensive way, which may increase the likelihood that "good" projects are being proposed.
- No repayment of funds is required.
- Large geographic footprint in East Africa.

Cons:

- The application process and disbursement have a high level of bureaucracy, requiring significant management time and external expense. Some developers expressed "fatigue" in seeking to access GRMF funds.
- Funds are for repayment of incurred costs, so projects must have funds available upfront.
- Restricted communication with GRMF leaves significant uncertainty about the application and award process, and what is required for projects to be awarded and actually receive funds.
- Because funds are distributed as reimbursements after expenditure and there is a rigorous review of the activity actually completed vs. what was planned, developers are uncertain if they will be reimbursed or not. Considering these elements, GRMF funding is seen by developers as a bonus if received, rather than part of a financing package.
- GRMF's impact on the pace of geothermal development has not been clearly demonstrated.
- A political "angle" seems to be used when selecting projects, which may hinder the selection of truly deserving projects in favor of equally distributing projects among participating countries.

- Similarly, many eligible countries have little or no geothermal infrastructure, in-country geothermal expertise, and/or significant geothermal potential, but are eligible to receive funds and may receive them, potentially at the expense of more deserving projects.
- To date, support for drilling has been limited.

2.2 Geothermal Development Facility (GDF) for Latin America

Facility Description

The Geothermal Development Facility (GDF) Latin America is a mechanism funded primarily by the German Federal Ministry for Economic Cooperation Development (BMZ), the European Union through the Latin America Investment Facility (EU-LAIF) through KfW Development Bank. Further grants are foreseen by members of the Stakeholder Group and third donors to the current facility, which has about € 50 million. The ultimate goal of the GDF LAC is to catalyze development of a minimum of 7 geothermal plants with a cumulative capacity of at least 350 MW at a total estimated investment of at least € 1 billion. The Facility and is managed by IDA Fund Management, LLC, a consortium between Interlink Capital Strategies (financial manager) with Dewhurst Group, LLC (technical manager).

The GDF will provide non-recoverable grants for surface studies and contingency grants for confirmation drilling for eligible countries in Central and South America: Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, Colombia, Ecuador, Peru, Bolivia and Chile. The funding will be available to private companies, public institutions, or public private partnerships. GDF is focused primarily on funding early stage projects seeking financing for surface studies (which may include 1 slim hole) and confirmation drilling (preferably a

3-well program). The projects will receive 40% of eligible costs; up to € 600,000 for surface studies and up to € 5.8 million for drilling projects. The facility may be used in conjunction with other funding, but the recipient of the grant must bear at least 20% of the cost of the eligible activity.

The application to the fund begins online at the GDF website (http://gdflac.com) with a short "pre-EOI" sign-up form found on the Expression of Interest page. The form is quickly reviewed, and a response is provided to indicate if the application is a good fit with GDF, and therefore should continue to the next step in the process (or not). After a positive response to the form, the application follows a two stage process when a Call for Proposals (CFP) is issued (expected to be 2-4 times per year). The first stage is an Expression of Interest (EOI) that requires the applicant to provide the developer's articles of incorporation, a cover letter describing the requested funding, and a narrative describing the project. EOIs receiving a score of 70% or more will be invited to submit proposals, which have specific requirements that vary depending on the type of application (surface study vs. confirmation drilling), some of which will then be selected for funding.

Applications for surface studies must include:

- a description of existing information;
- a cost estimate for the proposed work;
- the work plan itself;
- an organizational chart of the project team;
- copies of all required permits and licenses;
- an evaluation of the project's market viability;
- a project financing plan;

- the developer's financial statements for the last 3 years; and
- a certificate of the company's registration and a declaration of no-objection from tax authorities (to demonstrate the developer's good standing in the host country).

Drilling proposals require the submission of:

- a description of existing information;
- a cost estimate for the proposed work;
- the work plan itself;
- the anticipated well costs;
- an organizational chart of the project team;
- the drilling procurement plan;
- copies of all required permits and licenses;
- a business plan for project;
- a narrative about market viability;
- an estimate of the Levelized Cost of Energy (LCOE);
- the developer's financial statements for the last 3 years; and
- a certificate of the company's registration and a declaration of no-objection from tax authorities (to demonstrate the developer's good standing in the host country).

After submitting these documents on line, paper copies need to be submitted, including certified copies of permits and licenses (these require the stamp of an Apostille). Review of the application begins when the hard copies have been received by the Facility Managers. A Developers' Manual that provides significant detail on the application process is provided to everyone who is eligible to apply.

Upon receiving the GDF grant, requirements for the follow-up monitoring and reporting of the activities as well as specifications on the disbursement of grant funds will be detailed in the grant agreements, presumably on a per-project basis. Contingent grant agreements for drilling projects will also include success payback criteria.

The GDF has recently completed its first call for EOIs (closed on 28 February 2017) for its first round of grant applications. Additional information about the GDF is presented in Table 2.2.

Facility Pros and Cons

GDF took note of the difficulties with GRMF (see above), yielding an improved risk mitigation instrument. Our suggestions for the GeoFutures Facility has taken these "lessons learned" into account and incorporated many of them.

Pros:

- Addresses one of the most crucial stages of geothermal project development (*i.e.*, surface studies and exploration drilling).
- Has taken the GRMF model and learned from some of its perceived difficulties, notably the cumbersome management system and bureaucratic delays.
- No repayment is required for surface study grants.
- Repayment of contingent grants for drilling is required if the drilling is successful.
- If a performance bond is in place, GDF can use a milestone-driven payment schedule which allows developers to receive funds before task completion (rather than reimbursement after completion of work, which is how GRMF

operates). Reimbursement remains the only option if a performance bond is not provided.

- Has a flexible structure and a wide array of eligible activities.
- Has a clear set of objectives that allows for clear and consistent decisions about what should be funded, and why.

Cons:

- The facility has just closed its first round of accepting EOIs, so there is little information to be gathered from results yet.
- Little detail is provided about the extent of GDF's involvement after award (*e.g.*, monitoring the project, how effectively funds are deployed, etc.).

2.3 East Africa Geothermal Exploration Project (NDF + ICEIDA)

Facility Description

The East Africa Geothermal Exploration Project is the initial phase of a larger scale program known as the Geothermal Compact Partnership Program, initiated jointly by Iceland and the World Bank. The Icelandic International Development Agency (ICEIDA) is the lead managing agency of the Project, with joint co-financing from the Nordic Development Fund (NDF). The main objective of the Geothermal Exploration Project is to assist countries in East Africa to enhance geothermal knowledge and capacity – particularly related to exploration activities - to help enable progress on geothermal energy development. The main elements of the program are support for surface-based exploration and human capacity building. The facility is demand-driven and responds to requests from governments and government agencies only (it is not open to private-sector participants).

The Geothermal Exploration Project began in 2013 and is expected to continue through the end of 2017. It and has a total budget of $ 13 million, of which at least $ 8 million has been spent to date. The program also has a large geographic footprint that includes 13 eligible East Africa Rift System ("EARS") countries: Eritrea, Djibouti, Ethiopia, Uganda, Kenya, Rwanda, Burundi, Tanzania, Zambia, Malawi, Mozambique, Congo, and Comoros. The Geothermal Exploration Project provides assistance in terms of payment to contractors and procurement assistance for the eligible activities, which include geothermal reconnaissance, initial geothermal surface exploration, and building local geothermal capacity.

Several surface exploration and capacity building campaigns have been undertaken successfully under this program including:

- Capacity Building and Technical Assistance in Djibouti for the Djiboutian Office of Geothermal Energy Development (ODDEG) - $ 650,000
- Surface Exploration and Capacity Building in Ethiopia for the Geological Survey of Ethiopia and Ethiopian Electric Power Corporation – $ 3,318,000
- Capacity Building and Technical Assistance in Kenya for the Geothermal Development Company (GDC) – $ 1,580,000
- Capacity Building and Technical Assistance in Rwanda for the Energy Water and Sanitation Authority (EWSA) – $ 850,000
- Surface Exploration and Capacity Building in Tanzania for the Tanzania Geothermal Development Company Limited (Under the Ministry of Energy and Minerals) – $ 1,565,000

These funds are provided as grants, and repayment is not expected. The Geothermal Exploration Project's structure is flexible, and terms are negotiated on a case by case basis,

allowing the facility to address each country's needs with a tailored approach. This has allowed the facility to deploy funds effectively and efficiently. The Geothermal Exploration Project has worked closely with other existing risk mitigation facilities (notably the GRMF) to provide complimentary support to some countries and avoid overlap of funds. Further details on this facility are presented in Table 2.3.

Facility Pros and Cons

Pros:

- No repayment necessary
- Flexible structure and approach on a project per project basis
- Coordination and cooperation with existing risk mitigation structures and local geothermal stakeholders
- Addresses the need for capacity building in government institutions

Cons:

- Small amount of capital that may drive non-technical decisions
- Short time frame for implementation
- Only government agencies are eligible
- Quality of resulting surface studies is uncertain (there is a high value placed on engaging low-cost consultants, which may not lead to optimum results)

2.4 East Africa Geothermal Energy Facility (EAGER)

Facility Description

The East African Geothermal Energy (EAGER) Technical Assistance (TA) facility is designed to help improve geothermal policies and regulatory enabling environments by covering related gaps in the Government's role. The objective of the TA Facility is to collaborate

with and provide technical support to national and regional institutions to put in place the geothermal strategy, policies and regulations that facilitate investment in the geothermal sector.

Funding for the EAGER program comes via the United Kingdom's Department for International Development (DFID) and the International Climate Fund (ICF). DFID provides £ 6 million for technical assistance (through the EAGER TA) to put in place the geothermal strategy, policy and regulations that facilitate investment; and £ 1 million for independent project evaluation. ICF will provide a maximum of £ 48 million of grant capital that will be channeled through the GRMF and will be directed mainly toward reducing the risk of exploratory test drilling. Further details about this facility are presented in Table 2.4.

Facility Pros and Cons (of the TA Facility only)

Pros:

- Focuses on public sector capacity building, which is needed
- Higher perceived value for Ethiopian public entities, who are less advanced relative to Kenya (however, some improvements in the enabling environment in Kenya are still needed)
- Funds are deployed effectively and efficiently

Cons:

- Limited to public sector entities only
- Consultants are not directly contracted by the user of the service (they are contracted by the facility, which could reduce the accountability of the consultant to the user)

- Low perceived value for Kenyan public sector entities (KenGen, GDC) who may have advanced to the point where they generally do not require TA

2.5 EBRD Turkey Early Stage Geothermal Development Framework (PLUTO)

Facility Description

The European Bank for Reconstruction and Development (EBRD) and the Clean Technology Fund (CTF) developed this program to support exploratory drilling investments in Turkey. PLUTO combines $ 100 million from the EBRD with $ 25 million from the CTF, a funding window of the Climate Investment Funds. The program is available only to private developers in Turkey.

The main objective of this program is to help mitigate early risks of geothermal projects and provide comfort to lenders (including EBRD) interested in providing finance at early and later stages of project development. PLUTO is intended to help the interested developers to initiate projects according to industry best practices, and assist the Ministry of Energy and Natural Resources (MoENR) with implementing the existing geothermal legislation (mainly the New Electricity Market Law No. 6446) and other related regulations.

PLUTO is structured in two phases:

- Phase 1 will finance exploratory drilling, drawing on CTF funds, and will be provided for the exploration stage/early stage development of the geothermal power projects. "Soft" loans of up to $ 5 million for each project are offered with a 3-year grace period and a 7-year repayment period. PLUTO will provide up to $ 2 million per well, with the developer required to provide at least 50 percent of equity.

- If exploration proves successful, EBRD will be available to finance the final stages of the drilling and the construction of the power plant as the second phase. Phase 2 will provide loans to private sector investors aimed at bridging the funding gap existing at early stage of development of geothermal power plants (GPPs).

PLUTO's goal is to develop at least five new geothermal power projects with a combined capacity of at least 60 MW. Further detail on the PLUTO geothermal risk mitigation facility is presented in Table 2.5.

Facility Pros and Cons

Pros:

- Phase 1 funding is focused on an area of high risk in the development of geothermal projects in Turkey (and elsewhere), *i.e.*, exploration drilling
- Provides a path for low cost financing in the event of successful exploration and determination of feasibility.

Cons:

- It is unclear how EBRD selects projects for participation
- EBRD's main objective may be to leverage Phase I funding to enable EBRD to provide project financing in Phase II. While this alone is not a "con," some selected projects may not succeed, but would have utilized some of the available funds.

2.6 Chile Geothermal Risk Mitigation Program (MiRiG)

Facility Description

The Chile Geothermal Risk Mitigation Program (MiRiG; an acronym for the Spanish name of this fund, which is Programa de Mitigación de Riesgos de Geotermia) is designed and managed by the Interamerican Development Bank (IDB) and its private arm Interamerican Investment Corporation (IIC) in consultation with the Ministry of Energy of Chile. Its function is to support geothermal projects during the high risk early drilling phase, with the objective of stimulating additional investment in the sector. MiRiG started in 2015, with an original plan to support at least three geothermal projects in Chile through conditional loans for exploration and production drilling. The overarching goal of the facility is to promote geothermal development in Chile, possibly enabling IIC to provide project financing when projects reach the development and construction stage.

Funding for MiRiG comes from IDB and the Clean Technology Fund (CTF). At present there is approximately $ 50 million in available capital, which has the potential to be increased depending on the progression of the projects funded. Three valid projects and developers were identified and extensive due diligence was conducted to assess their capabilities and their projects. A fourth was also evaluated on a preliminary basis. However, with no specified price for power and a significant lack of transmission access to geothermal resources located in the high Andes, the commercial environment for geothermal power in Chile remains unfavorable. At present there is one project that has continued to pursue MiRiG funding. Further details on this funding mechanism are presented in Table 2.6.

Facility Pros and Cons

Pros:

- Lean structure for program administration, with little risk of high cost and delays due to administrative complexity
- Flexibility in designing support structure to match project needs

Cons:

- Chile's electricity market is not conducive to geothermal power because of low prices from other sources of power and a lack of transmission access in the high Andes, where geothermal resource are located
- Projects that are close to needing project finance may be preferred over others at earlier stages of development

2.7 Mexico Geothermal Financing and Risk Mitigation Program

Facility Description

The Geothermal Financing and Risk Mitigation Program for Mexico was developed and funded by the Interamerican Development Bank (IDB), the Clean Technology Fund (CTF) and the Mexican Government to channel support to private developers for work at different stages of geothermal development, including exploratory drilling. The application, award and post-award monitoring process is implemented by Nacional Financiera ("NaFin," Mexico's internal development bank), with support from IDB.

Offering a range of financial mechanisms to support exploration, drilling, field development and construction activities, the Mexico facility was designed with the intention of scaling-up investments in geothermal power generation projects by the private sector. There is a Technical Assistance window that can be used for regulatory

support, technical due diligence, capacity building and facilitation of PPP schemes. In addition, there is a drilling support element that uses a Partial Risk Guarantee (PRG) approach, as follows. The program offers loans at favorable terms for drilling the first two wells in new geothermal prospects, for a maximum amount of $ 5 million per well (which is estimated to represent 60% of the total drilling and testing costs). In the event that the wells do not yield an average capacity of at least 3 MW per well (which is the standard criteria for "success" in any project that uses this facility), the loan would convert to a grant. The use of well productivity insurance would help offset the facility's losses: CTF funds would be deployed to cover the premiums for well productivity insurance, which would make a payout (back to the facility) if "success" was not achieved. On the other hand, if the first two wells have an average capacity of at least 3 MW per well, five confirmation wells would be funded at the same level ($ 5 million per well), for a total loan amount of $ 35 million, which would yield at least 21 MW (at least 3 MW per well x 7 wells).

This facility was anticipated to provide support to private developers, but because the geothermal department of the Mexican state utility CFE holds perhaps as many as 13 geothermal concessions (and it is possible that these include the most prospective remaining geothermal resources in Mexico), there are few private-sector players. Plans are underway within the Ministry of Energy (SENER) to define concessions for three to five sites that will be offered to the private sector, which has some interest in geothermal development (there are at least two and probably more private-sector geothermal companies; at least one is active). However, at recent power auctions, the prices bid by gas and solar projects were reported by IDB to have been between $ 0.35 and $ 0.40 per kW-hour. Geothermal project costs are almost always higher than these prices; since this was an auction, no geothermal projects were selected for contract awards. IDB is

continuing to work with Sener to allow geothermal to participate, perhaps by applying a premium or "adder" for base-load geothermal power (this remains a concept at present).

Although initially launched in July 2015, the Mexico facility has not supported any geothermal projects to date and is essentially inactive at present due to the current geothermal development climate in Mexico.

Details of this facility are presented in Table 2.7.

Facility Pros and Cons

Pros:

- High potential to effectively leverage and recycle public funds for private projects because of the well productivity insurance element
- Engages domestic insurance industry, helping to build domestic capacity
- Attracts private sector capital in the form of local and international insurance capital
- An attractive options for Ethiopia, since Ethiopian law currently prohibits international banks but allows international reinsurance

Cons:

- No projects have been funded to date because of market conditions in Mexico
- Numerous entities are involved (including various government agencies), increasing the level of bureaucracy and time for reviews and approvals
- The mechanism is structurally complex and may be difficult to explain to developers

2.8 IRENA ADFD Project Facility

Facility Description

In 2009, the United Arab Emirates (UAE) committed concessional financing of up to $ 350 million, to be disbursed in seven cycles to renewable energy projects in developing countries that are recommended or endorsed by the International Renewable Energy Agency (IRENA). Through the Abu Dhabi Fund for Development (ADFD), the Facility supports IRENA's mandate to promote the widespread and increased adoption and use of renewable energy and is not limited to only geothermal developments or to any particular geographic extent.

Since 2013, $ 189 million in ADFD loans have been allocated to 19 renewable energy projects recommended by IRENA. Over $ 387 million has been leveraged through other funding sources to cover the rest of the project costs.

The projects must be in developing countries that are IRENA members, Signatories or States in Accession. Projects must be one of the six renewable energy technologies as per the IRENA Statute which includes geothermal projects and they must have the full support of the government of the country where the project is to be implemented. The ADFD loan must be backed by a sovereign guarantee.

The Abu Dhabi Fund for Development decides on the final selection of projects based on the submission of recommended projects by the Advisory Committee. The ultimate selection, financial support, administrative management and reporting of results remain the exclusive responsibility of the ADFD. A progress report of all selected projects is presented annually by the ADFD to the Director-General who, in turn, reports to IRENA Members.

The program provides concessional loans to the selected projects, as follows:

- The concessional loan value for projects ranges between $ 5 million and $ 15 million.
- The loan amount for each project shall not exceed 50 percent of the estimated project cost.
- Loan rates vary by country with 1% in least developed countries and other low-income countries and 2% in lower middle-income and upper middle-income countries as per the OECD DAC list of ODA recipients.
- Loan repayment periods are 20 years including a 5-year grace period.
- Loans obtained from ADFD must be used for activities or assets directly related to the proposed project. Loans cannot be used to fund any pre-development activities, such as feasibility, environmental-impact or socio-economic studies.

Two geothermal project loans have been granted to date: $ 15 million to St. Vincent and Grenadines and $ 6 million to Iran, for a 10-15 MW and 5 MW project respectively. Going forward, ADFD will select geothermal projects that are beyond exploratory drilling stage.

Table 2.8 provides further details of this facility.

Facility Pros and Cons

Pros:

- Provides low interest rate loans to renewable energy projects, which often have difficulty finding adequate and affordable financing

Cons:

- Not geothermal specific, which will likely reduce the impact of this facility on the geothermal industry

- Full repayment of the loan is necessary, even in the case of project failure

2.9 Attractive Features of Existing Facilities

The review and analysis of the main geothermal risk mitigation facilities operating today provide insight into what could be incorporated in the GeoFutures Facility. The following elements are identified for consideration:

- Setting Clear Objectives. Clear goals and objectives that can be referred to by all parties involved in the fund help align objectives and drive decision making in the correct direction. Risk mitigation funds with no clear, measurable, and achievable objectives have faltered at various stages, many due to unclear and inconsistent direction. A good example is GDF LAC, whose clear objective is to catalyze development of a minimum of 7 geothermal plants with a cumulative capacity of at least 350 MW (see Table 2.1). This will ultimately drive decisions about selecting projects for funding. Similarly, ICEIDA's Geothermal Exploration Project also has a very clear objective: to assist countries in East Africa to enhance their knowledge and practice of geothermal exploration. This has allowed ICEIDA to successfully deploy its funds in numerous African projects, building capacity in an activity that is fundamental to all geothermal projects and therefore promoting more geothermal development.
- Streamlining Facility Management. Facilities with a "lean" management structure seem to run more efficiently (and at a lower cost to the facility) than those with larger groups comprised of public and private sector entities. Having a limited number of points of contact and a reasonably small group of decision

makers avoids bureaucratic delays and reduces administration costs, allowing funds to be deployed more efficiently.

- Simplifying Procurement Processes and Guidelines. Many facilities have various stakeholders and investors involved, each bringing their own set of requirements related to procurement and other related issues. Having to comply with complex guidelines from several organizations makes the application and procurement process cumbersome and difficult for many applicants. Simple procurement guidelines that focus on the regulations associated with the country of operations – with minimal added regulations from lending institutions or others - would reduce bureaucratic hurdles and make the facility more accessible to more projects.
- Operating in the Digital Domain. Digital submission of procurement documents has been noted to save time and money. Information entered digitally helps save time for both the applicants and the facility managers, reducing the time for application, review and award. The onus of providing correct and complete data submission is on the applicant. GDF LAC developed and is using a system that automatically digitizes and transfers key application information and data into a database that automatically generates ranking criteria, allowing for an objective initial analysis. While not all elements of a proposal may be suitable for this approach, the speed and objectivity that it provides is attractive.
- Scheduling Disbursements Based on Milestones. Some facilities provide funds in arrears (as reimbursement after the completion of the eligible activities). This limits the risk and exposure of the fund, but is not optimal for the developer, who still needs to raise capital to do the work. This essentially makes the risk

mitigation funds more of a rebate or discount on work that the developer planned to do anyway, and therefore might not provide the catalyzing effect that was hoped for. Setting up a disbursement schedule with milestones for payment – including an option to provide a percentage of the funds upfront if an adequate performance bond or other security is in place – could be more effective.

- Maintaining Flexibility. Some facility managers and developers we spoke with noted a flexible framework as one of the most important characteristics to place funds appropriately. Matching the individual needs of individual projects with the right funding allows such facilities to target their investment accurately, helping to maximize the impact of the grant or loan. A strong Technical Assistance window that targets the resolution of specific technical issues with a small investment is a useful precursor to the effective placement of larger investments by the facility. Prescriptive and rigid programs can unduly disqualify some developers that could truly benefit from the facility's support, or provide support in a way that will not result in the desired benefit to the project or the facility's overall objectives.
- Allowing Application Submissions at Any Time. Rather than holding application rounds with specific deadlines, some facilities have a continuous application process and undertake their reviews of the applications periodically (typically on a quarterly basis). This approach could encourage a steady stream of applications and disbursements, and could enable each application to be considered more on its own merits, rather than being compared to many other applications received in a funding round).

- Requiring a Short Concept Paper / Project Brief. Some facilities use this technique to pre-qualify applicants and their intended use of funds in advance of a full application, typically through an Expression of Interest (EOI) process that precedes the full application. Applicants to the GeoFutures Facility could be required to include a pre-formatted Concept Paper / Project Brief that presents specific key information about the proposed funding, how it would be used, and its impact. The Concept Paper / Project Brief would enable the reviewer to quickly assess the level of alignment of the funding request with the facility's goals, allowing time to be saved by eliminating applications that are for activities that are not in the top tier for funding. An objective scoring mechanism for the Concept Paper / Project Brief (such as that discussed above for GDF LAC) could be used to assess if the proposal should be considered further.
- Using Well Productivity Insurance to Partially Replenish the Facility. The Mexico facility clearly recognized the need to return some funds to the facility and decided that well productivity insurance was an effective way to achieve this. As will discussed further in Chapter 4, this method effectively leverages public funds for use in private projects, and would be a very useful element of the GeoFutures Facility.

3. REGIONAL RISK FACTORS

3.1 Area-Specific Issues

3.1.1 Introduction

East Africa includes a variety of countries that have different characteristics in terms of their governments, legal and regulatory policies, institutional set-up, energy markets, investment climate, social climate, geothermal resource base, and level of geothermal expertise. These characteristics – and general perceptions about East Africa - may either support of hinder geothermal development. There has long been a perception that it is difficult for the private sector to do business in some African countries, because of factors such as corruption and lack of transparency, state control, import restrictions, currency restrictions, and other factors, including a lack of reliable power. Some are real risks and others are perceived, but the overarching reasons for the extraordinary level of interest in geothermal development in Africa include the following.

- Although sometimes located in "inconvenient" places away from major cities and transmission lines, geothermal energy is an indigenous resource, which is particularly important in countries that may not have other energy resources such as coal, oil or gas.
- Unlike intermittent wind and solar power, geothermal provides a clean source of the base-load power needed in many East African countries.
- Once developed, geothermal energy is reliable and long-lasting, and a good way to back-stop the risk of low hydropower production during periods of drought.

- Geothermal is often the lowest-cost solution for electricity production in countries that do not have (or seek not to develop) additional hydropower resources, fossil fuel resources, or nuclear power.
- Geothermal energy provides pathways for community involvement and the creation of new businesses through geothermal direct-use applications (*e.g.*, for greenhouse heating, milk processing and other industrial uses) and potentially for dedicated "market power" projects (in which power is sold directly to an end user). It is noteworthy that USAID recently supported a significant evaluation of specific geothermal direct use projects near most of the major geothermal fields.
- The addition of geothermal energy in a country creates a new industry to employ people and build technical expertise in both the public and private sectors.

These and other reasons explain why governments and the donor community consider geothermal power to be an integral part of East Africa's future, and why they are dedicated to overcoming its risks.

3.1.2 Kenya Situation

Kenya has a population of approximately 37 million, but only about 40% of the total population (predominantly middle and upper income groups) is supplied with power. Kenya Power and Lighting Company (KPLC) distributes power through its low-voltage, local system, and seeks to connect more customers to enhance sales growth. KPLC is also responsible for all electricity offtake and managing power purchase agreements, nearly always through direct procurement of electricity at the generator step up transformer or interconnection substation. In the case of the Menengai project, KPLC pays the electricity

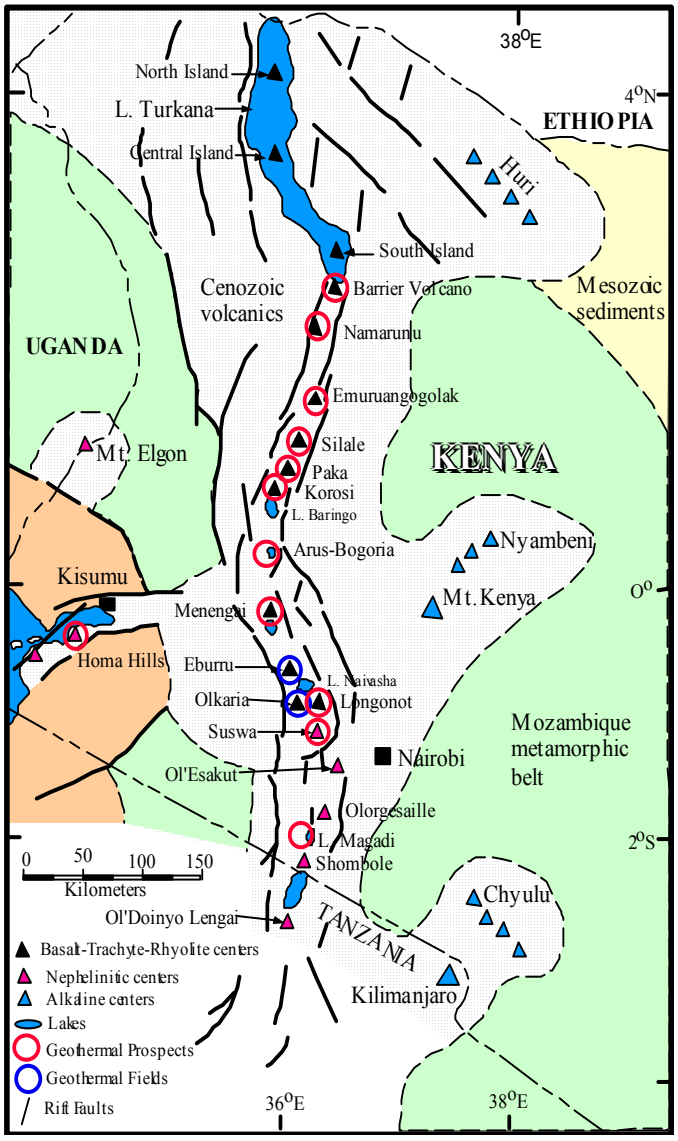
portion of the procurement to the power plant owner (IPP) and the steam portion to GDC, commensurate with their respective roles. The total price paid for geothermal power is between 8.5 and 9.0 US cents per kW-hour.

The Kenyan transmission company Ketraco is responsible for the construction and operation of regional, high-voltage transmission systems, and coordinates its expansion and upgrade plans with KenGen, GDC and other energy producers, and with the Energy Regulatory Commission (ERC).

The interconnected electricity sector system in Kenya has a total installed capacity of more than 2,100 MW, made up of primarily of hydropower and thermal power plants that are powered by diesel or other imported hydrocarbons.

Geothermal power is on the rise as existing projects expand and more enter the mix. Geothermal capacity continues to increase at Olkaria via new projects and improvements to existing projects operated by KenGen (the partially privatized state generator) and Ormat, an Independent Power Producer (IPP) that operates the southwest sector of the Olkaria field. State geothermal developer (Geothermal Development Corporation, GDC) will begin to supply steam to the first 100 MW of IPP geothermal power production at Menengai.

GDC continues its mission to explore other geothermal fields, at present focusing on several potential resources located from Lake Baringo north to Silali Caldera. GDC is also active at the Suswa project, south of Olkaria. KenGen and Ormat continue to evaluate the potential for further expansion at Olkaria, and KenGen recently expanded their project at nearby Eburru to 25 MW. Both companies have had favorable levels of support from the Government of Kenya and the donor community.



In addition to Ormat's Olkaria III project, geothermal concessions have been given to at least three other private companies:

- AGIL (at Longonot, southeast of Olkaria);
- Akiira One Geothermal (at Akiira Ranch, just outside the southern boundary of Olkaria); and
- Olsuswa Energy (at Barrier, in the far north rift near Lake Turkana).

Of these three, drilling has only occurred at Akiira (2 deep wells to date).

It is clear that Kenya is maintaining a positive outlook on what geothermal can do for the nation, and a variety of pubic- and private-sector projects are underway solutions for increasing geothermal development. Nevertheless, many of the traditional risks discussed in Chapter 1 are still present, potentially impacting the cost, schedule and outcome of resource development. For example:

- poor road access to / within up-rift resource areas
- logistical challenges related to drilling in remote areas
- challenging environmental or social issues
- deeper or more difficult resources than anticipated
- uncertainties in the regulatory process because of the changing role of the counties

GDC has dealt with first two by taking on road-building activities and owning more of its own drilling equipment, and has an active community engagement strategy to increase acceptance for its activities, as does KenGen. USAID supported a comprehensive study on creating local opportunities from the direct use of geothermal fluids. But resource-related risks are omnipresent since so few resources have been drilled yet, and increasing the human capacity to solve specific challenges during the geothermal development process – including long term operations and resource management – is still needed.

3.1.3 Ethiopia Situation

The combination of a shorter history of geothermal development, the lack of existing geothermal regulations, and no existing framework for IPPs to secure PPAs with Ethiopian Electric Power (EEP) have led to a less-advanced geothermal market in Ethiopia as

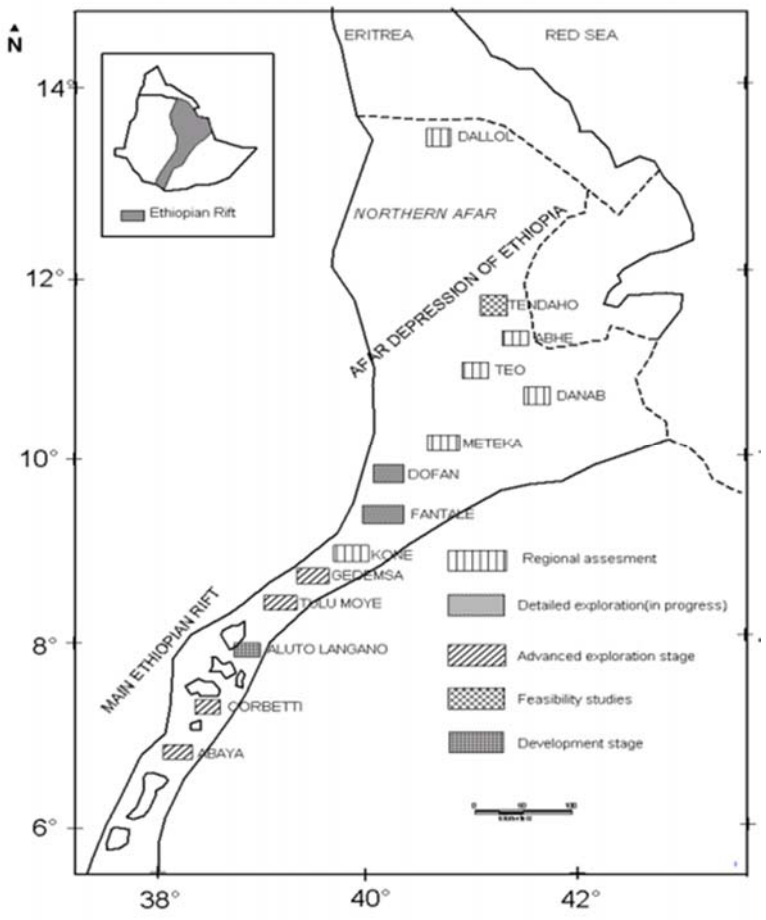
compared to Kenya. However, with a larger population than Kenya (100 million), one of the fastest growing economies in the world (with 10% economic growth for the last 10 consecutive years), a plan to increase power generation by an order of magnitude by 2030 (from the current 2,400 MW, 90% of which is hydropower), and a preference to generate virtually all electricity from clean and renewable sources, there is significant potential for geothermal growth. Ethiopia's Power System Expansion Master Plan envisages an increase of geothermal capacity from a few MW at present (at the Aluto Langano project) to 5,000 MW in 2037.

Although a Proclamation has been made declaring the legal framework specific to geothermal development, the associated regulations have not yet been promulgated in Ethiopia. It is expected that the legislation will be finalized and adopted in 2017; secondary regulations are still in the process of being crafted with support from IFC, DFID/EAGER, and other donors. For the moment, the relevant legal framework is Mining Proclamation No. 52/1993, which provides licensing for the duration of "resource life." Mining law gives the government an equity stake of 5%, and also requires the payment of royalties to the government. The process for issuing geothermal "claims" under the Mining law is first come, first served. All land is owned by government, which simplifies a number of permitting and access issues, and the permitting process includes the use of World Bank environmental and social standards. However, the jurisdiction is currently spread between several government agencies.

There is no existing feed-in tariff mechanism; however, this has been investigated since 2009, and it is expected that a feed-in tariff will be part of the new geothermal laws under development. As is common in many countries, power prices are driven by the lowest-cost option (hydropower) and do not reflect the costs of generating using different energy

sources. However, there are subsidies offered for geothermal power: it had been reported earlier that the Corbetti project had been offered a price between $ 0.075 and $ 0.08 per kW-hour, but this price may no longer be valid. A new electricity law enacted in January 2014 that provides guidelines for fully off-grid and grid-connected IPPs, but tariff negotiations appear to be made on a project-by-project basis.

Ethiopia started geothermal exploration in 1969. Since the late 1970s, geoscientific surveys have been carried out at the Abaya, Corbetti, Aluto-Langano, Tulu Moye and Tendaho prospects (the last consisting of the Dubti, Allalobeda, and Ayrobera areas), with participation by the Geological Survey of Ethiopia (GSE).



In addition, reconnaissance surveys have been done at ten other sites in the central and southern Afar Rift areas, some of which have been followed by more detailed surface investigation. The inventory work in the highland regions of the country for potential geothermal resources is not complete, but the Main Ethiopian Rift (MER) system has been well covered. Approximately 25 areas within the MER system that are believed to have potential for power generation, and more may be useful for direct use applications such as horticulture, animal breeding, aquaculture, agro-industry, and health and recreation.

Geothermal exploration peaked during the 1980s when exploration drilling was carried out at Aluto Langano. Eight exploratory wells were drilled with five of these considered productive. The original geothermal power plant (commissioned in 1998) was rated at 8.52 MW-gross/7.28 MW-net. Refurbished between 2006 and 2009, the plant was de-rated and was able to generate up to 4 MW until encountering operational issues related to lack of spare parts. Additional drilling has been conducted at Aluto Langano by EEP and GSE, with the support of international consultant.

From 1993-98, exploration drilling was also carried out at Tendaho, where geothermal fluids were encountered at shallow depths (between 200 and 600 m). With support from Agence Française de Dévéloppement (AFD, the French aid agency) and the European Union, a new plan for developing the shallow resource has been developed, requiring additional drilling. In addition, deep wells will be drilled to investigate the potential for a deeper, hotter resource in the area.

The known prospects in the country are at various stages of exploration, and significant surface exploration work include has been undertaken at Abaya, Corbetti, Tulu Moye, and Fantale and Dofan. Although it appeared that one geothermal PPA was been signed with an IPP for a geothermal project (Corbetti, in July 2015), we are not certain if that PPA

remains in place, and no other private-sector party has a signed geothermal PPA to the best of our knowledge.

The Government of Ethiopia has been slow to divest in strategic sectors, particularly finance and infrastructure. The World Bank's 2014 "Doing Business" report ranked Ethiopia at 125 out of 185 countries. The primary reasons for the low ranking related to low levels of investor protection, the fact that the Birr is not pegged to an internationally traded currency (such as the US Dollar or the Euro), low levels of tax payments by tax payers, poor trade logistics, barriers to accessing credit, and limited ability to resolve insolvencies. While there are no particular guarantees to protect geothermal investors, the high visibility of the Corbetti project and the stated interest in geothermal development by the government offer increasing assurance that opportunities will expand for private-sector geothermal developers and investors.

Many of the same risks that are present in Kenya are also present in Ethiopia, as listed below. These can have a significant impact on the pace and cost of geothermal development. For example:

- poor road access into concession areas
- logistical challenges related to drilling in remote areas
- challenging environmental or social issues
- difficult resource conditions with limited surface resource expression
- significant uncertainty in the agreement and regulatory process

Regarding the last point, GeothermEx understands the Government of Ethiopia is receiving funding from Power Africa for legal assistance to establish the PPA process and to develop new geothermal laws and regulations that may include tax or other incentives for development.

3.1.4 Key Risks in Kenya and Ethiopia

The risks presented in Table 1.1 have been analyzed to determine if they are present in Kenya and Africa, as shown in Table 3.1. The risks that are clearly present in Kenya and Ethiopia are indicated in the two right-hand with the letters and colors as follows:

- letter Y (Yes) + bright yellow color means that the risk exists;
- letter L (Likely) + pale green color means that the risk is likely to exist;
- letter M (Maybe) and a pale blue color are risks that may exist; and
- letter U (Unlikely) and a light purple color are risks that are unlikely to exist.

In designing the risk mitigation facility, we have focused mainly on the top 2 categories, *i.e.*, those risks that are known to exist (Y, bright yellow) and are likely to exist (L, pale green color).

Although both countries have many of the same risks – particularly those related to the actual project development process, there are interesting and subtle differences between the two countries. For example, road access to many of the geothermal prospects is marginally better in Ethiopia than in Kenya, although roads within geothermal areas are minimal in both countries. Banks willing to lend to geothermal developers are present in Kenya, but it is not clear if Ethiopian banks are ready to be project lenders. We note that many of the highlighted risks are also likely to be present in other geothermal countries in the region.

3.2 Other Regional Risk Mitigation Initiatives

NOTE TO REVIEWERS: A discussion will be included here in the final report. Your comments about UNEP, ARGeo and any other regional organizations,

programs or other initiatives that specifically support geothermal in East Africa would be welcome.

3.3 Results of Meetings in Nairobi and Addis Ababa

In January 2017, a series of face-to-face meetings were conducted in Nairobi and Addis Ababa with private-sector and public-sector geothermal developers, private-sector financial entities; government ministries and departments, electric utilities, international aid agencies and a variety of other stakeholders. The purpose was to have initial discussions with stakeholders, engage the donor community to inform them about the new risk mitigation facility, get feedback on experiences with other risk mitigation facilities, and identify possible pilot projects that would make use of the facility. Together with our analysis of typical geothermal risks and those that are particularly prevalent in the region, these interviews helped to understand the challenges facing geothermal developers and others (from both the public and private sectors) involved in geothermal development.

Table 3.2 presents specific interventions requested by some of the parties that were interviewed. Certain elements were anticipated, including the need for human capacity development across a wide range of topics, infrastructure development, mini-grids, stakeholder engagement support, and access to project finance. In addition, there were new and interesting requested interventions, including:

- An "instrument bank" for exploration equipment (mainly geophysical survey gear, but geochemical sampling equipment might also be helpful)
- A review of new and emerging technologies for well targeting
- An independent arbitration process to resolve disputes
- Improved transparency in resource licensing / concessioning

- Establishment of a Data Center for geoscientific and drilling data to make key data more accessible

Many of these ideas were added to the Risk Matrix, as shown in Tables 1.1 and 1.3, and some are the subject of proposed pilot projects for the GeoFutures Facility, as described in the following chapter.

4. PROPOSED GEOTHERMAL RISK MITIGATION INSTRUMENT

4.1 The Challenge

Despite significant domestic and international effort to develop the geothermal sector in East Africa, significant potential remains undelivered owing to risks and other barriers that are well highlighted herein. This final section of the report describes the design of the GeoFutures Facility based on gaps or limitations in other initiatives to define where and who additional support is needed. We describe herein an effective facility with the right funding elements, and estimate the amount of funding required to "move the needle" on geothermal development in East Africa, beginning in Kenya and Ethiopia.

Although there is potential to deploy public-sector funds in highly flexible ways, they need to demonstrate good value for money and remain accountable to taxpayers and to the international donor community. There are many competing demands from other potential development needs, both regionally and globally, for these scarce public resources.

Private sectors funds dwarf those available from the public sector. However, to attract this large pool of private capital, projects must meet very defined risk/return characteristics. This risk/return profile is relative to all other opportunities available to the private sector.

Recognizing that public funds are not unlimited and that private funds need to see an attractive risk / return profile to consider investment, the proposed facility has been designed with the following priorities in mind:

- the aggregate sum of public funding available;
- the ability to leverage in private sector capital, as measured by public sector funds used as a proportion of private sector capital deployed;

- the ability to move projects towards successful implementation, as measured both by project count and MW installed;
- local requirements and conditions as identified by stakeholders;
- compatibility with and complementarity to existing mechanisms; and
- long-term sustainability via recycling of committed funds.

Government representatives in both Kenya and Ethiopia have confirmed that significant private sector involvement in the development of their geothermal assets is a key strategic objective. Stimulating the involvement of the private sector is also a goal of this project. Private sector involvement may be in the form of private sector developers and/or capital providers (either debt, equity or insurance capital). This strategic objective is therefore a key underlying assumption in the design of the proposed instrument. The success of the instrument is therefore contingent upon the commitment of the host countries to honor this strategic objective.

On the geothermal development side, different stakeholders have different wants and needs, ranging from training of personnel through removal of specific risks to direct financial support. This is demonstrated by the range of potential interventions that were identified by stakeholders during the consultation meetings that were held in January 2017 (see section 3.2), and other needs that are presented in Table 3.1. We have specified three categories for these interventions: Technical Assistance, Direct Finance and Risk Mitigation. These categories have driven the structure of the GeoFutures Facility, with individual facility pillars representing each category.

4.2 The Proposed GeoFutures Facility

Based on the breadth of risks faced by geothermal projects and the review of existing risk mitigation facilities in Chapters 2 and 3, a gap analysis has been used to identify outstanding needs and risks requiring new or additional support, as shown in Table 4.1. On the far right of this table, risks that are not covered by any other facility are shown in red, those partially covered are shown in yellow, and those that are covered are shown in green. The risks highlighted in magenta are among the most important in Kenya and Ethiopia, and are likely to apply to other geothermal countries in the region.

Overlaying this gap analysis with best practice elements of other geothermal risk mitigation mechanisms and facilities leads to the following conclusions:

- A broad range of capacity building and enabling environment measures are still required
- The capability and resources of project developers is extremely variable
- GRMF, while complicated and bureaucratic, has provided some support and has helped applicants to increase the rigor of their own process of project development
- GDC Latin America is an attractive direct financing mechanism that places the best elements of GRMF into a more streamlined and simpler framework / process
- Resource risk remains a significant barrier
- Insurance based solutions offer attractive public-to-private leverage ratios

These conclusions have significantly informed the concept for the proposed GeoFutures Facility detailed below, which has been designed with three principal pillars as described below.

4.2.1 Pillar 1: Technical Assistance (TA)

This will provide non-financial assistance via advisory services from local or international specialists to address barriers that affect public and private developers and financiers and thus impact the enabling and implementation environment for geothermal projects. This TA pillar needs maximum flexibility to address the broad range of requirements already identified by stakeholders and others that will emerge in the short and medium term. In addition to its direct benefit in solving a particular problem, TA by local and international experts provides an inevitable and significant element of capacity building for geothermal developers.

The TA could address issues in a number of risk categories, including:

- Legal and regulatory (development of geothermal policies and regulations, geothermal Master Planning, community engagement program design, resource licensing / concessioning process and maintenance requirements, etc.)
- Financial (instruments to reduce capital requirement and/or cost of capital, access to loan guarantee facilities, credit wraps for off-takers, etc.)
- Technical (exploration project design, data evaluation, infrastructure development, pre-feasibility studies / well targeting, feasibility studies, resource management issues, technology review and transfer, etc.)

Although the EAGER Facility and the Geothermal Exploration Project (ICEIDA/NDF) already provide a certain amount of TA, as do others (for example, through specific support from development banks and regional organizations or initiatives), they are limited in terms of their funding and the activities that they cover and the amount of funds available. More is clearly needed, as demonstrated by the risks enumerated in Table 4.1. Some (including EAGER and ICEIDA/NDF) are restricted to public sector entities. To ensure that the

GeoFutures Facility is complementary to these existing facilities, it is suggested that one of the qualifying criteria for accessing this TA Pillar is that public-sector applicants could be that applicants have considered EAGER and the Geothermal Exploration Project (ICEIDA/NDF) for the same TA first, before approaching GeoFutures. The main qualifying criteria for accessing this pillar is that the funding requested will directly contribute to the key objectives of the GeoFutures Facility.

100% of eligible costs would be covered by the Technical Assistance facility. It is suggested that applications may be made at any time by public- or private-sector parties, or PPPs, and the Facility will hold quarterly reviews of applications and funding awards.

4.2.2 Pillar 2: Direct Finance

Because the risk profile of projects at the earliest stages of development are unattractive to most equity providers, and insurance solutions are unlikely to be economically justifiable at these early stages, Direct Finance would be used to support three main activities:

1. focused exploration work that is required to de-risk the selection of well sited and drilling targets, such as detailed geophysical surveys and temperature gradient surveys (which, although it involves drilling, is essentially a geophysical method);
2. Infrastructure development (roads, drilling pads and water supply); and
3. the first deep exploratory drilling (at least the first well, and possibly the first 2 or 3 wells).

As for Pillar 1, public-sector applicants for focused exploration work could be required to consider other sources of similar funding first (such as GRMF, EAGER, and the Geothermal Exploration Project ICEIDA / NDF), before approaching GeoFutures. With regard to drilling

support, the GRMF and GDF Latin America facilities have influenced the design of this pillar. It is proposed that the GeoFutures would cover up to 40% of eligible costs for focused exploration in the form a non-recoverable grant. In addition, 40% of eligible costs for project infrastructure may also be covered; however, this support will be provided in the form of a contingent grant or convertible loan that would be repayable in the event of a successful project (funds would be considered a grant if no project is developed). The reason for infrastructure funding to be a convertible loan rather than a grant is to encourage good project selection by developers. This is not to say that remote projects should not apply to the fund, but that there would need to be a clear path to a project (possibly including local off-take rather than a grid connection) for projects that are far from the grid and other infrastructure. It is proposed that the first deep exploration wells are also funded at 40%, as a non-recoverable grant.

As for Pillar 1, it is suggested that applications are accepted continuously and evaluated quarterly.

For this and the other two pillars, it is recommended that procurement procedures are kept as simple as possible, although it is acknowledged that the governance of the GeoFutures Facility would be dependent to some degree on the procurement requirements of funding entities.

4.2.3 Pillar 3: Risk Mitigation Instruments

When projects have reached the phase of confirmation / appraisal drilling, GeoFutures shifts from providing direct finance to supporting risk mitigation measures. At this point, the project risk profile matches the risk appetite of the international insurance sector, setting the stage for a new form a private sector capital (albeit contingent capital) to

support geothermal development: well productivity insurance. The insurance will be provided by private-sector insurers both domestically and internationally, meaning that the private sector is taking the majority of the risk at this crucial stage of project development. It also means that there is significant transfer or skills into the domestic insurance sector. Another benefit can be realized in Ethiopia, where international reinsurance is allowed, whereas international banks are not. This is therefore a potentially important way for Ethiopia to access international private capital within existing laws.

The contribution from the public sector would cover the costs of the pre-underwriting due diligence review and part of the premium payment, reflecting the model being implemented in Mexico with support of the Climate Investment Funds, via the Interamerican Development Bank (IDB) and Mexico's internal development bank Nacional Financiera (NaFin).

The insurance will guarantee the project developer a minimum energy output from their project over a campaign of typically 6 appraisal wells, effectively removing the tail risk of total loss, which typically dissuades other forms of private capital from participating. To maximize flexibility of the facility, the option to include exploratory wells in a drilling campaign of up to 10 wells in total could also be considered.

Importantly, the proportion of premium funded by the GeoFutures Facility can itself be insured, thereby ensuring the facility is reimbursed in the event of a project failure, thus extending the facility lifetime and increasing the number of projects that can be supported. As discussed in section 2.7, this can be an effective way to leverage public funds and return capital to a risk mitigation facility.

Pillar 3 has four sub-facilities, as described below.

Due Diligence Facility

For any project to access private investment and insurance, a robust and independent due diligence study is required to assess the project's bankability and if it is possible to underwrite the resource risk, and if so, determine the appropriate insurance structure and premium rates. These costs will not be accepted by the insurers and therefore need to be borne by the project developer. It is recognized that these costs, which range between $ 75,000 and $ 125,000 (and significantly more when drilling and well testing and monitoring costs are included), act as a barrier to obtaining the insurance because they represent an upfront cost, which is an additional capital requirement when capital is typically at its most scarce.

It is proposed that a Due Diligence Facility is made available to project developers to cover 60% of these costs, which are assumed to be about $150,000 on average, including monitoring costs during drilling and testing. These funds would be issued as a contingent loan that would be recoverable (repaid) in the event of a successful project. However, because not all covered wells will lead to successful projects (particularly since the due diligence is undertaken at an early stage), this facility is expected to have some degree of concessionality, because some projects will not progress beyond the due diligence stage and therefore there will be no repayment either from insurance or project cash flows.

Importantly, the due diligence report developed under this part of the facility will not only enable the project to access private sector insurance, it may also be used by potential equity investors and financiers to assess the bankability of the project.

Premium Payment Facility

Once a project has successfully demonstrated that it is insurable, the exact insurance structure and premium rates will be defined and agreed. In view of the significant risk that is being transferred from the developer to the insurer, the required premium rates are likely to be in the range of 15-25% of total drilling costs. This means that premiums may be between $ 6.3 million and $ 6.5 million per project, assuming a drilling cost of $ 7 million to drill each well, a 20% premium, and that a 6-well program that would be insured. Representing only a small proportion of total project costs, this premium cost does not have a major impact on the overall project IRR; however, it can act as a significant barrier to projects because it represents an additional upfront cost before the resource is proven.

For this reason, it is proposed that the Premium Payment Facility will cover 60% of the premium costs. The amount made available to each project will be agreed on a project by project basis with reference to the project developer's resources, the IRR impact and the commercial requirements of the insurers.

The funds made available to cover the premium costs will be repaid by the project in the event of a successful project, and by the insurers in the event of an unsuccessful project, ensuring this facility to be replenished and recycled many times over without recourse to public funds.

In addition to the above Due Diligence and Premium Payment Facilities that are core elements of this scheme, there is the opportunity to extend the intervention with other potential insurance structures. These may include offering similar due diligence and premium payment mechanisms for other risks as identified by Stakeholders (see Chapter 3). These mechanisms could include Cost Over-Run Insurance and Drilling Risk Insurance

per se (*i.e.*, to cover the risk of not being able to reach the planned drilling target). Additionally, Public Sector Co-Insurance and Public Sector Reinsurance Vehicle could also be developed to support one or more of the coverages described herein, as discussed below.

Commercial Public Sector Co-Insurance

The opportunity exists to create a co-insurance vehicle (or an insurance fund investing in such a vehicle) and supported by public sector investment. Being on a *pari passu* basis, this form of support will have zero concessionality. The presence of multi-lateral development banks (MDBs) as commercial co-insurers will help validate the risk being underwritten and thereby attract and accelerate the provision of private sector insurance capacity. The minimum investment size is likely to be in the range of $ 25 to $ 50 million, depending inter alia on the other forms of support available.

Public Sector Reinsurance

Recognizing the risk profile being underwritten and the newness of the risk to the private sector insurers, it may be necessary to provide reinsurance protection either as a First Loss and/or a Stop Loss layer to reduce the risks. First Loss Reinsurance protects insurers against multiple small losses whereas Stop Loss reinsurance contracts are designed to cap overall loss experience at a specified level. The degree of concessionality for this reinsurance is expected to be relatively modest, but will vary significantly depending on the risk position, scale and insurance structure finally agreed. The minimum investment size is likely to be in the range of $ 25 million to $50 million, again depending inter alia on the other forms of support available.

4.3 Summary of Differences Between GeoFutures and GRMF

The details of GRMF and GeoFutures are presented in Tables 2.1 and 4.2, respectively. The most important differences between them are summarized below.

Feature	GeoFutures Facility	GRMF
Appraisal Drilling	✓	✗
Recycles Funds to Facility	✓	✗
Payment Drawdown	Against milestones	Reimbursed after completion of funded work
Procurement Processes	Flexible / Streamlined	Highly Prescriptive
Submission Windows	Anytime with quarterly evaluations and awards	Only during 'Open Window' Periods
Submissions	On-line	2 hard copies to AfDB

As discussed above, GDF Latin America improved on GRMF, and GeoFutures used some of these improvements, as shown below.

Feature	GeoFutures Facility	GDF Latin America
Appraisal Drilling	✓	✓
Recycles Funds to Facility	✓	✓
Payment Drawdown	Against milestones	Milestones (if performance bond is in place) or reimbursement (if not)
Procurement Processes	Flexible / Streamlined	Less prescriptive than GRMF
Submission Windows	Anytime with quarterly evaluations and awards	"Pre-EOI" at any time. During specific proposal periods (2 – 4 times per year), EOIs followed by proposals
Submissions	On-line	On-line followed by hard copies

Additional details of how GeoFutures Facility compares with GRMF and GDF Latin America are presented in Tables 4.3 and 4.4, respectively.

4.4 Funding Requirements and Possible Sources of Funds

The total funding requirement is estimated to be $ 75.25 million, as follows.

The Technical Assistance facility is estimated to require $ 8 million. This relatively low amount reflects the existence of the facilities like EAGER and the Geothermal Exploration Project (ICEIDA / NDF), and technical assistance provided by other entities that already provide a certain level of TA for public sector entities, and TA support by entities like USTDA and Power Africa. This GeoFutures TA window would be therefore be used mainly for private-sector projects.

The Direct Finance facility is estimated to require $ 40 million, broken down as follows:

- Focused Exploration: $ 4 million in grant funding, which would cover 40% of the costs of ten projects costing $1 million each
- Infrastructure: $8 million as convertible loans, which would cover 40% of the costs of 10 projects costing $2 million each (a greater or lesser number of projects may be considered, depending on need)
- Initial Deep Exploration Wells: $ 28 million as non-recoverable grants, which would cover 40% of the costs for 10 wells costing $ 7 million each.

The funds required for the Due Diligence Facility are estimated to be $ 2.25 million. This assumes that 15 projects have average due diligence costs of $150,000 each. However, assuming a 30% success rate (*i.e.*, 30% of the funds may be repaid and thus recovered), a total of about 20 projects could benefit from this facility.

The funds required for the Premium Payment Facility are estimated to be $ 25 million. This assumes that 5 projects requiring an average premium financing support of $ 5 million (representing 60% of the premium costs, based on a premium is 20% of well costs for 6

wells costing $ 7 million each) may be insured at any one time. Since the premium amount would be part of the insurance coverage, the facility could be replenished from the insurance recovery even in the event of project failure.

Sources of funding should include donor countries who have already demonstrated their commitment to the geothermal sector. These include the United States, United Kingdom, Germany, France, Sweden, the European Union and Japan. Additionally, other entities with a commitment to sustainable development should also be considered. Various funding windows from existing facilities such as the Climate Investment Fund (CIF) and the Green Climate Fund (GCF) should also be targeted; we note that CIF has already supported similar facilities, including the IDB Mexico facility presented in section 2.7. However, the use of such funds would require the participation of an accredited partner as a channel for the funding; these are mainly comprised of the development banks, although there are some GCF partners that are not development banks, such as UNEP. It is recognized that accessing CIF or GCF funds would add complexity, time delay and cost to implement the GeoFutures Facility; however, the proposed facility is like others that have received significant funds from CIF or GCF.

4.4 Preliminary Guidelines for Implementation

The management and implementation of the GeoFutures Facility will require detailed governance and management frameworks to be put in place. Although the provision of a proper implementation plan is beyond the scope of this work, some guidelines are provided here.

Assuming the GeoFutures Facility is taken forward, an appropriate facility manager would be installed using the normal RFP procurement procedures of USAID. It is proposed that

the facility should have an overall manager, either from the public or private sector, with the following expertise:

- experience in the target region;
- experience managing and reporting on development facilities;
- fundraising experience, including access to GCF and other donor windows; and
- sector knowledge and experience.

It is possible that individual pillars could be independently sub-contracted to be managed by other existing organizations, such as EAGER or Africa Trade Insurance (ATI).

The main responsibilities for the facility manager will be to:

- establish and implement governance and reporting procedures;
- originate funding requests;
- assess funding requests;
- procure and manage external providers of technical support services, including due diligence services;
- establish a panel of insurance brokers for provision of insurance solutions; and
- report to funders as per agreed guidelines.

Example facility managers from both public and private sector would include UNDP, KPMG, ATI, CAMCO and Pegasys, among others.

4.5 Possible Pilot Projects

It is clear from the stakeholder discussions that a number of projects are now at a critical project development stage. Without exception, developers have found the development process to be challenging are keen to see additional support for the sector. One private

sector developer advised that they are close to withdrawing from the region. Therefore speed to implementation should be a high priority.

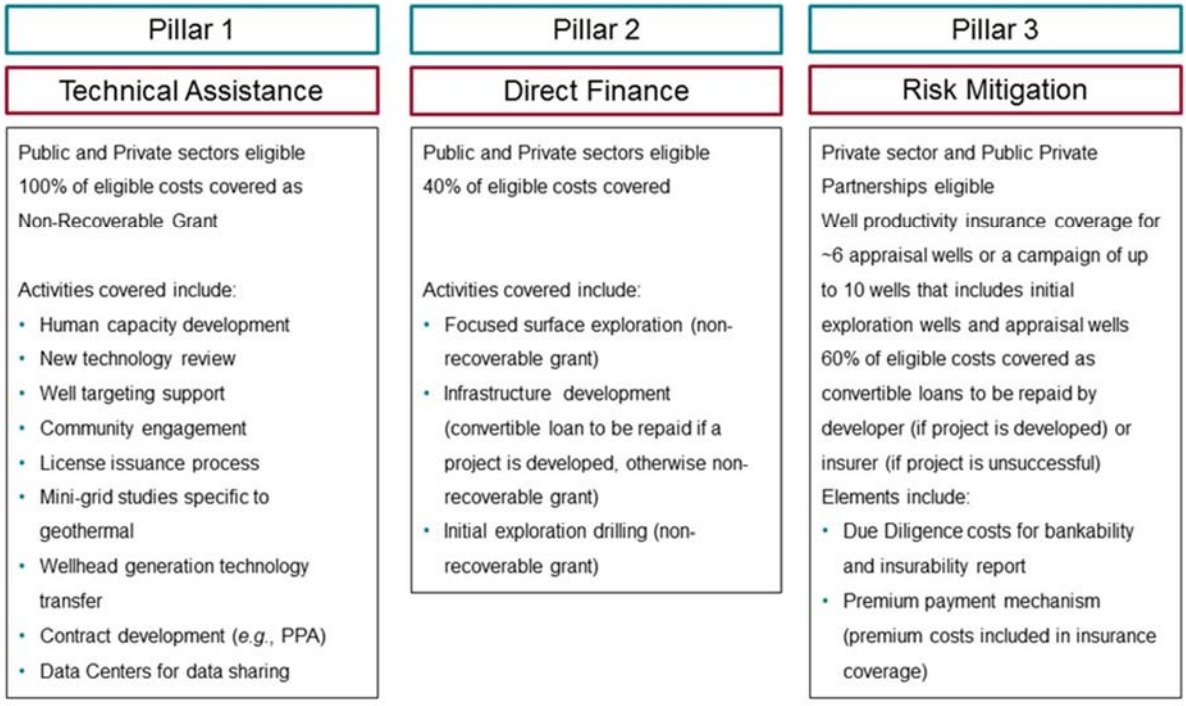
Potential projects that have been identified as being ready or near-ready for support from the GeoFutures Facility are listed in the table below.

Project	Country	Timing / Stage of Development	Pillar Access
Data Center for geoscientific and drilling data	Ethiopia	Concept (not applicable to a particularly development stage)	Pillar 1
Human Capacity Development (technical and financial)	Kenya and Ethiopia	Entire project life-cycle	Pillar 1
Licensing Process	Kenya and Ethiopia	Pre-Feasibility (robust licensing is required to initiate work at a prospect)	Pillar 1
Olsuswa Exploration and Confirmation Drilling	Kenya	Drilling anticipated in Q3 2017	Pillars 2 and 3
Akiira Confirmation Drilling	Kenya	Exploration wells completed	Pillar 3
Tulu Moye Exploration and Confirmation Drilling	Ethiopia	Drilling anticipated in Q4 2017	Pillars 2 and 3
Corbetti Exploration and Confirmation Drilling	Ethiopia	Drilling anticipated in Q2 2017	Pillars 2 and 3

5. SUMMARY

Drawing on best practice from other geothermal support mechanisms, the GeoFutures Facility has been designed to complement existing regional facilities and provide support in a variety of ways. It comprises three flexible pillars that will support the progression of projects from start to finish, and a funding scheme that allows for a high leverage of private capital relative to public capital.

The pillars are summarized in the graphic below.



The *Technical Assistance* pillar addresses the need for a more robust enabling and implementing environment by providing technical support in a variety of ways that fill gaps that are not covered by existing programs. To ensure complementarity and avoid overlap with existing facilities, access to this pillar will be contingent on confirmation that existing

facilities are not able to support the requested TA. Activities in this area are pre-commercial and therefore rely heavily on public funding.

The *Direct Finance* pillar supports projects at critical development points in a streamlined manner, increasing the ability for projects to rely on this flow of funds, and in turn increasing the ability to move further private sector investment. It also covers a wider spectrum of activities than existing facilities.

The *Risk Mitigation* pillar provides access to an innovative private-sector insurance mechanism that targets one of the key barriers to private sector geothermal investment – resource risk (more specifically, the risk of lower-than-expected well productivity). Rather than have the public sector assume all the risk, public funds are used to facilitate the insurance transaction by covering due diligence costs and 60% of the premium payment. This maximizes leverage of public sector funds relative to private sector funds, engages the domestic insurance market, and facilitates local capacity building and knowledge transfer. Opportunities to replicate this mechanism for other risks (*e.g.*, pure drilling risk) also exist within this pillar.

One of the important aspects of this element of the GeoFutures Facility is the high leverage of private capital relative to public capital. The table below shows typical costs and risk assumed by public and private sector under the GeoFutures Facility. Although direct financing of appraisal drilling is not proposed as part of the GeoFutures Facility, it has been included for comparison purposes. The right-hand column illustrates that for a relatively small commitment by the public sector to cover premium payments, significant risk is transferred to the private sector.

Cost Element	Surface Studies	Exploration Drilling	Appraisal Drilling (if Direct Financed)[1]	Appraisal Drilling (Due Diligence cost only)	Appraisal Drilling (Premium Payment[2] only)
Typical Cost ($)	$1 million	3 wells @ $7 million	6 wells @ $7 million	$150,000	$8.4 million
Total Cost	$1 million	$21 million	$42 million	$150,000	$8.4 million
Geofutures Commitment (%)	40%	40%	60%	60%	60%
GeoFutures Commitment ($)	$400,000	$8.4 million	$25.2 million	$90,000	$5 million
Recoverable?	N	N	N	N	Y
Risk Assumed by Private Sector ($)	$600,000	$12.6 million	$16.8 million	$60,000	$50.4 million[3]
Public-to-Private Leverage Ratio	**1.50**	**1.50**	**0.67**	**0.67**	**10.08**

Notes:

[1] Not being proposed as a Direct Finance option for GeoFutures (included herein for illustration purposes only)

[2] Premium estimated at 20% of drilling costs

[3] Private sector potentially pays total loss plus insurance premium (*i.e.* , premium itself is part of the coverage)

The total funding requirement is estimated to be $ 75.25 million, comprised of:

- $ 8 million for the Technical Assistance facility for various types of TA
- For the Direct Finance facility:
  - $ 4 million in grant funding for Focused Exploration
  - $ 8 million as convertible loans for Infrastructure
  - $ 28 million in grant funding for Deep Exploration Drilling
- For the Risk Mitigation Facility:
  - $ 2.25 million for the Due Diligence Facility, covering 15-20 projects
  - $ 25 million for the Premium Payment Facility, based on 5 projects requiring an average premium financing of $ 5 million at any one time

Funding would be sourced from donor countries who have already demonstrated their commitment to the geothermal sector (US, UK, Germany, France, Sweden, the EU and Japan). Other countries and financial institutions with an appetite to support sustainable development should also be considered. CIF and GCF could also be targeted if a suitable and willing facility that is accredited by CIF and GCF can be engaged without adding significant complexity and costs to the implementation of the GeoFutures Facility. The

facility could be managed entirely by a private-sector facility manager, or by an entity such as Africa Trade Insurance (ATI).

A summary of the features of the GeoFutures is provided in the graphic below.

Activity Addressed	Pillar 1 - Technical Assistance			Pillar 2 - Direct Finance			Pillar 3 - Risk Mitigation		
	Coverage	*Type*	*Sectors*	*Coverage*	*Type*	*Sectors*	*Coverage*	*Type*	*Sectors*
Enabling Environment	✓	100% NRG	Any	✗	N/A	N/A	✗	N/A	N/A
Surface Studies	✓	100% NRG	Any	✗	N/A	N/A	✗	N/A	N/A
Focused Exploration	✗	N/A	N/A	✓	40% NRG	Any	✗	N/A	N/A
Infrastructure	✗	N/A	N/A	✓	40% CL	Any	✗	N/A	N/A
Exploratory Drilling	✗	N/A	N/A	✓	40% NRG	Any	✓	60% CL	Pri + PPP
Appraisal Drilling	✗	N/A	N/A	✗	N/A	N/A	✓	60% CL	Pri + PPP

Intervention Type Key
NRG Non-Recoverable Grant
CL Convertible Loan
N/A Not Applicable

Sector Key
Any Any sector (public, private or PPP) eligible
Pri Private Sector Eligible
PPP Public Private Partnership Eligible

Stakeholder discussions have revealed at several projects that are near-ready for implementation and could benefit from participation in the GeoFutures Facility, including several Pillar 1 projects related to capacity building for public-sector and private-sector entities in specific areas, and 3 or 4 projects that could benefit from drilling under Pillars 2 and 3. These are listed in the table below.

Project	Country	Timing / Stage of Development	Pillar Access
Data Center for geoscientific and drilling data	Ethiopia	Concept (not applicable to a particularly development stage)	Pillar 1
Human Capacity Development (technical and financial)	Kenya and Ethiopia	Entire project life-cycle	Pillar 1
Licensing Process	Kenya and Ethiopia	Pre-Feasibility (robust licensing is required to initiate work at a prospect)	Pillar 1
Olsuswa Exploration and Confirmation Drilling	Kenya	Drilling anticipated in Q3 2017	Pillars 2 and 3
Akiira Confirmation Drilling	Kenya	Exploration wells completed	Pillar 3
Tulu Moye Exploration and Confirmation Drilling	Ethiopia	Drilling anticipated in Q4 2017	Pillars 2 and 3
Corbetti Exploration and Confirmation Drilling	Ethiopia	Drilling anticipated in Q2 2017	Pillars 2 and 3

Feedback from Stakeholders is a critical element of this study, and a Stakeholder Workshop was conducted on 23 March 2017. The feedback collected during the main session and separate break-out sessions for development entities and funding entities was interesting and comprehensive. Together with additional feedback on this draft report, the results of the Stakeholder Workshop will be used to prepare the final report on the GeoFutures Facility. We would be pleased to receive any suggestions for improving upon the concepts presented herein during the next 2-3 weeks.

TABLES

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Table 1.1: Master List of Typical Risks Encountered in Geothermal Projects

RISK CATEGORY / Risk Code	PROJECT STAGE / TYPE OF RISK	RISK DETAIL	POSSIBLE INTERVENTIONS
COUNTRY*	All		
C1	Political	Inadequate regulatory framework, political instability, possibility of unilateral voiding/cancellation of contracts	Legal advisory for drafting more transparent regulatory framework; political risk insurance; sovereign guarantee
C2	Political	Reservation of attractive prospects by government entities (leaving lesser prospects for the private sector)	Legal advisory to support policy changes that encourage open competition
C3	Political	Lack of transparency in resource concessioning (developer's technical and financial capabilities inadequately considered when awarding geothermal concession)	Policy advisory to support suitable policy changes; linking concessional funding to specific examples of Increase transparency
C4	Legal / Regulatory	Land ownership; lack of geothermal-specific regulations	Legal advisory
C5	Legal / Regulatory	Complex/overlapping regulations administered by a variety of national government agencies and local/provincial government agencies	Legal/regulatory advisory to help create more transparent regulatory framework; technical advisory to "navigate existing system
C6	Legal / Regulatory	Bureaucratic delay in issuing permits, lack of transparency in the decision-making process	Legal/regulatory advisory to adapt best permitting practices to the local environment
C7	Legal / Regulatory	Environmental restrictions or social issues limit the availability of land for geothermal development	Environmental/social advisory to help broker creative solutions (land swaps or buy-backs, environmental mitigation projects elsewhere, etc.); increased power price for smaller projects
C8	Social	Community opposition, socio-political unrest	Environmental/social advisory or other support for stakeholder outreach/community engagement; provision of more tangible benefit than power to the grid (*e.g.*, direct use application to support a local industry, educational opportunities)
C9	Infrastructure	Limitations related to road access, grid connection distance and cost, water availability, land access, availability of support facilities	Master Planning advisory; **infrastructure funding**; **helicopter drilling** to prove resource before spending large sums on roads; support for development of local mini-grids; "market Power" projects (direct sale to end consumer);
FINANCIAL	Feasibility; Development; Operation		
F1	Lack of funding	Lack of funding / banks unwilling to lend	Loan guarantee program
F2	Lack of access to funding	Difficulty in obtaining loans / high costs for loans	Access to low-cost financing via development bank or aid agency loans with favorable terms; loan guarantee program with local banks; private equity fund with some public funding (*e.g.*, OPIC's IFIC?)
F3	Power price	Lack of a geothermal feed-in tariff that recognizes geothermal's unique values; use of lower-cost power sources as a basis for electricity pricing	Policy advisory (feed-in tariffs, tax credits, other incentives); economic advisory for power pricing (to reflect the different costs of various energy sources)
F4	Single off-taker (monopoly)	Creditworthiness of off-taker	Sovereign guarantee?
PROJECT IMPLEMENTATION			
	Pre-Feasibility		
PI-PF1	Remoteness / logistical difficulty	Lack of major road access; steep, dissected terrain	Master Planning advisory; **infrastructure funding**; **helicopter drilling**; local mini-grid; "market Power" projects (direct sale to end consumer)
PI-PF2	Lack of exploration equipment	Contracted services may not be affordable	Equipment bank; technical advisory/training (to ensure proper use of instruments and return to the instrument bank); dedicated funds or facilities that support exploration
PI-PF3	Access to previous exploration and/or drilling data	Collected by public or private entities	Policy advisory to make data public after a set period (*e.g.*, 5 years after data collection or well completion, pe the South Australia model)
PI-PF4	Failure to find adequate indications of a resource	Size and/or temperature are uneconomic	Technical advisory/training; support for additional exploration (including temperature gradient drilling to map resource extent)
PI-PF5	Failure to reduce risk in the feasibility stage	Poor well targeting	Technical advisory/training; **drilling support** (cost-shared drilling; well productivity insurance if drilling campaign includes confirmation drilling also)

Table 1.1: Master List of Typical Risks Encountered in Geothermal Projects

RISK CATEGORY / PROJECT STAGE / Risk Code	TYPE OF RISK	RISK DETAIL	POSSIBLE INTERVENTIONS
Feasibility			
PI-F1	Remoteness / logistical difficulty	Lack of major road access; steep, dissected terrain	Master Planning advisory; **infrastructure funding**; **helicopter drilling**
PI-F2	Lack of grid connection	Power line construction lags behind development or not planned for the area where the resource is located	Master Planning advisory; **infrastructure funding**; agreement with local offtaker; mini-grid
PI-F3	Lack of drilling services, laboratories	Geothermal resources located in remote areas and/or in countries without oil & gas development	Targeted funding (considered herein as **infrastructure funding**) to build centralized facilities in key locations near areas of operation
PI-F4	Failure to confirm an exploitable resource	Poor well targeting	Technical advisory/training; **drilling support** (cost-sharing, well productivity insurance)
PI-F5	Failure to demonstrate adequate resource capacity	Lower than desired average well productivity	Technical advisory/training; power price increase for a smaller project; **drilling support** (cost-sharing, well productivity insurance)
PI-F6	Inadequate resource characterization in the feasibility stage	Increased risk in the development stage	Technical advisory/training; power price increase for a smaller project; **drilling support** (cost-sharing, well productivity insurance)
PI-F6	Cost overruns due to drilling problems	Inability to complete entire drilling program due to lack of funds	Technical advisory/training; **drilling support** (cost-sharing, well productivity insurance)
PI-F7	PPA risk	Power price is inadequate	Policy advisory to develop feed-in tariff structure, tax credits, and/or other incentives
PI-F8	Inability to obtain project financing	No willing lender in the market	Loan guarantee program
PI-F9	Inability to obtain project financing	Inadequate Feasibility Study	Technical advisory; **support for additional drilling** (cost-sharing, well productivity insurance)
Development			
PI-D1	Timing risk (poor coordination of development work, PPA execution and project financing)	Activities are poorly synchronized	Technical advisory/training; financial advisory
PI-D2	Cost overruns in development drilling	Lower success ratio than planned	Technical advisory/training; **drilling support** (cost-sharing, well productivity insurance)
PI-D3	Unexpected drilling results require changes to the power plant and gathering system	Surface facilities may already be in construction	Technical advisory/training; support for re-design or retrofit
PI-D4	Failure to achieve full capacity (with initial spare-capacity margin)	More wells than planned are required to reach capacity	Technical advisory/training; **drilling support** (cost-sharing, well productivity insurance)
PI-D6	Delays in drilling and plant construction	Delay in project start-up	Wellhead generation (if power dispatch is available)
Operation			
PI-O1	Inadequate project cash flow	Debt cannot be supported	Re-financing support to lower interest rates
PI-O2	Resource degradation	Inadequate monitoring/management/response; excessive productivity decline due to pressure drawdown; rapid cooling due to injection or cold-aquifer breakthrough	Technical advisory/training; **support for additional drilling** (cost-shared drilling, well productivity insurance)
PI-O3	Increase in production of non-condensable gases	Generation inefficiency; overloading of gas-handling equipment	Technical advisory/training; support for plant retrofit
PI-O4	Mechanical well problems	Casing collapse, wellbore plugging by solids, scaling, corrosion, gases	Technical advisory/training; **support for additional drilling** (cost-shared drilling, well productivity insurance)
PI-O5	Operator solvency and competence	Short-term decisions made to address financing or cash-flow requirements negatively impact long-term operations	Technical and financial advisory to develop integrated recovery plan; sale of project

Notes
* Country risk may be real or perceived

Table 2.1: Details of Geothermal Risk Mitigation Facility (GRMF) for Eastern Africa

Geothermal Risk Mitigation Facility (GRMF) for Eastern Africa	
Overview	Start Date: 03/2012 - End Date: 03/2019 Current Stage: 4th Application Round; awards are expected to be announced in Q1 2017. A final (fifth) round of funding is anticipated. Facility Size: € 115 million (some sources indicate $ 115 million) The Geothermal Risk Mitigation Facility (GRMF) was established in 2012 by the African Union Commission (AUC), the German Federal Ministry for Economic Cooperation and Development (BMZ), and the EU-Africa Infrastructure Trust Fund in cooperation with the German government owned development bank KfW.
Objectives	Encourage public and private investors as well as public private partnerships to develop geothermal prospects for power generation in Eastern Africa by providing grants for two types of activity: surface studies and drilling and testing of reservoir confirmation wells.
Structure and Key Features	The GRMF provides grants to developers using a two-stage application process; eligible developers are both private and public entities as well as public -private partnerships. • First stage - Open pre-qualification process: potential applicants submit an EOI. Those that pass pre-qualification must attend a pre-bidding workshop. • Second stage - Application phase: qualified applicants submit a full application. Successful applicants sign a grant contract, which outlines follow-up monitoring and reporting requirements, as well as milestones and disbursement schedules.
Funding Sources	German Ministry of Economic Co-operation and Development (BMZ) (€ 20M/£ 17M), UK Department for International Development (DFID) (initial £ 10M, potentially a further £ 37M), EU-Africa Infrastructure Trust Fund (EU-Africa ITF) (€ 30M/£ 26M), all via KfW Development Bank (KfW)
Geographic Extent	Initially, GRMF only supported geothermal activities in the following countries: Ethiopia, Kenya, Rwanda, Tanzania and Uganda. Based on the mandate of the African Union Commission for a much wider range of countries than the five GRMF pilot countries and on the interest of further countries to join GRMF, from the second application round onwards, projects from the following six additional countries from the East African rift became eligible under the GRMF: Burundi, Comoros, Djibouti, Democratic Republic of Congo, Eritrea and Zambia.

Geothermal Risk Mitigation Facility (GRMF) for Eastern Africa	
Eligible Activities	•Infrastructure upgrades: Upgrades required for eligible surface studies or eligible drilling and testing programs (*e.g.*, access roads, water supply, etc.) can 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 program grant. • Surface studies: Can include geophysical surveys (*e.g.*, seismic, gravity, magnetic or magnetotelluric surveys) including supplementary geological, hydrogeological and/or geochemical surveys if necessary for siting reservoir confirmation wells. In addition a surface study program may include infrastructure required for conducting surface studies (*e.g.*, access roads). Surface studies shall include an integrated resource report interpreting and summarizing the results of the surface studies in terms of a conceptual model of the resource and identifying high priority drill sites. • Drilling projects: Exploration drilling program for funding by the Facility may comprise up to two full size reservoir confirmation wells (≥ 5" diameter of the last casing or liner) or up to three slim hole wells (< 5" diameter of last casing or liner) or a combination of two slim holes and one full size reservoir confirmation well. In addition, a drilling program may include: infrastructure required for exploration drilling (*e.g.*, access roads, water supply, if applicable: grid-connected power supply); mobilization and demobilization of drilling rigs; and well-testing. Furthermore, a drilling program may incorporate a feasibility study that has the explicit aim of securing finance for subsequent reservoir confirmation wells. As such, it is expected that a feasibility study would combine exploration drilling results and reservoir engineering together with market, regulatory and technical considerations. • Continuation Premium (complementary to the initial grant funding): Eligible activities for the CP – to be undertaken for the same site as the initial drilling and testing program - comprise the following: additional full size well, installation of well-head unit(s), long term discharge testing (minimum six months), reservoir evaluation update, feasibility study.
Funding Mechanisms	•Infrastructure grants: 20% of approved allowable costs for infrastructure required for eligible surface studies and eligible drilling programs (*e.g.*, access roads, water supply, etc.) •Surface studies grants: 80% of approved allowable costs (excluding infrastructure costs) •Drilling grants: 40% of approved allowable costs for the exploration drilling and testing program for reservoir confirmation wells (excluding infrastructure costs) •Continuation Premium: up to 30% of the approved eligible and expended costs of continuation activities, or up to 30% of the developer's share of the eligible and expended costs incurred during the initial drilling and testing program - whichever is lower. As reimbursements, funds are disbursed based on actual costs up to the limits stated above. The GRMF experts will assess whether or not the proposed project budgets are plausible and reasonably priced. This also extends to cost items not formally covered by the Anticipated Well Cost Guidelines (AWC Guidelines) and applies to both surface studies and

Geothermal Risk Mitigation Facility (GRMF) for Eastern Africa	
	drilling programs. The funding levels refer to costs that are both eligible and reasonable according to the GRMF experts.
Indications of Success	About $ 60 million have been awarded so far. Some projects have been completed, particularly surface studies, which have led to drilling programs in Comoros and Ethiopia. No plant has been commissioned since the beginning of the GRMF fund, and there are no clear, measurable objectives that have been stated to quantify the success of the program.
Operation and Management	Operation and management of the program is shared between the African Union and Rödl & Partner. Financial aspects are managed by KfW. There is also a technical subcontractor that reviews the technical geothermal merits of projects.
Criteria used to select developers and projects	Eligibility is determined in three categories: •Developer eligibility •Project eligibility • Activity / Cost eligibility
Criteria and triggers for disbursement of funds	The grant contract, in conjunction with several annexes and the general conditions, details the obligations of the recipient and stipulates milestones for the payment of funds by the GRMF. Payments are always tied to specific milestones and are offered only as reimbursements after funds have been spent. Whether or not the payment milestones have been reached is determined by reviewing and evaluating the reports submitted by the recipient. Statements made in these reports are verified by the GRMF experts during monitoring visits to the site, and by plausibility checks of the data submitted in the reports.
Requirements for monitoring, reporting and evaluation of results	The reporting requirements for surface studies are: • Monthly status reports • For final disbursement: Integrated resource report, financial report, expenditure verification report The reporting requirements for drilling programs are: • Weekly or daily progress reports (daily reports only required during drilling) • For final disbursement: Completion report on drilling and testing, financial report, expenditure verification report The grant contract also specifies the maximum permissible implementation periods: For surface studies: • Initiation of field work: 6 months after grant contract signing • Submission of final report: 15 months after grant signing For drilling programs: • Construction of well pad: 12 months after grant contract signing • Submission of final report: 24 months after grant contract signing Monitoring is both financial and technical. It is based both on site visits and on the evaluation of reports submitted by the recipient. The final disbursement will consequently be based on the submitted financial information, invoices and receipts, as well as audited accounts and the technical reports.

Geothermal Risk Mitigation Facility (GRMF) for Eastern Africa	
Back-stopping requirements	None specified.
Financial Impact on Stakeholders	
Liquidity and availability of risk capital	Risk reduction to the developer by providing capital for surface studies and exploration drilling.
Options for recovering funds	There is no repayment of any of the GRMF grants.
Who pays the bill / holds the risk	There is no funding repayment required, therefore, the funding facility holds the risk in proportion to its share of the costs. The grant recipient holds the risk for its costs, which can include 20% of surface studies, up to 80% of infrastructure costs, and 60% of drilling and testing costs.
Strong and Weak Points	Strong: 1. No repayment necessary 2. Large geographic footprint 3. Funds available are still substantially large Weak: 1. A political "angle" seems to be used when selecting of projects, which may hinder the selection of truly deserving projects in favor of equally distributing projects among participating countries. 2. Many eligible countries have little or no geothermal infrastructure, in-country geothermal expertise, and/or significant geothermal potential, but are eligible to receive funds. 3. To date, support for drilling programs has been limited.
Additional information	Website: http://www.grmf-eastafrica.org

Table 2.2: Details of Geothermal Development Facility (GDF) for Latin America

Geothermal Development Facility (GDF) for Latin America	
Overview	• Start of the Fund: Fourth quarter, 2016 (Q4, 2016) • First call for Expressions of Interest (EOIs): First quarter, 2017 (Q1, 2017) • Duration of the Facility: 10 years. • Current facility size: 50 million Euros. • Fund Manager: IDA Fund Management, LLC.
Objectives	Improve access to equity or other funding sources for geothermal developers in the region, thus playing a catalytic role in establishing geothermal energy. The primary objective is to support the geothermal power production of at least 350 MW in Latin America. To meet this goal, the GDF hopes to fund at least 8 surface studies, support at least 14 projects for confirmation drilling, and create a robust Technical Assistance forum that will promote geothermal knowledge transfer and further geothermal development in the region. The first two elements are the current focus.
Structure and Key Features	The GDF targets early stage projects seeking support for surface studies and confirmation drilling (preferably a 3-well program). It will provide non-recoverable grants for surface studies (which may include 1 slim hole) and contingent grants for confirmation drilling. The funding will be available to private companies, public institutions, or public-private partnerships. The projects will receive 40% of eligible costs for surface studies and drilling. The application to the fund begins online at the GDF website (http://gdflac.com/expression-of-interest/) with a short "pre-EOI" sign-up form. The form is quickly reviewed, and a response is provided to indicate if the application is a good fit with GDF, and therefore should continue to the next step in the process (or not). After a positive response to the form, the application follows a two stage process when a Call for Proposals (CFP) is issued (expected to be 2-4 times per year). The first stage is an Expression of Interest (EOI) that requires the applicant to provide the developer's articles of incorporation, a cover letter describing the requested funding, and a narrative describing the project. EOIs receiving a score of 70% or more will be invited to submit proposals, which have specific requirements that vary depending on the type of application (surface study vs. confirmation drilling). Some projects will be selected for funding. Projects in rural areas, projects that incorporate a local workforce, and drilling projects of at least 3 wells will be looked upon favorably. The GDF fund can be used in conjunction with other funding mechanisms, however, the developer needs to have skin in the game and cover a minimum of at least 20% of the cost has to be borne by the developer. Multiple EOIs for various activities by one bidder will be accepted. Documents are mostly completed out and uploaded on-line; however, due to the international nature of the fund, financial and business documents such as articles of incorporation will need to be certified by an Apostille, and provided in hard copy by mail or courier before the application will be reviewed.

Geothermal Development Facility (GDF) for Latin America	
Funding Sources	• Grant Providers: German Federal Ministry for Economic Cooperation Development (BMZ), European Union through the Latin America Investment Facility (EU-LAIF) respectively through KfW Development Bank. Further grants are foreseen by members of the Stakeholder Group and third donors. • GDF Stakeholders: BMZ, EU-LAIF, KfW, CAF, CABEI, WB, ESMAP, IDB, AfD, EIB, JICA, NDF, BGR, GIZ
Geographic Extent	• Andean Region - Bolivia, Chile, Colombia, Ecuador, and Perú. • Central America - Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua.
Eligible Activities	1. Surface studies (exploration) Surface studies can include geophysical surveys (*e.g.*, seismic, gravity, magnetic, or magnetotelluric surveys), as well as supplementary remote sensing, geological, hydrogeological, and/or geochemical surveys, if these are necessary for siting reservoir confirmation wells. In addition, a surface-study program may include infrastructure required for conducting surface studies (*e.g.*, access roads), as well as the drilling of up to one slim-hole well (< 5" diameter of the last casing or liner). Surface studies shall include an integrated resource report interpreting and summarizing the results of the work. This report should include a geological-conceptual model of the resource and identification and prioritization of prospective drilling sites. 2. Drilling Drilling projects include well-testing programs to help confirm and update the conceptual model. An appropriate confirmation drilling program for funding by the GDF may comprise up to three full-size wells (≥ 5" diameter of the last casing or liner) suitable for production. In addition, a drilling program may include: infrastructure required for exploration drilling (*e.g.*, access roads, water supply, and electrical power), mobilization and demobilization of drilling rigs, and well testing. Finally, a drilling program may incorporate a feasibility study with the explicit aim of securing financing for subsequent reservoir-confirmation wells or steam-field development—in other words, for siting additional wells.
Funding Mechanisms	The GDF will provide non-recoverable grants for surface studies and contingent grants for exploration drilling (repayable if the wells are successful). The funding will be available to private companies, public institutions, or public private partnerships. The fund is focused primarily on funding early stage projects seeking financing for surface studies and early stage drilling (preferably a 3 well program). The projects will receive 40% of eligible costs.
Indications of Success	The program has not begun and therefore its impact cannot yet be quantified.

Geothermal Development Facility (GDF) for Latin America	
Operation and Management	• Fund Manager: IDA Fund Management, LLC. (IDA is a consortium of: Interlink Capital Strategies with Dewhurst Group, LLC.) • Lead Geothermal Project Manager- Warren T. Dewhurst (Chief Executive Officer of the Dewhurst Group, LLC) Lead Geothermal Project Manager is responsible for all aspects of GDF-related geothermal technology, project recommendation and monitoring. • Lead Fund Manager - Alan Beard (Managing Director of Interlink Capital Strategies, Inc.) Together with his Interlink staff he supports all aspects of donor relations, funding recommendations, and fund management.
Criteria to select developers and projects	Developers and projects are selected based on a scoring system that evaluates the geoscientific merits of the project, land access and permits, financial soundness of the applicant, and overall quality of the application.
Criteria and triggers for disbursement of funds	Selected projects need a Work-Plan document prior to fund disbursement. A site visit might also be required of some projects. Environmental, Social Impact Assessments (ESIA) will be required for contingency grant funding for drilling programs. Certain ESIA activities may be considered eligible for grant funding. The Fund may also require an applicant to complete a GAP analysis by a third party and remedy any issues identified. No ESIA is required for surface study grant funding. However, the applicant will need to prove that they have the relevant local permits for the activity proposed and that they have legitimate access to the survey area.
Requirements for monitoring, reporting and evaluation of results	After the funds are disbursed, continuous monthly reporting is expected along with a final report for both surface studies and drilling activities. Other monitoring requirements may include site visits and 3rd party review of drilling activity results.
Back-stopping requirements	3rd party review of certain documents may be required.
Financial Impact on Stakeholders	
Liquidity and availability of risk capital	The projects will receive 40% of eligible costs: • Up to 600,000 Euros for surface studies (total project cost of € 1.5 million) • Up to 5.8 million Euros for drilling projects (project cost of € 14.4 million)
Options for recovering funds	In the case of surface studies, payback is not required. In the case of the drilling activities, the grant recipient is required to repay a minimum of 80% of the grant in the event of a successful drilling campaign. Success or failure will be determined on a per project basis using the Munich RE/GeothermEx well testing guidelines. Unsuccessful drilling projects will not be required to pay back the grants.

Geothermal Development Facility (GDF) for Latin America	
Who pays the bill / holds the risk	The grant recipient pays the bill and holds some of the risk in the case of the drilling projects. The fund holds all the risk and pays the bill for all money awarded for surface studies. For surface studies and confirmation drilling, in the event of failure, the funding facility holds the risk for all costs paid out (40% of eligible costs). For all activities, the developer holds the risk for its 20% (minimum) cost share. Any other funding mechanisms used may holds risk according to their terms reached with the developer.
Strong and Weak Points	Strong point: 1. No repayment of surface study grants 2. Wide array of eligible activities 3. Can be combined with other funding mechanisms Weak points: 1. Many international agencies involved (WB, KfW, etc.) with a wide range of procurement and sustainability requirements that may hinder the funds objectives. 2. Fund manager can be hired as consultant during fund procurement process creating a potential conflict of interest during project selection. 3. Little detail in the extent of the funds involvement on how the money is spent once awarded
Additional information	Website: http://gdflac.com/

Table 2.3: Details of Geothermal Exploration Project (NDF + ICEIDA)

Geothermal Exploration Project (NDF + ICEIDA)	
Overview	• 2013-2017 • ICEIDA Amount $ 6,500,000 Co-financer Amount $ 6,500,000 Total Facility Size $ 13,000,000
Objectives	Assist countries in East Africa to enhance geothermal knowledge and capacity in order to enable further actions on geothermal energy development in the respective countries. This includes support to the exploratory phase of geothermal development and capacity building in the field of geothermal research and utilization. The Geothermal Exploration Project is demand-driven and activities funded by the project are based on specific needs and requests from governments in the countries of the region. At the end of the project it is expected that: 1) Participating countries have a realistic assessment of potential geothermal sites, 2) Plans for further action are developed (where applicable), and 3) Projects will move forward on the basis of those plans and submit exploration drilling projects into other funding pipelines.
Structure and Key Features	The Geothermal Exploration Project provides funding for government agencies. Subsequent to an expression of interest from the respective countries, ICEIDA will meet with the relevant authorities and jointly assess the potential for engagement. Implementing agencies/authorities in the respective countries will be identified on a country to country basis. ICEIDA will enter into a cooperation agreement with the respective governments regarding the project support. All activities and implementation of the project will be demand-driven. Governments and/or appropriate geothermal authorities will be invited to express interest for support under the project. ICEIDA will be responsible for all legal and contractual arrangements with the involved governments.
Funding Sources	ICEIDA and NDF (with support from World Bank)
Geographic Extent	13 East Africa Rift System (EARS) countries: Eritrea, Djibouti, Ethiopia, Uganda, Kenya, Rwanda, Burundi, Tanzania, Zambia, Malawi, Mozambique, Congo, and Comoros
Eligible Activities	Stage 1: Reconnaissance – Gathering of existing data Stage 2: Exploration Stage 3: Exploration drilling of 1-3 wells1 Stage 4: Pre-Feasibility report The Geothermal Exploration Project will mainly cater to stages 1 and 2. If required, the project could potentially contribute towards stages 3 and 4 if funding allows. In parallel to the described stages the Project will offer financial support to parallel activities, mainly technical assistance and capacity building.

Geothermal Exploration Project (NDF + ICEIDA)	
Funding Mechanisms	All activities and implementation of the project will be demand-driven. Governments and/or appropriate geothermal authorities will be invited to express interest for support under the project. ICEIDA will be responsible for all legal and contractual arrangements with the involved governments. A process on engagement for interested EARS countries is established, including the process of seeking support from the Exploration Project and contractual formalization of exploration activities in each country. ICEIDA will finance Stage 1 (reconnaissance) activities in all participating countries, while both NDF and ICEIDA will finance Stage 2 (exploration) activities. • Stage 1 - Reconnaissance. Contracts for each reconnaissance study are estimated not to exceed $ 100,000 in each country. • Stage 2 – Geothermal Exploration. The geothermal exploration stage, subject to positive results of reconnaissance studies, is estimated at around $ 1 million in each country. It is expected that there will be one consultancy contract per country covering all exploration activities, subject to international competitive bidding. The procurement may be carried out by the respective governments, with technical support provided, or by ICEIDA, as circumstances dictate.
Indications of Success	Several surface exploration and capacity building campaigns have been undertaken successfully under this program including: • Capacity Building and Technical Assistance in Djibouti for the Djiboutian Office of Geothermal Energy Development (ODDEG) - $ 650,000 • Surface Exploration and Capacity Building in Ethiopia for the Geological Survey of Ethiopia and Ethiopian Electric Power Corporation – $ 3,318,000 • Capacity Building and Technical Assistance in Kenya for the Geothermal Development Company (GDC) – $ 1,580,000 • Capacity Building and Technical Assistance in Rwanda for the Energy Water and Sanitation Authority (EWSA) – $ 850,000 • Surface Exploration and Capacity Building in Tanzania for the Tanzania Geothermal Development Company Limited (TGDC) (Under the Ministry of Energy and Minerals) – $ 1,565,000
Operation and Management	ICEIDA serves as the Lead Agency for NDF's participation and provides administrative and technical oversight and management. The cooperation between ICEIDA and NDF is based on joint co-financing, with each agency primarily financing costs in specific countries, but under a joint program. ICEIDA and NDF have entered into an agreement covering all relevant aspects of the cooperation, including, administration, financial and institutional arrangements, evaluation and procurement procedures.
Criteria used to select developers and projects	Implementing agencies/authorities in the respective countries are identified on a country by country basis. ICEIDA enters into cooperation agreements with the respective governments regarding the project support.

Geothermal Exploration Project (NDF + ICEIDA)	
Criteria and triggers for disbursement of funds	ICEIDA enters into cooperation agreements with the respective governments regarding the project support.
Requirements for monitoring, reporting and evaluation of results	Presumably negotiated on a project by project basis.
Back-stopping requirements	Constant cooperation and communication with ICEIDA is expected.
Financial Impact on Stakeholders	Governments would receive the money as grants and would not need to repay ICEIDA. The impact is that the program allows previously unexplored areas to get their geothermal programs off the ground even when the local government funding is inadequate.
Liquidity and availability of risk capital	$ 13 million
Options for recovering funds	No repayment of funds
Who pays the bill / holds the risk	In the event of failure (which could be defined in different ways, but mainly consists of the ability to provide more certainty that a resource exists), there is no funding repayment required. Therefore, the funding facility holds all the risk. There is no required cost-share by the state developer. Negative exploration results: While all EARS countries have known potential, the most obvious sites (*e.g.*, those in Kenya and Ethiopia) may already have been identified and explored. In this project, the focus is on secondary potential countries and sites. Therefore it should be considered that results may be negative in some prospects in various countries. Nevertheless, that outcome has value as it removes uncertainty and allows energy planning to move forward at a more informed level.

Geothermal Exploration Project (NDF + ICEIDA)	
Strong and Weak Points	Strong: 1. No repayment necessary 2. Flexible structure and approach on a project per project basis 3. Coordination and cooperation with existing risk mitigation structures and local geothermal stakeholders Weak: 1. Many countries eligible with little to no geothermal infrastructure or significant potential. 2. Small amount of capital 3. Short time frame for implementation 4. Only government agencies eligible 5. Quality of resulting surface studies is ambiguous
Additional information	http://www.iceida.is/iceida-projects/nr/1488

Table 2.4: Details of East Africa Geothermal Energy Facility (EAGER)

East Africa Geothermal Energy Facility (EAGER)	
Overview	Fund Start: May 2015 Fund End: November 2018? Fund Amount: £ 6 million over 3.5 years
Objectives	Seeks to cover gaps in the role played by governments to support geothermal development by removing barriers and speeding progress. The objective of the Technical Assistance Facility is to collaborate with and provide technical support to national and regional institutions to put in place the geothermal strategy, policies and regulations that facilitate investment in cost effective geothermal power in East Africa.
Structure and Key Features	The East African Geothermal Energy (EAGER) TA facility is designed to help improve policy and regulatory enabling environments to enable geothermal power development in various East African countries. • Available to Public Sector Entities Only: government ministries, regulators, public utilities and development agencies are typical recipients • Uses of Funding: technical assistance to put in place the geothermal strategy, policy and regulations that facilitate investment
Funding Sources	DFID is the entity that either provides or channels the funds. £ 6 million is available for technical assistance (RDEL) to put in place the geothermal strategy, policy and regulations that facilitate investment Separate from EAGER funding, UK funding from the International Climate Fund (ICF) is also being provided - a maximum of £ 48 million of grant capital through the GRMF to reduce the risk of exploratory test drilling (these funds are not used to support the TA fund described here).
Geographic Extent	Covers 5 countries: Ethiopia, Kenya, Rwanda, Tanzania, and Uganda
Eligible Activities	The EAGER Implementation Phase work plan focuses on the areas where there is greatest demand and need, as well as where the facility can make a difference. The four areas of focus are (in the 5 participating countries): • Defining the role of geothermal power in electricity markets • Institutional development of geothermal development agencies • Awarding and monitoring concessions for private sector development (technical and commercial issues) • Filling gaps in development and implementation of geothermal specific policy and regulations
Funding Mechanisms	DFID funds

East Africa Geothermal Energy Facility (EAGER)	
Indications of Success	The EAGER team has engaged effectively with relevant organizations in the focus countries, responding to demand in a way that manages expectations of the facility. There is high demand for the facility, and it has exceeded initial expectations in implementing 7 initial tasks in the Inception Phase. These tasks include, for example, guidance on geothermal power purchase agreements, a simplified economic model for geothermal power production, and assistance such as: • In Ethiopia, starting to help the regulator to clarify its mandate for geothermal development, and improve its understanding of geothermal pricing. This work is also a building block for similar tasks in other countries, promoting regional harmonization and lesson-learning. • In Kenya, working with the transmission company to optimize the role of geothermal in the Kenyan power system. • In Tanzania, helping the Tanzania Geothermal Development Company (TGDC) to develop its business model.
Operation and Management	DFID: Gareth Martin (UK) Program Management: Adam Smith International Team Leader: John Heath (UK) Program Managers: Laura Rizzotto (UK) and Matt Blythe (Nairobi)
Criteria used to select developers and projects	Governments agencies need to contact EAGER directly, no formal application process.
Criteria and triggers for disbursement of funds	No apparent criteria, we presume this is on a project by project basis.
Requirements for monitoring, reporting and evaluation of results	None stated
Back-stopping requirements	None stated
Financial Impact on Stakeholders	No repayment is requested
Liquidity and availability of risk capital	Likely limited to the amounts specified above, but some replenishment may be possible.

East Africa Geothermal Energy Facility (EAGER)	
Options for recovering funds	None stated
Who pays the bill / holds the risk	In the event of failure, there is no apparent funding repayment required. Therefore, the funding facility holds all the risk. However, relative to other instruments, the risk of failure is low because of the facility's focus on bureaucratic elements, rather than exploration or drilling activities.
Strong and Weak Points	Strong 1. Flexible, and addresses issues not covered by others. 2. Streamlined management team. Weak 1. Limited to public sector entities only. 2. Low perceived value for Kenyan public sector entities (KenGen, GDC) who may have advanced to the point where they are beyond this need
Additional information	https://devtracker.dfid.gov.uk/projects/GB-1-203153

Table 2.5: Details of EBRD Turkey Early Stage Geothermal Development Framework (PLUTO)

EBRD PLUTO (Private Sector Early Stage Geothermal Development Framework)	
Overview	The European Bank for Reconstruction and Development (EBRD) and the Clean Technology Fund (CTF) launched a program to support exploratory drilling investments in Turkey. Facility size: $125 million PLUTO, named after the ruler of the underworld in classic mythology, combines $ 100 million from the EBRD with $ 25 million from the CTF, a funding window of the Climate Investment Funds. The program is part of a global push by multilateral development banks to scale up geothermal energy production. It is available only to private investors.
Objectives	Help the Government of Turkey to mitigate the geothermal projects' risks and provide comfort to lenders (including EBRD) interested in providing finance at the early stages of project development. The assignment will help the interested developers to initiate projects according to the best industry practice, and assist the Ministry of Energy and Natural Resources (MoENR) with implementing the existing geothermal legislation (mainly the New Electricity Market Law No. 6446) and other related regulations. The project will provide loans to private sector investors aimed at bridging the funding gap existing at early stage of development of Geothermal Power Plants (GPPs). PLUTO aims to develop at five new GPPs with a combined capacity of at least 60 MW.
Structure and Key Features	PLUTO is structured in two phases: • Phase 1 will finance geothermal exploration, drawing on the funds provided by the CTF. • If exploration proves successful, the EBRD will be available to finance the final stages of the drilling and the construction of the power plant as Phase 2. PLUTO provides support to projects according to these two stages. Phase 1 financing is to be provided for the exploration stage/early stage development of the geothermal power projects. Phase 1 offers up to $ 5 million for each project to be supported under the Program. The soft loan is provided with a 3 year's grace and 7 years repayment at 75 bps fixed. EBRD will provide up to $ 2 million per well, with the Sponsor required to provide at least 50 percent of equity for Phase 1 financing. The loan and the equity will be blended on a minimum 50-50 basis.
Funding Sources	EBRD and CTF
Geographic Extent	Turkey
Eligible Activities	Technical Assistance ("TA") would be provided on a grant basis. The TA program would include, among other activities: (i) pipeline preparation; (ii) risk mitigation analysis (including early stage exploration best practices); (iii) review of drilling campaign to maximize drilling success rate; (iv) plant construction due diligence; and

EBRD PLUTO (Private Sector Early Stage Geothermal Development Framework)	
	(v) environmental compliance support, including the abatement and/or commercial distribution of CO_2 from geothermal resources.
Funding Mechanisms	Phase 1 - Clean Technology Fund ("CTF") funds provided as a loan and blended with the Sponsors' equity on a 50-50 basis. After the resource is proven in Phase 1, the Project will progress to Phase 2 which allows support for the finalization of the drilling stage and the construction of the power plant, provided that the geothermal resource has been proven and the GPP is ready for construction, in which case EBRD will consider arranging a long term loan for the project. For such a loan EBRD, could provide up to 35% of the total project cost with the balance of the loan being provided by commercial banks.
Indications of Success	A few projects have begun the process, but no funds have been disbursed to date to the best of our knowledge.
Operation and Management	EBRD operates and manages the fund. Deniz Yurtsever , PLUTO Program Manager Tel: +90 555 995 2961 e-mail: deniz.yurtsever@plutogeo.org
Criteria used to select developers and projects	• The ability of the Sponsor's company to successfully develop a project and repay a loan in the long term • A resource with potential for developing a GPP in the near future
Criteria and triggers for disbursement of funds	Terms and conditions of the loans and grants are negotiated on a per-project basis
Requirements for monitoring, reporting and evaluation of results	Third party consultants evaluate project technical data at the request of EBRD. The frequency and detail of the reports is determined by EBRD and may vary on a per project basis. Basic reporting requirements are: • review and recommendations on early stage exploration, exploration drilling and production drilling campaigns • review of due diligence reports • project monitoring to ensure successful completion and continued implementation of required institutional support measures
Back-stopping requirements	
Financial Impact on Stakeholders	Stakeholders get access to project financing in a risk averse market. By lowering the resource risk through early stage exploration, more capital for development is available at later stages.
Liquidity and availability of risk capital	$ 125 million fund, with per-project funding of up to $ 5 million for Phase 1 and several million for Phase 2, depending on project size.

EBRD PLUTO (Private Sector Early Stage Geothermal Development Framework)	
Options for recovering funds	Loans are granted with the EBRD terms and conditions for repayment negotiated at the time of contracting.
Who pays the bill / holds the risk	In the event of failure, since the funds are provided as loans, the developer holds the majority of the risk. However, EBRD holds some risk via loan financing.
Strong and Weak Points	Strong: 1. Focused on areas of most risk in Turkish project development 2. Provides a path for low cost financing in the event of successful exploration. Weak: 1. Ties the Sponsor to EBRD financing
Additional information	Can be obtained from Deniz Yurtsever (see contact information above)

Table 2.6: Details of Chile Geothermal Risk Mitigation Program (MiRiG)

Chile Geothermal Risk Mitigation Program (MiRiG)	
Overview	Fund Start: 2015 Fund End: None specified Fund Amount: Approximately $ 50 million (potential to be increased if necessary) MiRiG (an acronym for the Spanish name of this fund, which is Programa de Mitigación de Riesgos de Geotermia) was designed by the Interamerican Development Bank (IDB) in consultation with the Ministry of Energy of Chile to support geothermal projects during the high risk drilling phase, with the objective of stimulating additional investment in the Chilean geothermal sector.
Objectives	Promoting geothermal power generation in Chile by supporting the development of up to 3 geothermal projects in Chile.
Structure and Key Features	Conditional loans for production and exploratory drilling with the goal of providing project financing in the construction stage.
Funding Sources	Clean Technology Fund (CTF)
Geographic Extent	Chile
Eligible Activities	Fund for de-risk early drilling to help projects reach the stage of full development and operation.
Funding Mechanisms	Conditional loan of up to a maximum of $ 30 million per project.
Indications of Success	Has not yet been put into practice. No funds disbursed to date, no agreements signed. At least one candidate has backed out because the commercial environment for geothermal power in Chile is so poor that the developer decided not to proceed with the projects even though funding is available.
Operation and Management	Interamerican Development Bank (IDB) and Interamerican Investment Corporation (IIC – the private funding arm of IDB)
Criteria used to select developers and projects	Several projects submitted Expressions of interest and were compared to each other on based on a due diligence review of each project, its planned drilling activities, its overall project development plan, and the qualifications of the developer. Two projects were selected and further review of the drilling activities was undertaken. One project has been selected to receive funds.
Criteria and triggers for disbursement of funds	Negotiated on a project-by-project basis

Chile Geothermal Risk Mitigation Program (MiRiG)	
Requirements for monitoring, reporting and evaluation of results	Flexible reporting structure. Quarterly reporting for current project, site visits as needed.
Back-stopping requirements	None specified
Financial Impact on Stakeholders	Low interest loan that makes more capital available for exploration and development well drilling.
Liquidity and availability of risk capital	A maximum of $ 30 million per project is available.
Options for recovering funds	Contingent loans are repaid in the event of a successful drilling campaign.
Who pays the bill / holds the risk	In the event of failure, IDB / IIC holds the risk.
Strong and Weak Points	Strong 1. Lean structure for program administration with little risk of high cost and delays due to administrative complexity. 2. Flexibility in designing support structure to match project needs. Weak 1. Chile is not an ideal place to develop geothermal because there are alternative power sources that are available at lower cost than geothermal, and because many geothermal resources are located in areas without access to the transmission grids. 2. IDB / IIC seek to provide project financing, and would therefore might tend to favor projects that are close to needing finance rather than those at earlier stages of development. 3. Limited fund size
Additional information	http://www.iadb.org/es/proyectos/project-information-page,1303.html?id=CH-T1160

Table 2.7: Details of Mexico Geothermal Financing and Risk Mitigation Program

Geothermal Financing and Risk Mitigation Program for Mexico	
Overview	The Geothermal Financing and Risk Mitigation Program will channel resources from the Interamerican Development Bank (IDB), the Clean Technology Fund (CTF) and the Mexican Government (specifically, Nacional Financiera or "NaFin") to private developers for different stages of geothermal development, including exploration. Fund Start: July 2015 Fund Amount: $ 54 million
Objectives	The objective of the program is to increase power production from geothermal sources by the private sector, thus contributing to the diversification of the energy mix, reducing dependency on fossil fuels, and reducing GHG emissions in Mexico. To this end, the program intends to scale up investments in geothermal power generation projects by making available a range of financial mechanisms tailored to meet the specific needs for each project's stage of development. This included risk mitigation mechanisms as well as various forms of financing for exploration, drilling, field development and construction and operation phases of private-sector geothermal projects.
Structure and Key Features	Technical assistance under the Program includes regulatory support, technical due diligence, capacity building and facilitation of PPP schemes. • Component I: Risk mitigation for geothermal projects in the early stages of exploration and test drilling. • Component II: Financing adapted to different phases of project exploration and development. • Loans Convertible to Grants: this is the primary mechanism that will be used for projects in the exploration and confirmation drilling phases • Due Diligence Grants: to cover due diligence for insurance coverage • Insurance Premium Payment Grants: to cover a part of the insurance premiums
Funding Sources	CTF, IDB, and Mexican government (via NaFin and the Ministry of Energy, "SENER")
Geographic Extent	Mexico
Eligible Activities	• Exploration and test drilling activities of geothermal power generation projects – This will be a loan convertible to grant in case of failure • Partial payment of premium/interests for insured loan - Grant

Geothermal Financing and Risk Mitigation Program for Mexico	
Funding Mechanisms	The funding mechanism includes 3 main phases with 3 facilities. 1. An early exploration risk mitigation facility in which a CTF US 20M backstop guarantee supports a well productivity insurance policy for the development of up to 4 wells in a project (in 2 stages of 2 wells each) on a success/failure basis. This facility is funded by NaFin, with long term funds provided by CTF and IDB for up to $ 20 million with an equity/debt ratio of no less than 30/70. 2. If the first wells are successful, the guarantee facility and the funding will still be in place, and financing for another 3 wells will be available on similar terms. Maximum total financing in this stage would be $ 35 million for the 7 wells ($ 5 million per well). 3. If the second phase proves a minimum capacity of at least 21 MW (*i.e.*, 3 MW per well), a third long-term facility would be available for project development and operation on the same 30/70 equity/debt ratio. Depending on project conditions and PPA prices, this ratio could be changed to up to 20/80.
Indications of Success	At the moment program is in hiatus due to unfavorable market conditions. This facility was anticipated to provide support to private developers, but because the geothermal department of the Mexican state utility CFE holds perhaps as many as 13 geothermal concessions (and it is possible that these include the most prospective remaining geothermal resources in Mexico), there are few private-sector players. Furthermore, recent power auctions in Mexico have had responses at costs ranging from $0.035 to $0.040 per kW-hour, which is lower than geothermal prices.
Operation and Management	Borrower, Beneficiary and Executing Agency: Nacional Financiera S.N.C (NaFin)
Criteria used to select developers and projects	• A robust project with all the legalities in place • A firm commitment of equity investors either in the case of success or failure • A firm commitment of equity investor for all stages • A marketable PPA that will enable a successful project to proceed and make a reasonable profit
Criteria and triggers for disbursement of funds	All normal procedures for obtaining Project Finance basis, plus compliance with all requirements for the insurance policy that is issued in the first and second stages. Success in stages 1 and 2 will leading to the third stage.
Requirements for monitoring, reporting and evaluation of results	Not specified
Back-stopping requirements	Equity stake guaranteed for 3 stages and PPA.
Financial Impact on Stakeholders	Loans offered on favorable terms for drilling of first two wells. In the event of failure, the use of well productivity insurance would help offset the facility's losses. If successful, five additional wells can be funded at the same level.

Geothermal Financing and Risk Mitigation Program for Mexico	
Liquidity and availability of risk capital	The developer must guarantee sufficient equity to fund all three stages
Options for recovering funds	The use of well productivity insurance helps offset the facility's losses. CTF funds would be deployed to cover the premiums for well productivity insurance, which would make a payout (back to the facility) if success (defined as an average of 3 MW per well, regardless of specific conditions in a project) is not achieved. If the project is successful, funding is repaid through normal operating revenue. The only likely option for recovering funds from a failure in exploration drilling would be the insurance coverage.
Who pays the bill / holds the risk	Exploration Risk – CTF Backstop Facility / Equity 70/30 ratio. Development Risk – Developer Price Risk – Developer and/or Offtaker
Strong and Weak Points	Strong 1. Engages domestic insurance industry, helping to build domestic capacity 2. Attracts private sector capital Weak 1. Very complicated 2. Too many entities involved 3. Structurally complex
Additional information	

Table 2.8: Details of IRENA ADFD Project Facility

IRENA ADFD Project Facility	
Overview	Start: 2013 Current facility size: $ 350 million from Abu Dhabi Fund for Development (ADFD) over 7 years Fund Manager: IRENA/ADFD
Objectives	The Facility supports IRENA's mandate to promote the widespread and increased adoption and use of renewable energy, with a view to sustainable development to support the energy transition and development goals in developing countries through the provision of attractive loans to government-driven renewable energy projects.
Structure and Key Features	The United Arab Emirates (UAE), through the Abu Dhabi Fund for Development (ADFD), committed concessional financing of up to $ 350 million for seven annual cycles to renewable energy projects in developing countries that are recommended by the International Renewable Energy Agency (IRENA). ADFD loans must be backed by a sovereign guarantee. Since 2013, $ 189 million in ADFD loans have been allocated to 19 renewable energy projects recommended by IRENA. Over $ 387 million is being provided by other funding sources to cover the rest of the project costs.
Funding Sources	ADFD
Geographic Extent	Developing countries worldwide
Eligible Activities	• Projects should be submitted by Members of IRENA, Signatories of the Statute, or States in Accession which are developing countries included in the "DAC List of ODA Recipients" from the Organization for Economic Co-operation and Development (OECD). Preference will be given to project proposals submitted by IRENA Members. • Projects should deploy renewable energy as defined in the Statute of IRENA: bioenergy, geothermal energy, hydropower, ocean energy, solar energy, and/or wind energy. • Projects must have the support of, and must be prioritized by the government of the country where the project is to be implemented. All applicants must be able to obtain a government guarantee to cover any default on the loan. • Projects must be beyond feasibility study stage and pre-implementation stage, *i.e.*, prior to tendering and procurement and execution at point of selection. • Projects must have positive socio-economic, environmental and other sustainable development impacts in the country of implementation.

IRENA ADFD Project Facility	
Funding Mechanisms	Concessionary loans: • The total amount of concessional loans committed per annual project selection cycle shall not exceed $ 50 million unless there is a rollover from the previous cycle if there is a shortfall of projects selected for funding. • The concessional loan value for project(s) will range between $ 5 million and $ 15 million. • The loan amount for each project shall not exceed 50 percent of the estimated project cost. Loan rates vary by country with 1% for Least developed countries and other low-income countries and 2% for Lower middle-income and Upper middle-income countries. Loan period: 20 years including a 5-year grace period. Loans obtained from ADFD must be used for activities or assets directly related to the proposed project. Loans cannot be used to fund any pre-development activities, such as feasibility, environmental-impact or socio-economic studies.
Indications of Success	$ 189 million loan allocation includes loans to two geothermal projects: • $ 15 million for a 10-15 MW project in St. Vincent and Grenadines • $ 6 million for a 5 MW project in Iran
Operation and Management	IRENA carries out its project screening and recommendation process through two bodies: • a strategic Advisory Committee, appointed annually by the IRENA Assembly, and • an independent Panel of Experts established by the Committee and recommended by IRENA's Director-General based on the IRENA Secretariat's knowledge of experts in the field and nominations of qualified experts by IRENA's membership. Applicants are first asked for an Executive Project Summary, which is evaluated by an independent international Panel of Experts who short-list projects based on technical feasibility, economic/commercial viability and socio-economic and environmental benefits. The proponents of short-listed projects are then asked to submit Full Project Proposals. The evaluation process includes a strategic review by the Advisory Committee, who assess and recommend a list of projects considering alignment with national development priorities, geographic spread and diversity of technologies. The Advisory Committee then recommends projects to ADFD for final selection. The ADFD decides on the final selection of projects based on the submission of recommended projects by the Advisory Committee. The ultimate selection, financial support, administrative management and reporting of results remain the exclusive responsibility of the ADFD.

IRENA ADFD Project Facility	
Criteria used to select developers and projects	Consideration by the Panel of Experts involves scoring and commenting on each project in terms of: • technical merit, including appropriate design, management capability and project deliverables; • economic/commercial viability, including an appropriate business plan, demonstrated economic feasibility; and • socio-economic and environmental benefits, including addressing development goals (*e.g.*, equity, health and gender empowerment). To the extent possible, short-listed projects must be: • transformative (expected to have a significant positive impact on the energy landscape, society, environment and/or business situation); • replicable/scalable (show an effective, efficient business model for the given technologies that can be replicated or scaled up, and/or involves a solid and tested approach); and • innovative (*i.e.*, an innovative business model that is financially viable and technically sound). Projects must also improve energy access and address energy security issues. The second level of consideration involves the Advisory Committee, which selects and recommends projects based on their strategic importance in terms of national priorities and expected impact, as well as on the scores, ranking, short-listing and comments from the Panel of Experts. Strategic considerations by the Advisory Committee include: • geographic spread, to ensure that the projects selected represent different regions; • diversity of technologies, such as solar photovoltaic (PV), wind power, solar PV hybrids, mini-grids, small hydro, small-scale waste-to-energy, etc.; and • alignment with government priorities.
Criteria and triggers for disbursement of funds	• Funds are disbursed according to the actual progress of work. • Disbursement is made directly to the services provider depending on the finance percentage. ADFD does not finance more than 50% of the project. • A Government letter of consent to the loan and a government guarantee is required. • Project implementation shall be in accordance with the tendering and procurement procedures of ADFD.
Requirements for monitoring, reporting and evaluation of results	None specified
Back-stopping requirements	A qualified and experienced Project Implementation Unit (PIU) would need to be identified/established by the beneficiary (*e.g.*, Ministry/Authority) behind the project to be responsible for the overall administration of the execution of the Project and will be subject to the approval of ADFD. The PIU manager needs to be an experienced and qualified project manager acceptable to the Fund.

IRENA ADFD Project Facility	
Financial Impact on Stakeholders	Low interest loans available for high risk geothermal activities but only after exploratory drilling stage.
Liquidity and availability of risk capital	The concessional loan value for project(s) will range between $ 5 million and $ 15 million. The loan amount for each project shall not exceed 50 percent of the estimated project cost.
Options for recovering funds	Full repayment of all loans
Who pays the bill / holds the risk	The borrower holds the risk and pays the bill. Each project must have a government guarantee to cover any default on the loan.
Strong and Weak Points	Strong point: 1. Low rate loans, 20-year loan period 2. Focus on underserved developing countries Weak points: 1. Only available to government entities 2. Not geothermal specific 3. Full repayment is required in all cases
Additional information	http://adfd.irena.org/Funding.aspx http://adfd.irena.org/howwork.aspx http://adfd.irena.org/howapply.aspx

Table 3.1: Identification of Risks Likely to be Present in Kenya and Ethiopia

RISK CATEGORY / PROJECT STAGE	Risk Code	TYPE OF RISK	RISK DETAIL	POSSIBLE INTERVENTIONS	RISK EXISTS IN . . . ?** KENYA	ETHIOPIA
COUNTRY All						
	C1	Political	Inadequate regulatory framework, political instability, possibility of unilateral voiding/cancellation of contracts	Legal advisory for drafting more transparent regulatory framework; political risk insurance; sovereign guarantees	M	M
	C2	Political	Reservation of attractive prospects by government entities (leaving lesser prospects for the private sector)	Legal advisory to support policy changes that encourage open competition	M	M
	C3	Political	Lack of transparency in resource concessioning (developer's technical and financial capabilities inadequately considered when awarding geothermal concession)	Policy advisory to support suitable policy changes; linking concessional funding to specific examples of Increased transparency	M	M
	C4	Legal / Regulatory	Land ownership; lack of geothermal-specific regulations	Legal advisory	M	Y
	C5	Legal / Regulatory	Complex/overlapping regulations administered by a variety of national government agencies and local/provincial government agencies	Legal/regulatory advisory to help create more transparent regulatory framework; technical advisory to "navigate" existing system	Y	M
	C6	Legal / Regulatory	Bureaucratic delay in issuing permits, lack of transparency in the decision-making process	Legal/regulatory advisory to adapt best permitting practices to the local environment	M	M
	C7	Legal / Regulatory	Environmental restrictions or social issues limit the availability of land for geothermal development	Environmental/social advisory to help broker creative solutions (land swaps or buy-backs, environmental mitigation projects elsewhere, etc.); increased power price for smaller projects	Y	M
	C8	Social	Community opposition, socio-political unrest	Environmental/social advisory or other support for stakeholder outreach/community engagement; provision of more tangible benefit than power to the grid (e.g., direct use application to support a local industry, educational opportunities)	Y	Y
	C9	Infrastructure	Limitations related to road access, grid connection distance and cost, water availability, land access, availability of support facilities	Master Planning advisory; infrastructure funding; helicopter drilling to prove resource before spending large sums on roads; support for development of local mini-grids; "market Power" projects (direct sale to end consumer);	Y	M
FINANCIAI	Feasibility; Development; Operation					
	F1	Lack of funding	Lack of funding / banks unwilling to lend	Loan guarantee program	U	Y
	F2	Lack of access to funding	Difficulty in obtaining loans / high costs for loans	Access to low-cost financing via development bank or aid agency loans with favorable terms; loan guarantee program with local banks; private equity fund with some public funding (e.g., OPIC's IFIC?)	U	Y
	F3	Power price	Lack of a geothermal feed-in tariff that recognizes geothermal's unique values; use of lower-cost power sources as a basis for electricity pricing	Policy advisory (feed-in tariffs, tax credits, other incentives); economic advisory for power pricing (to reflect the different costs of various energy sources)	M	Y
	F4	Single off-taker (monopoly)	Creditworthiness of off-taker	Sovereign guarantee?	M	L
PROJECT IMPLEMENTATION						
	Pre-Feasibility					
	PI-PF1	Remoteness / logistical difficulty	Lack of major road access; steep, dissected terrain	Master Planning advisory; infrastructure funding; helicopter drilling; local mini-grid; "market Power" projects (direct sale to end consumer)	Y	M
	PI-PF2	Lack of exploration equipment	Contracted services may not be affordable	Equipment bank; technical advisory/training (to ensure proper use of instruments and return to the instrument bank); dedicated funds or facilities that support exploration	Y	Y
	PI-PF3	Access to previous exploration and/or drilling data	Collected by public or private entities	Policy advisory to make data public after a set period (e.g., 5 years after data collection or well completion, per the South Australia model)	Y	Y
	PI-PF4	Failure to find adequate indications of a resource	Size and/or temperature are uneconomic	Technical advisory/training; support for additional exploration (including temperature gradient drilling to map resource extent)	Y	Y
	PI-PF5	Failure to reduce risk in the feasibility stage	Poor well targeting	Technical advisory/training; drilling support (cost-shared drilling; well productivity insurance if drilling campaign includes confirmation drilling also)	Y	Y

Table 3.1: Identification of Risks Likely to be Present in Kenya and Ethiopia

RISK CATEGORY / PROJECT STAGE / Risk Code		TYPE OF RISK	RISK DETAIL	POSSIBLE INTERVENTIONS	RISK EXISTS IN . . . ?** KENYA	ETHIOPIA
	Feasibility					
PI-F1		Remoteness / logistical difficulty	Lack of major road access; steep, dissected terrain	Master Planning advisory; infrastructure funding; helicopter drilling	Y	M
PI-F2		Lack of grid connection	Power line construction lags behind development or not planned for the area where the resource is located	Master Planning advisory; infrastructure funding; agreement with local offtaker; mini-grid	Y	Y
PI-F3		Lack of drilling services, laboratories	Geothermal resources located in remote areas and/or in countries without oil & gas development	Targeted funding (considered herein as infrastructure funding) to build centralized facilities in key locations near areas of operation		
PI-F4		Failure to confirm an exploitable resource	Poor well targeting	Technical advisory/training; drilling support (cost-sharing, well productivity insurance)	Y	Y
PI-F5		Failure to demonstrate adequate resource capacity	Lower than desired average well productivity	Technical advisory/training; power price increase for a smaller project; drilling support (cost-sharing, well productivity insurance)	Y	Y
PI-F6		Inadequate resource characterization in the feasibility stage	Increased risk in the development stage	Technical advisory/training; power price increase for a smaller project; drilling support (cost-sharing, well productivity insurance)	Y	Y
PI-F6		Cost overruns due to drilling problems	Inability to complete entire drilling program due to lack of funds	Technical advisory/training; drilling support (cost-sharing, well productivity insurance)	Y	Y
PI-F7		PPA risk	Power price is inadequate	Policy advisory to develop feed-in tariff structure, tax credits, and/or other incentives	Y	Y
PI-F8		Inability to obtain project financing	No willing lender in the market	Loan guarantee program	Y	Y
PI-F9		Inability to obtain project financing	Inadequate Feasibility Study	Technical advisory; support for additional drilling (cost-sharing, well productivity insurance)	Y	Y
	Development					
PI-D1		Timing risk (poor coordination of development work, PPA executio	Activities are poorly synchronized	Technical advisory/training; financial advisory	M	M
PI-D2		Cost overruns in development drilling	Lower success ratio than planned	Technical advisory/training; drilling support (cost-sharing, well productivity insurance)	M	M
PI-D3		Unexpected drilling results require changes to the power plant an	Surface facilities may already be in construction	Technical advisory/training; support for re-design or retrofit	M	M
PI-D4		Failure to achieve full capacity (with initial spare-capacity margin)	More wells than planned are required to reach capacity	Technical advisory/training; drilling support (cost-sharing, well productivity insurance)	L	L
PI-D6		Delays in drilling and plant construction	Delay in project start-up	Wellhead generation (if power dispatch is available)	L	L
	Operation					
PI-O1		Inadequate project cash flow	Debt cannot be supported	Re-financing support to lower interest rates	M	M
PI-O2		Resource degradation	Inadequate monitoring/management/response; excessive productivity decline due to pressure drawdown; rapid cooling due to injection or cold-aquifer breakthrough	Technical advisory/training; support for additional drilling (cost-shared drilling, well productivity insurance)	L	L
PI-O3		Increase in production of non-condensable gases	Generation inefficiency; overloading of gas-handling equipment	Technical advisory/training; support for plant retrofit	L	L
PI-O4		Mechanical well problems	Casing collapse, wellbore plugging by solids, scaling, corrosion, gases	Technical advisory/training; support for additional drilling (cost-shared drilling, well productivity insurance)	L	L
PI-O5		Operator solvency and competence	Short-term decisions made to address financing or cash-flow requirements negatively impact long-term operations	Technical and financial advisory to develop integrated recovery plan; sale of project	M	M

Notes
* Country risk may be real or perceived
** Key: Y (Yes), L (Likely), M (Maybe), N (No), U (Uncertain / Unknown)

Table 3.2: Interventions Suggested by Interviewees, January 2017

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Intervention	Description	Pros	Cons	Geography	Impact Potential
Access to technical equipment	It was recognized that it can be difficult to access technical equipment, in particular for surface studies. Some of this equipment is already 'in country' but it is dispersed across various public sector organization with no formal mechanism with which to access it. Other equipment is simply not available 'in country' and needs to be brought in.	Low cost to establish formal mechanism to access equipment Support domestic capacity to undertake surface studies Potential to generate revenue from hire charges. Increases utilization rates of existing equipment	Likely low utilization rate of equipment	All Countries / Regional potential.	Medium
Human Capacity Development	Provision of technical training to develop human capacity. Needs range from PPA drafting and negotiation through to training of geoscientists, drilling engineers and reservoir engineers.	Skills transfer Helps ensure equitable negotiation capacity for government entities Supports a robust framework for long term geothermal sector development	Some human capacity development activities (such as training of geothermal professionals) are 'long-term' in nature (i.e., it will take a long-time line to see direct benefits)	Ethiopia	Low
Drilling Risk	Guarantees to cover the risk that wells are not drilled and completed as envisaged (according to plan)	Could allow private sector capital to be deployed to support credible drilling companies Removes pure drilling risk for project developer and investors	Potential to disrupt alignment of interest of drilling contractor with project success. Reduces alignment of interest between drilling contractor and project. Unclear whether GDC would be considered 'bankable' as a drilling contractor.	Regional	Medium
New Technology Review	A request was made by KenGen to review emerging technologies for improved well targeting. They are interested in improved technologies but do not have the capacity to assess their viability.	Could be part of a more general TA facility		Regional / Global	Low
Stakeholder and Community Engagement	It was recognized by several stakeholders that community engagement is an important part of successful project development but that there was little understanding of how to do this well. Support was therefore requested in this area.	Improved community engagement and support Reduced project delays Project benefits shared with local communities Capacity building		Regional	Medium
Independent International Arbitration Process	It was noted that politics has caused problems for private sector developers in the past. It was felt that establishing an independent international arbitration system for the geothermal sector could be a benefit.	Reduces political risk of projects	Would require government buy-in and commitment Would require waiver of sovereign immunity	Regional but country specific	Medium
Infrastructure Funding	A request was made for additional funding to support the development of project infrastructure (water and roads in particular) as these can make up a significant proportion of early costs.	Reduces early stage costs for private sector developers	Does not directly increase private sector funding	Regional	Medium

Table 3.2: Interventions Suggested by Interviewees, January 2017

Intervention	Description	Pros	Cons	Geography	Impact Potential
Licensing Process Support	It was noted by several stakeholders that the licensing process, either for green field or late stage projects, was lacking in transparency. Projects have been awarded to developers without the technical or financial resources to progress them.	Greater transparency will increase private sector developers and investors that licenses will not be disputed later on Will ensure licenses are awarded to entities with the resources to implement projects			High
Energy Storage Study	A request was made for a study in to the role and cost / benefits of energy storage	Will support grid balancing Would allow developers to dispatch power when needed (and when the price may be higher than, for example, during the day in a region with lots of utility-scale solar power or rooftop solar)	Geothermal remains a needed base-load power source in Kenya and Ethiopia, which have few intermittent renewable resources Not specific to geothermal energy	Regional but country specific	Low
Energy Access Creation	Access to energy remains a challenge in the region. Kenya's energy access project has not progressed as anticipated .	Will increase demand Significant social benefits associated with energy access Relevant to more remote geothermal resources	Existing programs in place but not progressing	Regional	Low
Mini-grids	A current study is underway for this in Kenya, but it was felt further support and work would be needed	Good potential to improve energy access (see previous)		Regional but country specific	Medium
Wellhead Generator Technology Transfer	A request was made for improved access and knowledge of wellhead generator technology	Early revenue generation reduces capital requirements and delivers some power to the grid sooner Domestic capacity building	Will need to made available to private sector if they are to benefit from it.	Regional	Low
Cost of Finance	It was generally recognized that the high cost of finance is a significant barrier. Therefore, any intervention that can reduce the cost of finance would be welcomed. (See RLSF below)	Potential to access existing mechanisms, e.g., PIDG	Non-specific request Likely to require significant donor funds and country buy-in	Regional but country specific	
Regional Liquidity Support Facility	This is a yet to be announced facility supported by KfW and managed by ATI that will provide 6 months liquidity via stand-by letter of credit to support IPPs	Reduced capital requirements and cost of capital Addresses short term liquidity risk Can be combined with long term 'non-honoring ' insurance cover	Facility still in development	Regional	High
Insurance to cover Excessive Drilling Days	An over-run in the number of drilling days was identified by one investor as a risk they would like insurance for	Removes 'drilling cost overrun risk'	Would need detailed specification of risks and policy triggers	Regional	Low
Formation Risk Insurance	An insurance protection to cover the risk of hitting a formation that significantly impacts drilling cost	Removes formation-specific drilling risk	Would need detailed specification of risks and policy triggers	Regional	Low
Long Term Capital Facility	Local banks do not have access to long term capital. The French aid agency (AFD) has provided a 13-year facility to a Kenyan Bank for loans to geothermal projects?	Reduces cost of capital Enables borrowers to access long tenor credit facilities	Not clear if macroeconomic conditions would support this	Regional but country specific	Medium

Table 3.2: Interventions Suggested by Interviewees, January 2017

Intervention	Description	Pros	Cons	Geography	Impact Potential
Investment Guarantee of Profits	Guarantee to investors of minimum investment return	Very attractive to investors	Unlikely to be supported by donors Does not address specific risks, many of which should be assumed by project developers	Regional	Low
Well Targeting	Recognizing the importance of well targeting funding support was requested to improve this	Reduces drilling risk Could be part of a TA package			
Contract Support	Funding was requested to support the development of a bankable set of contracts (PPAs, Letters of Support etc.)	Ensures robust contractual nexus		Regional	High
Data Center	Geoscientific and drilling data for each country is often dispersed across a number of different entities and is not easily accessible. Proposal to centralize data and make it more accessible, perhaps after a specified time has elapsed since data collection.	Reduce search cost to identify potential resources Increase competition by bringing in more developers	Entity that collected the data or drilled the wells will prefer that the data are proprietary	Regional but country specific	Medium

Table 4.1: Key Risks** Associated With Geothermal Projects in Kenya and Ethiopia and Coverage by Other Risk Mitigation Facilities

RISK CATEGORY / PROJECT STAGE				Key Risks	Green = Covered; Yellow = partial cover; Red = not addressed	NEED EXISTS IN . . . ?**	
Risk Code		TYPE OF RISK	RISK DETAIL	POSSIBLE INTERVENTIONS	Existing Source of Support?	KENYA	ETHIOPIA
COUNTRY*	All						
C1		Political	Inadequate regulatory framework, political instability, possibility of unilateral voiding/cancellation of contracts	Legal advisory for drafting more transparent regulatory framework; political risk insurance; sovereign guarantees	EAGER / ICEIDA NDF	M	M
C2		Political	Reservation of attractive prospects by government entities (leaving lesser prospects for the private sector)	Legal advisory to support policy changes that encourage open competition	EAGER / ICEIDA NDF	M	M
C3		Political	Lack of transparency in resource concessioning (developer's technical and financial capabilities inadequately considered when awarding geothermal concession)	Policy advisory to support suitable policy changes; linking concessional funding to specific examples of Increased transparency	EAGER / ICEIDA NDF	M	M
C4		Legal / Regulatory	Land ownership; lack of geothermal-specific regulations	Legal advisory	EAGER / ICEIDA NDF	M	Y
C5		Legal / Regulatory	Complex/overlapping regulations administered by a variety of national government agencies and local/provincial government agencies	Legal/regulatory advisory to help create more transparent regulatory framework; technical advisory to "navigate" existing system	EAGER / ICEIDA NDF	Y	M
C6		Legal / Regulatory	Bureaucratic delay in issuing permits, lack of transparency in the decision-making process	Legal/regulatory advisory to adapt best permitting practices to the local environment	EAGER / ICEIDA NDF	M	M
C7		Legal / Regulatory	Environmental restrictions or social issues limit the availability of land for geothermal development	Environmental/social advisory to help broker creative solutions (land swaps or buy-backs, environmental mitigation projects elsewhere, etc.); increased power price for smaller projects	EAGER / ICEIDA NDF	Y	M
C8		Social	Community opposition, socio-political unrest	Environmental/social advisory or other support for stakeholder outreach/community engagement; provision of more tangible benefit than power to the grid (e.g., direct use application to support a local industry, educational opportunities)	EAGER / ICEIDA NDF	Y	Y
C9		Infrastructure	Limitations related to road access, grid connection distance and cost, water availability, land access, availability of support facilities	Master Planning advisory; infrastructure funding; helicopter drilling to prove resource before spending large sums on roads; support for development of local mini-grids; "market Power" projects (direct sale to end consumer);	None	Y	M
FINANCIAL	All						
F1		Lack of funding	Lack of funding / banks unwilling to lend	Loan guarantee program	DCA / OPIC / EXIM	U	Y
F2		Lack of access to funding	Difficulty in obtaining loans / high costs for loans	Access to low-cost financing via development bank or aid agency loans with favorable terms; loan guarantee program with local banks; private equity fund with some public funding (e.g., OPIC's IFIC?)	OPIC / World Bank	U	Y
F3		Power price	Lack of a geothermal feed-in tariff that recognizes geothermal's unique values; use of lower-cost power sources as a basis for electricity pricing	Policy advisory (feed-in tariffs, tax credits, other incentives); economic advisory for power pricing (to reflect the different costs of various energy sources)	None	M	Y
F4		Single off-taker (monopoly)	Creditworthiness of off-taker	Sovereign guarantee?	MIGA / OPIC	M	L
PROJECT IMPEMENTATION							
	Pre-Feasibility						
PI-PF1		Remoteness / logistical difficulty	Lack of major road access; steep, dissected terrain	Master Planning advisory; infrastructure funding; helicopter drilling; local mini-grid; "market Power" projects (direct sale to end consumer)	None	Y	M
PI-PF2		Lack of exploration equipment	Contracted services may not be affordable	Equipment bank; technical advisory/training (to ensure proper use of instruments and return to the instrument bank); dedicated funds or facilities that support exploration	None	Y	Y
PI-PF3		Access to previous exploration and/or drilling data	Collected by public or private entities	Policy advisory to make data public after a set period (e.g., 5 years after data collection or well completion, per the South Australia model)	None	Y	Y

Table 4.1: Key Risks** Associated With Geothermal Projects in Kenya and Ethiopia and Coverage by Other Risk Mitigation Facilities

RISK CATEGORY / PROJECT STAGE				Key Risks	Green = Covered Yellow = partial cover Red = not addressed	NEED EXISTS IN . . . ?**	
Risk Code		TYPE OF RISK	RISK DETAIL	POSSIBLE INTERVENTIONS	Existing Source of Support?	KENYA	ETHIOPIA
PI-PF4		Failure to find adequate indications of a resource	Size and/or temperature are uneconomic	Technical advisory/training; support for additional exploration (including temperature gradient drilling to map resource extent)	GRMF (partial)	Y	Y
PI-PF5		Failure to reduce risk in the feasibility stage	Poor well targeting	Technical advisory/training; drilling support (cost-shared drilling; well productivity insurance if drilling campaign includes confirmation drilling also)	GRMF (partial)	Y	Y
	Feasibility						
PI-F1		Remoteness / logistical difficulty	Lack of major road access; steep, dissected terrain	Master Planning advisory; infrastructure funding; helicopter drilling	None	Y	M
PI-F2		Lack of grid connection	Power line construction lags behind development or not planned for the area where the resource is located	Master Planning advisory; infrastructure funding; agreement with local offtaker; mini-grid	None	Y	Y
PI-F3		Lack of drilling services, laboratories	Geothermal resources located in remote areas and/or in countries without oil & gas development	Targeted funding (considered herein as infrastructure funding) to build centralized facilities in key locations near areas of operation	None		
PI-F3		Failure to confirm an exploitable resource	Poor well targeting	Technical advisory/training; drilling support (cost-sharing, well productivity insurance)	None	Y	Y
PI-F4		Failure to demonstrate adequate resource capacity	Lower than desired average well productivity	Technical advisory/training; power price increase for a smaller project; drilling support (cost-sharing, well productivity insurance)	None	Y	Y
PI-F5		Inadequate resource characterization in the feasibility stage	Increased risk in the development stage	Technical advisory/training; power price increase for a smaller project; drilling support (cost-sharing, well productivity insurance)	None	Y	Y
PI-F6		Cost overruns due to drilling problems	Inability to complete entire drilling program due to lack of funds	Technical advisory/training; drilling support (cost-sharing, well productivity insurance)	None	Y	Y
PI-F6		PPA risk	Power price is inadequate	Policy advisory to develop feed-in tariff structure, tax credits, and/or other incentives	EAGER	Y	Y
PI-F7		Inability to obtain project financing	No willing lender in the market	Loan guarantee program	None	Y	Y
PI-F8		Inability to obtain project financing	Inadequate Feasibility Study	Technical advisory; support for additional drilling (cost-sharing, well productivity insurance)	None	Y	Y
	Development						
PI-D1		Timing risk (poor coordination of development work, PPA execution and project financing)	Activities are poorly synchronized	Technical advisory/training; financial advisory	None	M	M
PI-D2		Cost overruns in development drilling	Lower success ratio than planned	Technical advisory/training; drilling support (cost-sharing, well productivity insurance)	None	M	M
PI-D3		Unexpected drilling results require changes to the power plant and gathering system	Surface facilities may already be in construction	Technical advisory/training; support for re-design or retrofit	None	M	M
PI-D4		Failure to achieve full capacity (with initial spare-capacity margin)	More wells than planned are required to reach capacity	Technical advisory/training; drilling support (cost-sharing, well productivity insurance)	None	L	L
PI-D6		Delays in drilling and plant construction	Delay in project start-up	Wellhead generation (if power dispatch is available)	None	L	L
	Operation						
PI-O1		Inadequate project cash flow	Debt cannot be supported	Re-financing support to lower interest rates	OPIC / EXIM	M	M
PI-O2		Resource degradation	Inadequate monitoring/management/response; excessive productivity decline due to pressure drawdown; rapid cooling due to injection or cold-aquifer breakthrough	Technical advisory/training; support for additional drilling (cost-shared drilling, well productivity insurance)	None	L	L
PI-O3		Increase in production of non-condensable gases	Generation inefficiency; overloading of gas-handling equipment	Technical advisory/training; support for plant retrofit	None	L	L
PI-O4		Mechanical well problems	Casing collapse, wellbore plugging by solids, scaling, corrosion, gases	Technical advisory/training; support for additional drilling (cost-shared drilling, well productivity insurance)	None	L	L
PI-O5		Operator solvency and competence	Short-term decisions made to address financing or cash-flow requirements negatively impact long-term operations	Technical and financial advisory to develop integrated recovery plan; sale of project	None	M	M

Notes
* Country risk may be real or perceived
** Risks that are known to exist or likely to exist ("Y" and "L" in Table 3.1)

Table 4.2: Details of GeoFutures Facility

GeoFutures Facility	
Overview	New intervention providing Technical Assistance to further develop the enabling environment for geothermal project development combined with direct finance and risk mitigation option for early project drilling.
Objectives	This new facility will support public sector capacity building and enabling environment and private sector development and investment in to geothermal energy production. It will initially focus on Kenya and Ethiopia but is intended for deployment in our geothermal countries in the East Africa Rift System region. It will complement existing regional mechanism and bring in additional features based on best practice identified from other international interventions to fill identified gaps.
Structure and Key Features	Pillar 1 – Technical Assistance • The GeoFutures Facility will provide TA for activities not covered under existing TA geothermal focused facilities (*i.e.*, EAGER and ICEIDA). These existing facilities should be the first port of call for applicants and a simple Letter of Declinature from both facilities will be required in order to access the GeoFutures Facility TA pillar. TA will be provided on a non-recourse grant basis and awarded for activities that directly support the development of the geothermal sector in the target region. Pillar 2 – Direct Financing • Direct Financing in the form of non-recourse grants for surface studies and up to 3 exploratory wells will be available. For Surface Studies a total of 40% of eligible costs can be received. Funds will be drawn down in 3 equal tranches upon reaching pre-defined criteria (see below). • Convertible loans will be available for up to 40% of infrastructure costs. In the event that the project is not successful (basis of success to be defined in advance on project by project basis) the loan will convert to a grant. Pillar 3 – Risk Management • For Appraisal drilling phase of the project convertible loans will be available for 60% of eligible costs for Due Diligence and Premium Payment. In the event of project failure loans for Due Diligence will be converted to grants whereas loans for premium payment will be recovered from private sector insurers. The funding will be available to private companies or public private partnerships only. In respect of Pillar 2 and 3 an Expression of Interest (EOI) open to the public, will be made to initiate the application process. Projects accepted at the EOI stage will be eligible to draw down the first tranche of eligible funding (*i.e.*, 20% part of 60% available). Thereafter the funding pathway will be contingent on completion of the due diligence with the conclusion that the project is bankable and or insurable. A panel of pre-approved due diligence providers and insurance brokers will be

	established. Each approved panelist must have sufficient technical and professional expertise relevant to geothermal sector. The GeoFutures Facility can be used in conjunction with other funding mechanisms, however, the developer needs to have skin in the game and cover a minimum of at least 20% of the cost has to be borne by the developer. Multiple EOIs for different projects by one bidder will be accepted. Documents will be mostly filled out and uploaded online but due to the international nature of the fund, financial and business documents such as articles of incorporation will need to be apostilled and mailed in. Applications may be received on a continuous basis rather than through periodic rounds. Quarterly meetings will be held to evaluate applications.
Funding Sources	International donors and multilateral development financial institutions will provide the concessional funding elements. The private sector insurance markets, both domestic and international, will take the majority of the risk by providing the risk capacity associated with the "resource risk" insurance.
Geographic Extent	All of the following countries are eligible, subject to discrete qualifying criteria for individual applications: Kenya, Ethiopia, Djibouti, Tanzania, Uganda, Rwanda, Burundi, Zambia
Eligible Activities	Pillar 1 – Technical Assistance Eligible activities are not restricted beyond the following key criteria: a) EAGER and ICEIDA have already declined to cover the TA request b) The activity will directly support the continued development of the geothermal sector in the region. This will be a subjective decision of the facility manager. Pillar 2 - Direct Finance 1. Surface studies: Surface studies can include geophysical surveys (*e.g.*, seismic, gravity, magnetic, or magnetotelluric surveys), as well as supplementary remote sensing, geological, hydrogeological, and/or geochemical surveys, if these are necessary for siting reservoir confirmation wells. In addition, a surface-study program may include infrastructure required for conducting surface studies (*e.g.*, access roads), as well as the drilling of up to one slim-hole well (< 5" diameter of the last casing or liner). Surface studies shall include an integrated resource report interpreting and summarizing the results of the work. This report should include a geological-conceptual model of the resource and identification and prioritization of prospective drilling sites. 2. Exploratory Drilling: Drilling projects include well-testing programs to help confirm and update the conceptual model. An appropriate exploration drilling program for funding by the GeoFutures Facility may comprise up to three full-size wells (≥ 5" diameter of the last casing or liner) suitable for production. In addition, a drilling program may include: infrastructure required for exploration drilling (*e.g.*, access roads, water supply, and electrical power), mobilization and demobilization of drilling rigs, and well testing. A drilling program may incorporate a feasibility study with the explicit aim of securing financing for

	subsequent reservoir-confirmation wells or steam-field development - in other words, for siting additional wells. Developers will be at liberty to follow their own procurement procedure. They will however be assessed on the quality of project and output. Pillar 3 – Risk Management This pillar will only be eligible for projects that have reached the drilling phase of the project and have a viable drilling plan. This will be subject to independent technical review as covered by the due diligence element of this pillar.
Funding Mechanisms	The GeoFutures Facility will provide non-recourse grants for surface studies and up to 3 exploratory wells up to 60% of total eligible costs. Convertible loans will be available for 60% of eligible costs for infrastructure costs, Bankability / Insurability Due Diligence fees and Premium Payment. These will be repayable in the event of a successful project. Any Premium Payment loans will be recoverable from Insurers in the event of project failure.
Indications of Success	Pillar 1 Discrete success criteria will be developed for individual TA activities. However, the high level demonstration of success for this pillar is significant progress in the implementation of multiple projects (we suggest approximately 10 projects) by private-sector developers or public-private partnership projects in the region within 5 years. The rationale for this is that without a supportive enabling environment for developers and financiers, very few projects will progress. Pillar 2 A minimum of 5 surface studies for private-sector developers, plus 8 for public-sector developers or public-private partnerships should be completed within 5 years. A minimum of 12 exploratory drilling projects are supported across the public and private sector within 5 years Pillar 3 A minimum of 5 appraisal drilling projects are underwritten by private sector insurers on behalf of private sector developers
Operation and Management	Pillar 1 • It is proposed that existing infrastructure be used where possible. Therefore, discussions should be held with both EAGER and ICEIDA NDF for the TA proportion of the GeoFutures Facility, with a view to considering either of these entities managing the GeoFutures TA Pillar. This will ensure the GeoFutures facility is complimentary and completing with existing initiatives. • Where applications are made for third party services the third-party service provider will contract directly with the applicant but be paid directly from the GeoFutures Facility. Pillar 2 & 3 • As a regional Development Finance Institution Africa Trade Indemnity (ATI) could be considered as a manager for the Due Diligence and Premium Payment Facility. Additionally established private sector fund managers with regional

	capability such as KPMG, CAMCO (www.camco.com) and Pegasys (www.pegasys.co.za), as well as IDA Fund Management LLC, (current managers of the GDF LAC facility).
Criteria used to select developers and projects	Developers and projects will be selected based on a scoring system that evaluates the geoscientific merits of the project, land access and permits, financial soundness of the applicant, and overall quality of the application. [Private sector developers with license concessions awarded after March 2017 will need to have secured concessions through open public RFP. License concessions awarded prior to March 2017 will be grandfathered through.]
Criteria and triggers for disbursement of funds	Pillar 1: • Requests for TA funds delivered from Pillar 1 will be assessed by the fund manager based on the activities ability to progress geothermal sector development in the region. Pillar 2: • Selected projects will need a detailed Work-Plan document and demonstrable technical experience in geothermal project development prior to fund disbursement. Technical experience can be contracted in but the contract will be subject to review by the GeoFutures Facility to ensure content and alignment of interest. A site visit might also be required of some projects. Environmental, Social Impact Assessments (ESIA) will be required for contingency grant funding for drilling programs. Certain ESIA activities may be considered eligible for grant funding. The Fund may also require an applicant to complete a GAP analysis by a third party and remedy any issues identified. No ESIA is required for surface study grant funding. However, the applicant will need to prove that they have the relevant local permits for the activity proposed and that they have legitimate access to the survey area. Pillar 3: Projects are expected to provide comprehensive project information in order to access these funds. Initial information requirements are detailed separately below. Upon submission of the project information pack, 20% of total Due Diligence costs will be made available to cover an initial 'Completeness Review' by the due diligence consultant. This will identify any significant gaps in information. Subject to satisfactory Completeness Review the full Due Diligence study will be undertaken. The output will be a comprehensive independent project review that will be suitable for procuring private sector insurance and investment.
Requirements for monitoring, reporting and evaluation of results	After the funds are disbursed, continuous monthly reporting is expected along with a final report for both surface studies and drilling activities. Other monitoring requirements may include site visits and 3rd party review of drilling activity results. Final well testing will be required to assess coverage and payout under any private sector insurance placement.

Back-stopping requirements	Communication between the fund and the recipients is expected. 3rd party review of certain documents may be required, however, exact requirements for support and backstopping may be determined on a case by case basis.
Financial Impact on Stakeholders	Pillar 1 • Applicants, both public and private sector, will receive funds in grant form and not need to repay the GeoFutures Facility. Pillar 2 • For Surface Studies a total of 60% of eligible costs can be received. Funds will be drawn down in 3 equal tranches upon reaching pre-defined criteria (see below). • Convertible loans will be available for up to 60% of infrastructure costs. In the event that the project is not successful (basis of success to be defined in advance on project by project basis) the loan will convert to a grant. Pillar 3 – Risk Management • For appraisal/confirmatory drilling phase of the project convertible loans will be available for 60% of eligible costs for Due Diligence and Premium Payment. In the event of project failure loans for Due Diligence will be converted to grants whereas loans for premium payment will be recovered from private sector insurers. The funding will be available to private companies or public private partnerships only.
Liquidity and availability of risk capital	Pillar 1: • 100% of costs may be covered. Contracting for services may be directly by GeoFutures Facility or directly by the TA applicant. Pillar 2: The projects will receive 40% of eligible costs: • Up to $400,000 for surface studies (total project cost of $1,000,000) • Up to $8,000,000 for drilling projects (project cost of $20,000,000) Pillar 3: The projects will receive 60% of eligible costs: • Up to $90,000 for due diligence studies (total due diligence cost of $150,000) • Up to $3,000,000 for premium payment (total premium cost of $5,000,000)

Options for recovering funds	Pillar 1 • Funds made available for TA are not required to be paid back. Pillar 2 • In the case of surface studies and for up to 3 exploratory wells, payback is not required. In the case of infrastructure costs the project is required to repay 80% of the loan in the event of a successful drilling campaign. Pillar 3 • In respect of due diligence costs and premium payment loans the recipient is required to repay a minimum of 100% of the loan in the event of a successful drilling campaign. Success or failure will be determined on a per project basis using the pre-agreed well testing guidelines. Unsuccessful drilling projects will not be required payback of due diligence costs but premium payment loans will be repaid under the private sector insurance policy that is executed.
Who pays the bill / holds the risk	Risk is shared between donors and project developers for surface studies and exploration drilling. Private sector insurers hold the majority of the risk for Appraisal drilling.
Strong and Weak Points	Strong point: 1. No repayment of surface study grants 2. Wide array of eligible activities 3. Can be combined with other funding mechanisms 4. High public:private leverage ratios 5. Engagement of and capacity developer of domestic insurance industry 6. Compliments existing facilities Weak points: 1. Requires continued development of pool of insurers willing to provide coverage 2. Requires host country engagement and commitment to private sector involvement 3. Limited existing capacity in domestic insurance market
Additional information	Pillar 3 Initial Evaluation - Information Requirements Basic Information 1. Coordinates of the boundary of the License area 2. Topographical map showing the boundaries of the subject area and other geothermal developments in the area 3. Well location map (planned and existing wells including water boreholes) 4. Project timing and timelines Description of the drilling project 5. Well field layout 6. Expected flow rate and enthalpy for the wells 7. Required flow rate and enthalpy for the wells to be covered 8. Requested coverage (*e.g.*, number of wells and the amount to be covered, etc.) 9. Anticipated drilling time for each well and for the to be insured wells in aggregate

	Feasibility Studies (*i.e.*, describing the development plan) 10. Analyses of geoscientific data 11. Drilling results from within the subject area 12. Results from the surrounding area including geology, depth, temperature or enthalpy, flow rates, generation capacities, number of dry holes, current status and/or use, geology, etc. 13. Results from the exploration undertaken so far 14. Conceptual hydrogeologic model of the resource including description of what zones are to be targeted for drilling and why 15. Planned depths and targets of wells, including directional drilling as appropriate 16. Detailed drilling plans for project wells, including specification of the drilling rig capacity, drilling equipment and materials, uncertainties, contingency plans (*e.g.*, stimulation, re-drilling etc. if poor initial drilling result) etc. 17. Drilling cost estimates and their bases (drilling contract is already in place) 18. Detailed testing plans for the project wells 19. Planned stimulation measures (including time and costs) to be used if the initial drilling result does not meet the required productivity 20. Information about the fluid requirements and operating conditions of the power plant to enable suitable criteria to be defined for well "success" 21. Numerical reservoir model of the resource These components will require Independent expert assessment and an opinion on the ability of the project to achieve the planned objectives. Other Information 22. Details of the Developer/Sponsor, including their general geothermal experience and their specific field/regional experience, capabilities and financial stability 23. Details of the Project Management Team and primary service contractors and consultants, highlighting both their general geothermal experience and their specific field/regional experience 24. Details and status of the project's funding including both debt and equity providers, the amounts already spent, the providers of these funds (including grant or similar funding) and the total project costs if different 25. Information on the rights to the geothermal resource, the conditions of its sue, any restrictions that could hinder exploration, drilling, well testing or routine operation 26. Evidence that the relevant environmental permits and studies have been obtained or undertaken 27. Information about the power purchase agreement terms and transmission interconnection plan

Table 4.3: Differences Between GeoFutures Facility and GRMF

Pillar	*GeoFutures Facility Element*	*GeoFutures Facility (GFF)*			*GRMF*			*Comment*
		Included?	Coverage	Recoverable?	Included?	Coverage	Recoverable?	
1	Technical Assistance – Enabling Environment	Y	100%	N	N	- -	- -	Legal, regulatory, env/social, capacity building, policy development, etc.
	Technical Assistance – Project Support	Y	100%	N	N	- -	- -	Peer reviews, technology suggestions, pre-feasibility studies, etc.
2	Focused Exploration (to enable wellsite selection)	Y	40%	N	Y	80%	N	GFF: specific to additional exploration required to target wells GRMF: all exploration
	Infrastructure Development (roads, water supply, well pads)	Y	40%	Maybe	Y	20%	N	GFF: Contingent grant (repaid if successful project) GRMF: Grant, only in conjunction with grant for surface study or drilling
	Exploratory Drilling (up to 3 wells)	Y	40%	N	Y	40%	N	GRMF: up to 2 wells
3	Insurance Mechanism	Y			N			Transfers risk to private sector; available to private-sector and PPP projects
	Confirmation Drilling (up to 6 wells)	Y	60%	Y	N	- -	- -	In GFF, 60% of premium is recovered in the majority of cases (insurance payout for well failures; developer repays for successful project)
	Exploration + Confirmation Drilling (up to 10 wells)	Y	60%	Y	N	- -	- -	

Table 4.4: Differences Between GeoFutures Facility and GDF Latin America

Pillar	*GeoFutures Facility Element*	*GeoFutures Facility (GFF)*			*GDF Latin America (GDF)*			*Comment*
		Included?	Coverage	Recoverable?	Included?	Coverage	Recoverable?	
1	Technical Assistance – Enabling Environment	Y	100%	N	N	- -	- -	Legal, regulatory, env/social, capacity building, policy development, etc.
	Technical Assistance – Project Support	Y	100%	N	N	- -	- -	Peer reviews, technology suggestions, pre-feasibility studies, etc.
2	Focused Exploration (to enable wellsite selection)	Y	40%	N	Y	40%	N	GFF: specific to additional exploration required to target wells GDF: All exploration, including 1 slim hole
	Infrastructure Development (roads, water supply, well pads)	Y	40%	Maybe	Y	40%	Maybe	Both use contingent grant mechanism, repaid if successful project (GFF) or successful wells (GDF)
	Exploratory Drilling (up to 3 wells)	Y	40%	N	N	- -	- -	GFF: Outright grant (no repayment). GDF: One slim hole may be covered as part of exploration (see above), but otherwise developer must fund exploration drilling.
3	Insurance Mechanism	Y			N			GFF transfers risk to private sector; available to private-sector and PPP projects
	Confirmation Drilling (up to 6 wells)	Y	60%	Y	Y	40%	Maybe	GDF: Up to 3 wells covered at 40% (repaid if wells are successful). GFF: Insurance mechanism for confirmation or exploration + confirmation wells; 60% of premium is recovered in majority of cases (insurance payout for well failures; developer repays for successful project)
	Exploration + Confirmation Drilling (up to 10 wells)	Y	60%	Y	N	- -	- -	