GEF

Global Environment Facility

MOHAMED T. EL-ASHRY
CHIEF EXECUTIVE OFFICER
AND CHAIRMAN

November 14, 2001

Dear Council Members:

I am writing to notify you that we have today posted in the GEF's website at http://www.gefweb.org/Whats_New/whats_new.html, a project proposal, *Kenya: Olkaria III Geothermal Development* for your review. As noted in the Cover Note for the December 2001 Work Program, this project is being submitted on an exceptional basis to allow for a more rapid response to a private sector client. This is the first private sector financed and managed geothermal project in Africa and incorporates a novel use of GEF funds with promise of much wider applicability in the developing world. This project proposal will be discussed at the Council Meeting during the Work Program which is on the proposed agenda for December 7, 2001.

Sincerely,

Mohamed T. El-Ashry

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THE WORLD BANK/IFC/M.I.G.A.

OFFICE MEMORANDUM

DATE: October 24, 2001

TO: Mr. Ken King, Assistant CEO, GEF Secretariat
Att: GEF PROGRAM COORDINATION

FROM: Lars Vidaeus, GEF Executive Coordinator

EXTENSION: 3-4188

SUBJECT: **Kenya: Olkaria III Geothermal Power Development**
Submission for Work Program Inclusion

Please find enclosed the electronic attachment of the above mentioned project brief for work program inclusion. We would appreciate receiving any comments by November 7, 2001. As you are aware, it is proposed that this proposal be subject to expedited processing by the GEF due to the time-sensitive nature of the project and its private sector sponsor. We would also note that it is the first proposal for use of this type of GEF contingent finance approach in a geothermal exploration project.

The proposal is consistent with the *Criteria for Review of GEF Projects* as presented in the following sections of the project brief:

- Country Drivenness: please see part B, section 1 *(Sector-related Country Assistance Strategy Goal supported by the Project)* on pages 6-7; part B, sections 2 and 3 *(Main Sector Issues and Government Strategy, Sector Issues to be addressed by the Project and Strategic Choices)* on pages 8-10; part C, section 2 *(Benefits and Target Population)* on page 11; part D, section 2 *(Project Alternatives and Reasons for Rejection)* on page 13.
- Endorsement: Two letters of endorsement for this project from the Kenyan Operational Focal Points are attached, please see Annex 9 on pages 45-46.
- Program Designation & Conformity: please see part A, section 1(b) *(Global Objective)* on page 5, and part B, section 1(a) *(Global Operational Strategy/Program Objective addressed by the Project)* on pages 7-8.
- Project Design: please see part A, section 1(a) *(Project Development Objective)* on pages 2-4; part C, section 1 *(Project Components)* on page 10; part C, section 3 *(Institutional and Implementation Arrangements)* on page 11; part D, section 1 *(The Proposed Project)* on pages 12-13. Please see also Annex 1 *(Project Design Summary)* on pages 23-25; Annex 2 *(Incremental Costs Analysis)* on pages 26-29; Annex 3 *(Technical Issues of Geothermal Exploration)* on pages 30-31 for more details.
- Sustainability: please see part F *(Sustainability and Risks)* pages 20-22.
- Replicability: please see the last paragraph of part A section 1(a) *(Project Development Objective)* on page 4.
- Stakeholder Involvement: please see section 5 of part D *(Indications of Borrower and Recipient Commitment and Ownership)* on page 15.

PROJECT BRIEF

1. IDENTIFIERS:

PROJECT NUMBER:	505590
PROJECT NAME:	**Kenya: Olkaria III Geothermal Power Development**
DURATION:	Two (2) years
IMPLEMENTING AGENCY:	World Bank
EXECUTING AGENCY:	International Finance Corporation
REQUESTING COUNTRY:	Kenya
ELIGIBILITY:	Kenya ratified the FCCC on August 30, 1994
GEF FOCAL AREA:	Climate Change
GEF PROGRAMMING FRAMEWORK:	OP# 6

2. SUMMARY:

The Olkaria III Geothermal Power Development project will use GEF funds to provide a partial risk guarantee facility to address incremental risks and costs of exploration and development of the Olkaria III geothermal field in Kenya. Risks and costs associated with the development of geothermal fields have been identified as one of the major barriers for the growth and development of this type of renewable energy. The project provides a partial guarantee facility to cover, on a cost-sharing basis with the private sector developer, unforeseen cost overruns that may occur during the final exploration and development phase of this geothermal field. This financing mechanism represents a novel use of GEF funds to assist geothermal resource development and may serve as a template for future applications in other similar situations in the developing world.

3. COSTS AND FINANCING (MILLION US$):

GEF:	-Project	(up to)	5.000
	-PDF A:		.025
	Subtotal GEF:		5.025
CO-FINANCING:	-Private Co-Financing: Development (at least)		11.000
	-Balance of Project Costs	(up to)	169.000
TOTAL PROJECT COST:		(at least)	185.025

4. ASSOCIATED FINANCING (MILLION US$) N/A

5. OPERATIONAL FOCAL POINT ENDORSEMENT:

Name: Mr. Mathias Benedict Keah
Organization: Ministry of Lands and Settlement
Title: Assistant Minister, GEF Political Focal Point
Date: October 11, 2001 (attached, Annex 9)

Name: Mr. Benard O. K' Omudho
Organization: National Environment Secretariat, Ministry of Environment and Natural Resources
Title: Director, GEF Operational Focal Point
Date: October 22, 2001 (attached, Annex 9)

6. CONTACT:

Dana R. Younger, IFC/GEF Coordinator
Tel: (202) 473-4779; Fax: (202) 974-4349
Email: dyounger@ifc.org

Project Document

A: Project Development Objective

1.(a) Project Development Objective

The project's development objective is to provide expanded clean electricity generation in Kenya by facilitating further private sector investment for electric power generation in the Olkaria III geothermal field. To meet this objective, the International Finance Corporation (IFC) plans to administer a partial guarantee mechanism, using US$ 5 million in funds from the Global Environment Facility (GEF) to address remaining exploration and development risks and their associated incremental costs in proving up an adequate geothermal resource in the Olkaria III field. This GEF support will facilitate an increment of up to 17 MW in additional electric power output above the current baseline level 36 MW of expected geothermal power plant capacity at the field.

Geothermal energy, similar to most renewable energy technologies, is capital intensive, with initially high, fixed costs but low operating and maintenance costs (mainly due to the absence of fuel expenditures). The costs of exploration and development of the geothermal resource (used as the 'fuel' for the electricity generating power plant) are a significant component of the fixed costs of geothermal projects. Furthermore, such costs cannot be fully and accurately forecasted a priori but require an extensive and expensive exploration program. A schematic representation of relationship between risks and expenditure for geothermal development is presented in Figure 1. Thus, the geothermal development phase results in additional complexity and uncertainty in mobilizing sufficient commercial financing for project development.

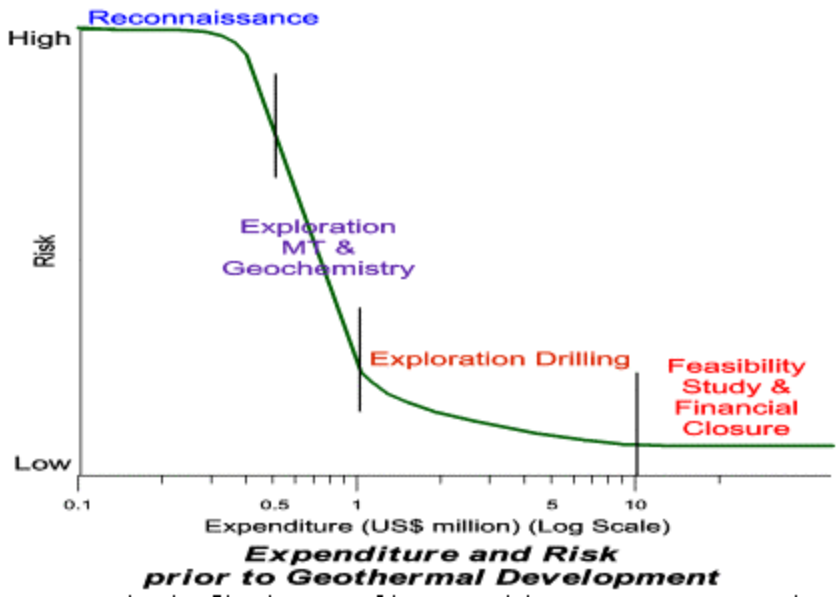

Figure 1. Risk – Expenditure relationship for geothermal resource development (Source: World Bank, http://www.worldbank.org/html/fpd/energy/geothermal/index.htm)

In a liberalizing electricity sector and commercial business environment most power plant projects are developed using limited recourse or non-recourse project financing, where expected project cash flows and the assets of the projects are the primary basis for raising necessary funds for project implementation. Higher uncertainty in any aspect of a project venture generally requires risk mitigation arrangements which usually result in increased project costs and financing requirements.

In the case of geothermal energy the successful delineation and confirmation of the geothermal resource during an exploratory well drilling program has multiple beneficial effects in improving the possibilities for securing the development phase's project financing. First of all, it removes the uncertainty of the resource availability (and therefore guarantees the level of energy input available for power generation), and secondly it creates an asset value for the project. Generally, at this point the necessary additional financing can be mobilized for achieving project financial closure and proceeding to project completion and operation.

The risks involved in the development of a geothermal field are often cited as one of the main barriers for the development of this type of renewable energy. While geothermal energy technology is commercially proven and such applications do not suffer from the intermittency of other renewable forms, uncertainties surrounding the geothermal resource availability present one of the first and most important obstacles in developing such projects.

The Olkaria III geothermal field is located in the Olkaria geothermal region in Kenya's Rift Valley where another two geothermal power plants (Olkaria I of 45 MW and Olkaria II of 64 MW) have been previously developed under government auspices during the last forty years, with considerable support through World Bank loans. While the geothermal potential in the areas of Olkaria I and II is now well established, the Olkaria III field is part of a distinct and quite complex related geological formation and there are still uncertainties about the actual field capacity. The sponsoring company ORMAT International Inc. has undertaken a drilling program since February 2000 and has currently established enough potential to support about 36 MW of electric generating capacity from its initial exploration well drilling program.

The GEF guarantee funds will be used to address the incremental costs of the remaining phase of the exploration and development plan, which aims to prove sufficient geothermal energy for the installation of up to 53 MW of electric capacity[1]. This will involve drilling and evaluation of an additional four to six wells over the next 30 months. Based on information about the chemical and physical characteristics of the steam/hot water produced by a drilled well, supplementary information is gathered about the geothermal field. By analyzing such data together with previously accumulated records a choice of a new exploration point for additional well drilling is made. The actual number and costs of the wells cannot be determined beforehand, since drilling decisions are based

[1] The power plant size negotiated between the sponsoring company and the local electricity buyer is at 48 MW, allowing for a 10 % deviation from this capacity (plant size will likely range between 43 and 53 MW).

on marginal information collected from every additional well. Table 1 illustrates the general situation of the project sponsor's exploration program and where the GEF support will be applied.

Table 1 – Summary Status of Olkaria III Exploration Program and Wells to be Covered by GEF Guarantee

Well Category	Number of Wells	Average Well Capacity	Net Capacity Addition	Accumulated Capacity	Power Generation Capacity from Plant Perspective (after 120% deduction factor)	Accumulated Costs
Previously Drilled Exploration Wells	8	4 MW	31.5 MW	31.5 MW	26.3 MW	US$ 14.9M
Current Exploration Wells	3	4 MW*	12 MW*	43.5 MW*	36.3 MW*	US$ 21.9M
Additional Exploration Wells Proposed to be Covered by GEF Partial Guarantee	4	3.5 MW*	14 MW*	57.5 MW*	47.9 MW* **	US$ 29.9M

Source: ORMAT
* Projected
** This amount could be exceeded if wells are more productive on average than projections

While this project is being developed within the boundaries of the Hell's Gate National Park, geothermal development preceded the national park status of the area. The project lies on the edge of the park boundary and is further removed from current park visitation areas than the existing Olkaria I and II developments. Furthermore, the company has recently signed an agreement with the Kenyan Wildlife Service for the geothermal development covering management of key environmental issues including: park management, environmental protection and management, tourism planning, aesthetics and revenue collection.

This is the first project in which it is proposed that GEF funds be provided through a contingent financing arrangement to address the issue of risks and uncertainty in a geothermal electricity generation exploration and development project[2]. In addition, this is the first private sector financed and managed geothermal electric project in Africa and among the first private power projects in Kenya and East Africa. It therefore has significant demonstration value, since if successful a similar use of partial guarantees for the development of geothermal fields may be extended in the future to other applications in Kenya, the whole East Africa region where there are good indications of a high geothermal potential, as well as possibly to other promising locations in the developing world.

[2] GEF has previously directly financed an electric transmission line for a geothermal electric generation project in the Philippines and a number of geothermal district heating projects in Central and Eastern Europe.

1. (b) Global Objective

This project is expected to result in avoided Greenhouse Gas (GHG) emissions of up to 2.8 million tons of CO_2.[3] Furthermore, it aims to demonstrate the use of a contingent financing instrument that addresses the barrier of the exploration and development risks of geothermal resources, by incremental risk sharing with the private sector developers and other financiers.

The identification and measurement of the geothermal resource needed for power generation is the most important and highest risk aspect of a geothermal project. The nature and extent of the geothermal exploration risk is described in more detail in section E (Issues requiring special attention – Technical, on page 19, and Annex 3 on page 30).

Drilling costs and rates of exploration success can vary widely. These variations greatly increase the perception of investor risk and further raise the cost of securing adequate risk capital. High costs of capital significantly affect the overall project costs, because the initial capital outlays represent a significant part of the total project cost. Moreover, there is very limited experience among commercial financial institutions in financing the exploration and development drilling phases of geothermal projects, particularly in a developing country context[4].

Without GEF funding the project has significantly lower probability to be fully implemented for the maximum electricity capacity potential of 53 MW. Thus, GEF support is necessary to render this project financially viable by addressing the barrier of perceived risk in the remaining geothermal exploration program and its high initial capital costs. The provision of a GEF-funded partial guarantee that covers unexpected cost overruns lowers the cost of capital for the exploration activities, and effectively reduces the capital costs of the project, so that it will be considered more bankable and will be more likely to attract further private or multilateral investment through debt and/or equity. This approach is fully consistent with the concept of using contingent finance as a GEF financing modality "…to cover some portion of perceived performance risk of climate friendly technologies to attract equity and/or debt participation by public or private venture capital providers"[5].

[3] At a 92% plant availability, 25 years of operation, 53MW nominal power, the plant will produce about 9500GWh of electricity. GEF funds are expected to contribute to realization of up to 53MW of electrical capacity from the present expected level of about 36 MW, an increment of 17MW. This increment under the previous assumptions and a diesel plant alternative for the same amount of energy, results in avoided emission of about 2.8 million tons of CO_2 (17MW x 8760hrs x 92% x 25yrs x 0.824).

[4] IFC itself does not directly finance geothermal resource exploration programs due to their high risk profile and uncertainty of success.

[5] See Ashford M. (1999) "Contingent Finance as a GEF Financing Modality", The World Bank, Climate Change Team Environment Department, June 1999.

2. Key Performance Indicators

The key performance indicators linked to the above development objectives are:

- Continuation of the exploration and development of the geothermal resource in Olkaria III. This will be monitored through quarterly progress reports and field inspections during the remaining exploration and development phase.

- Establishment of sufficient geothermal capacity to support a power plant with a capacity of between 43 and 53 MW. This is the final milestone to be achieved at the end of the project, at the latest six months after commissioning of the power plant. Relevant reporting will occur with the final project report.

- Financial closure for the proposed power plant in Olkaria III involving multilateral support and/or commercial financing. While still an ongoing process, it is expected that GEF support will heighten interest in the project and facilitate the availability of project finance. MIGA has already agreed to provide political risk coverage for this project, and the U.S. Export-Import Bank, the IFC/GEF Renewable Energy and Energy Efficiency Fund (REEF), and a commercial bank are interested in providing equity and/or debt to the project. However, IFC's Power Department has declined to participate in the financing of this project due to its portfolio exposure in the country, and concerns about the progress of the power sector reform process. In view of these issues, it will likely be difficult for the project to achieve financial closure.

B: Strategic Context

1. Sector-related Country Assistance Strategy (CAS) Goal supported by the Project

Currently electricity is available to less than 10% of Kenya's population, and persistent load shedding is affecting the productivity of the industrial and agricultural sectors, leading to reduction in economic growth. Electricity demand in Kenya is growing and the electricity system is vulnerable due to its high dependency on supply from hydroelectric plants that often have limited water capacity to supply demand. The country recently suffered from extensive blackouts and interruptions of supply which required emergency diesel plants to be brought in the country funded by an emergency World Bank loan (summer of 2000).

While new diesel capacity became operational in September 2001, geothermal energy is still the preferred option for electricity system expansion for the Government of Kenya (GoK), because it uses an indigenous energy supply source which reduces exposure of the country to fuel price fluctuations, it increases security of supply and is environmentally preferable to diesel plants.

The World Bank's latest Country Assistance Strategy (CAS) prepared in September 1998 requires the Government of Kenya to sustain commitment to good governance and implementation of reforms of the civil service and parastatals. The Bank is currently assisting with the reform of the power sector under the IDA sponsored Energy Sector Reform and Power Development project (approved in 1997). Implementation of the project has been slow, however, the following aspects are under implementation: (i) reorganization of electricity sector assets into separate generation and distribution companies; (ii) assistance with structuring of the Electricity Regulatory Board; and (iii) review of the tariffs.

The CAS calls for support to the program of privatization and investment promotion, by the private sector in infrastructure development (the power sector included). This project contributes directly to this objective since it is the first private sector geothermal power project in Africa. The GEF standby financial support will provide the necessary mitigation for the remaining risks associated with the geothermal resource exploration phase which is crucial to the project's development and ultimate economic viability.

1a. Global Operational Strategy/Program Objective addressed by the Project

The project's objective falls within the GEF's Operational Program # 6 (OP 6), "Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs". The objective of this program is to remove the barriers to the use of commercial or near commercial Renewable Energy Technologies (RET). Geothermal energy driven electric power generation is a proven and commercially available renewable energy technology. However, one of the main barriers for its promotion is associated with the exploration and development risk of proving an adequately sized geothermal resource[6]. This project is designed to remove this barrier by providing a contingent financing mechanism to partially offset any unforeseen cost overruns associated with agreed aspects of the final phase of exploration drilling at the Olkaria III geothermal field.

Further compliance with the OP 6 guidance is indicated by the following points:

- Geothermal projects are a national priority in Kenya; economic and environmental benefits will accrue from further development of this indigenous geothermal energy supply source.
- Transfer of technology which is environmentally sound and adapted to suit local conditions will occur.

[6] This risk is widely accepted to be one of the main factors that hinders geothermal energy development. See Project Description Summary below and the technology description available at http://www.worldbank.org/html/fpd/energy/geothermal/index.htm. See also, Battocleti E.C. (1998) Geothermal Financing Workbook, Sandia National Laboratories/US Department of Energy Geothermal Division, Contract No. 1998, February 1998.

- The project's success will result in a sustainable power development and most likely will lead to additional applications in the country. The potential for geothermal energy in Kenya ranges to hundreds of MW and additional planned generation capacity to 2020 is estimated to reach 576 MW[7]. While this particular project may not result in removing the exploration and development barrier for all geothermal capacity, this partial guarantee risk-sharing mechanism is likely to be widely replicable to help develop other less proven geothermal fields.
- The project strives to leverage other funds by enabling ORMAT, the private sector developer, to incur necessary exploration costs under partial risk coverage from the GEF, which would share in a portion of agreed potential overrun costs. It thereby facilitates the raising of additional finance for the power plant since the risk associated with proving the availability of the resource is partially covered.
- The project is expected to directly mitigate climate change by reducing GHG emissions that would occur if the same level of power would need to be supplied by fossil fuels. This is described in more detail in the incremental cost analysis section (on page 26).

2. Main Sector Issues and Government Strategy

Sector Context

The World Bank has been supporting the Kenyan power sector since 1971, and has provided seven loans/credits to date for development of hydroelectric and geothermal power in Kenya. An eighth project, the Energy Sector Reform and Power Development project (ESRPD), which is co-financed by OECF, EIB and KfW, is now under implementation.

The ESRPD stated objectives are to assist the GoK in formulating and implementing major policy and institutional reforms aimed at creating an efficient and environmentally sustainable energy sector, and to support investments needed to meet power demand and increase operational efficiency. These objectives specifically encompass, *inter alia*, (i) reorganizing the power sector to enable commercially sustainable operations; (ii) creating a legal and regulatory environment necessary for private sector projects; and, (iii) adoption of economic pricing for both electricity and petroleum products. Unfortunately, the process of implementing power sector reform has been moving more slowly than expected.

The power demand in Kenya has grown by four to six percent for the last twenty years and is expected to grow by five percent per year in the near future. Load growth declined to 2.7% in 1998 and was almost unchanged in 1999 and 2000. However, the main issue

[7] Peter Omenda (2001) "Geothermal Power Generation in Kenya" in *Renewable Energy Technologies: Potential for Africa, Proceedings from the 21st Session of the Governing Council of UNEP/Second Global Ministerial Environment Forum.* Naivasha, Kenya. 10 February 2001

has been scarcity of financing and was associated with inferior macro-economic performance during that period. There are also concerns for the financial capacity of the national utility company. The current electric power system in Kenya is made up of about 846 MW of installed capacity with effective generation of about 806 MW. Of this effective capacity, 584 MW are generated by hydroelectric facilities, 177 MW by thermal power and 45 MW by geothermal.

Kenya Electricity Generating Company Ltd. (KenGen), the government agency responsible for power generation, has identified geothermal as a key source of future power; it plans to expand geothermal power generation by an additional 576 MW in the next 20 years while expecting only an additional 313 MW from hydro. The Olkaria geothermal area, which consists of several distinct geological formations, is thought to have reserves of up to 220 MW.

Over the past few years Kenya has been experiencing brown-outs and load shedding, and today faces an evening peak shortfall of over 130 MW. The system operates with practically no reserve margin and, with 80% of its capacity coming from hydropower, is particularly vulnerable to climatic and hydrological variations. The government of Kenya (GOK) invited the private sector into power generation and in 1997 the Kenyan Power and Lighting Company (KPLC), the national power utility, signed up Kenya's first two stop-gap Independent Power Producers (IPPs)[8]. These were followed by Requests for Proposals (RFPs) for two more IPPs: Kipevu II and Olkaria III. Kipevu II is a diesel plant project partially funded by IFC and the private sector which became operational in September 2001. However, even this added new capacity will not satisfy electricity demand in the medium term. Persistent load shedding is affecting the productivity of the industrial and agricultural sectors, leading to reduction in economic growth. The Olkaria III project will help mitigate the effects of current power shortages and over the long term provide much needed back-up power to Kenya's largely hydroelectric generation system.

Apart from meeting an electricity supply deficit which is stifling economic growth in Kenya, full development of Olkaria III will allow KPLC to diversify its power sources and reduce weather-related risks associated with its reliance on hydroelectric dam projects. The project is identified as part of the least cost system expansion strategy in the Least Cost Power Development Plan (July 1998) prepared by Acres International Ltd. under the World Bank power sector program in Kenya. This study estimates a power capacity deficit of about 200 MW for 2001 which is not expected to be fully eliminated even with the operation of the Kipevu II diesel plant.

3. Sector Issues to be addressed by the Project and Strategic Choices

Private sector involvement in infrastructure development is one of the key components of the GoK and the World Bank Group's strategy. Projects to develop the geothermal

[8] IberAfrica, a 45MW diesel station was commissioned in June 1997, and Westmont Kenya, a 43 MW barge-mounted gas turbine, started operations in September 1997. Neither project was financed by the Bank Group.

potential of Kenya have been facilitated over the last four decades by the World Bank and the GoK. The Olkaria III project is the first in which a private developer has won a concession (through a World Bank administered competitive bid process) to develop and use a geothermal field. The GoK is strongly supporting the project.

C: Project Description Summary

1. Project Components

Financial Mechanism - Investment Component

A guarantee will be extended to the project developer for coverage of possible agreed cost overrun items that may occur during the final exploration and development drilling phase of the Olkaria III geothermal field. This guarantee facility will have the following main features: (i) limited time availability until six months after the power plant's commissioning; (ii) a maximum coverage of US$ 5 million; (iii) limited exposure for a maximum geothermal resource capacity of 63.4 MW (equivalent electric capacity of 53 MW, based on the upper value as set by the PPA); and (iv) partial coverage of specific items of allowable cost overruns. GEF guarantee funds will not exceed 50% of such agreed costs.

Indicative Project Cost

The total project cost is expected to reach US$ 170 to 180 million. It is expected to be covered by ORMAT's own equity, other possible equity investors, and funds from multilateral agencies, export credit agencies and commercial bank financing.

GEF financing

The final amount of GEF financial liability to the project will be determined once the exploration and development phase is concluded. It may range from nil to a maximum of US$ 5 million, depending on the actual final cost of the exploration and development drilling activities.

Guarantee as a percent of Total cost

Depending on the actual results of the exploration and geothermal field development program, the amount of funds callable from the guarantee facility may range from 0 % to about 3 % of total project costs.

2. Benefits and Target Population

The project will directly contribute to economic growth by alleviating the persistent electricity interruptions that affect the productivity of the industrial, commercial and agricultural sections of the Kenyan economy. It will mitigate the effects of power shortages that hinder economic development in the short and long term, by providing base load power supply which is consistent with the least cost expansion plan. Moreover, it will supply the much needed back-up power for Kenya's hydroelectric dam system which is prone to water shortages and climatic uncertainty.

The project will use an indigenous energy resource for power generation. Therefore it will reduce exposure of the economy to fossil fuel price fluctuations and the associated exchange rate risk for fuel procurement. In addition it will be beneficial for the local and regional environment (especially air quality) since geothermal electricity production produces none of the conventional air pollutants associated with alternative fossil fuel generation options. It will also supply jobs to some local residents and be a source of local economic growth.

The global benefits of the project include avoided GHG emissions of up to 2.8 million tons of CO_2 and the replication potential of the GEF's financing approach towards the barrier of exploration and development of geothermal energy.

3. Institutional and Implementation Arrangements

Information about Project Sponsor

ORMAT International, Inc., a member of the ORMAT Group of Companies, is a Sparks, Nevada-based developer and owner-operator of geothermal projects worldwide. The ORMAT Group has over 30 years of experience in the design, production, construction, and maintenance of power generation units, and geothermal power plants. As a project developer or EPC contractor, ORMAT has installed over 600 MW of power generating capacity in more than 16 countries, including the United States, Iceland, Portugal, New Zealand, the Philippines, Guatemala (the Ozunil project in which IFC is an investor) and Mexico. OrPower 4, Inc., a project company, was created to own, construct and operate the Olkaria III plant, and for the construction of an energy transmission system to the projected KPLC distribution site.

Project Duration

The GEF-funded contingent finance support project will be active for the duration of the exploration, drilling and evaluation of the geothermal field development, likely to be for a period of about 24 to 30 months. ORMAT will provide quarterly reports on the progress of the program together with detailed cost information. IFC will independently audit statements of expenses of the drilling and evaluation program if cost overruns for agreed items are declared and registered and any part of the guarantee is called. At the end of the project all remaining funds not committed under the guarantee provision will be available to the GEF for redeployment to other projects.

D. Project Rationale

1. The Proposed Project

ORMAT International, Inc. through its fully owned subsidiary OrPower4, will build, own and operate a geothermal power plant of approximately 48 MW in the Olkaria geothermal region of Kenya. ORMAT is currently the sole owner of the project, but intends to involve other equity investors in the venture, while maintaining majority control. As part of developing the power plant, ORMAT will develop the geothermal resource that will supply steam for the plant within the 11.9 km^2 Olkaria III Geothermal Concession Area. The geothermal resource development includes utilizing some of the eight existing geothermal wells and drilling additional wells as required to reach the contracted capacity of 48 MW plus/minus 10% plus a 20% reserve margin. The project is to be developed in phases[9].

The first phase included drilling five appraisal wells and the construction of a 12 MW early generation production project, which is owned by ORMAT and was entirely financed from ORMAT's own funds and shareholder loans under insurance coverage from the Bank Group's Multilateral Investment Guarantee Agency (MIGA). The 12 MW (net) first phase of Olkaria III is a Binary Geothermal Power Plant. It is comprised of three air-cooled ORMAT® Energy Converters (OECs).

ORMAT manufactured the OECs and supplied the entire plant on a turnkey basis under an EPC contract. The balance of plant includes the high voltage substation, the geothermal gathering system and other required auxiliary systems. The plant was later expanded to 13.5 MW and is known as the early generation facility. Steam from two existing completed exploration wells (OW-301 and OW-305) and three new exploration wells (A-1, B-1 and B-3) are connected to the early generation facility by a geothermal gathering system. The geothermal exploration, engineering and testing was executed in cooperation with Ken Gen, Geothermex, PB Genzl, and Orkustofnun. The electricity generated by the power plant is sold to KPLC. This power plant has been in commercial operation since August 2000.

In the second phase, for which this project's GEF partial guarantee will be deployed, ORMAT will expand the project to a total capacity between 43 and 53 MW. In this phase, ORMAT expects to use conventional steam turbine technology for the balance of the plant's capacity by installing one steam turbine generator and an additional OEC. The project size has been based on the resource appraisal of the geothermal field, which lasted 18 months and was concluded in June 2001. Ultimately the project will include the power plant, well field, gathering system, access roads, and transmission lines. In addition, ORMAT is constructing approximately 20 housing units for use by plant operators. This may increase to 60 housing units during Phase II. This housing is located on a 17.5 Ha site near the southern shore of Lake Naivasha.

[9] Detailed project timelines and associated cost information are listed in Table 2 (section E2) on page 18.

The Olkaria III project is the first private geothermal power plant in Kenya and in Africa. The Power Purchase Agreement (PPA) was awarded by KPLC under a World Bank supervised international tender for the field and plant development of up to 100 MW. Based on the results of the exploration drilling program to that time and evaluation of relevant data, ORMAT agreed in June 2001 with KPLC to a final project size of 48 MW, with an option to deviate 10% around this capacity. The contract requires an additional 20% safety margin.

2. Project Alternatives considered and Reasons for Rejection

The Olkaria III project is part of the least-cost expansion plan of the Kenyan electricity system. The planned capacity for the project was initially 64 MW, with the PPA allowing for a capacity range between 28 to 100 MW. However, based on the drilling and evaluation program results achieved through June 2001 ORMAT finalized the PPA at a plant capacity of 48 MW.

The next best alternative solution to provide equivalent electricity to the system network in a cost-efficient way is fossil fuel-based generation. Indeed, emergency diesel plants where shipped to Kenya at very high cost during the summer of 2000 to provide energy and back-up for the predominantly hydro-electric system, which due to low rainfall, could not meet demand.

Given the time frames and urgent need for electricity generation of that capacity and required reliability (the geothermal plant is expected to operate at a 92%, or higher, capacity factor) Olkaria III seems at present to be the best available option for the electricity system in Kenya. In addition, it offers economic, social and environmental benefits that cannot be matched by other available choices.

3. Major Related Projects financed by the Bank and/or other Development Agencies **(completed, ongoing and planned)**

This section briefly describes the World Bank's involvement in developing the geothermal power sector in Kenya. The World Bank has been supporting the Kenyan power sector since 1971, and has provided seven loans/credits to date for development of geothermal as well as hydroelectric power in Kenya. An eighth project, the Energy Sector Reform and Power Development project (ESRPD, 16001-KE, May 1997), which is co-financed by OECF, EIB and KfW, is now under implementation.

Between 1979 and 1996 the World Bank carried out five projects to support Kenya's program to develop geothermal power resources; the first such program in Africa. An

OED audit[10] of the five projects found that they were successful, but warned that the sustainability of the last two projects is unlikely without further government support. The audit highlights actions that both the Bank and borrowers could take in the future to increase the chances of success for similar power projects in the region. For the GoK the report suggests the need for the government to intensify its commitment to expansion of geothermal exploration and development, boost its expertise in the field, and provide sufficient resources for maintenance, while pursuing private sector participation.

In the period from 1979 to 1989, the Bank approved three loans and two credits, for a total of US$ 117.2 million, to support the development of Kenya's geothermal power program and resources. The five projects, carried out between 1979 and 1996, helped KPC install the first geothermal-based power plants in Africa.

The Bank has been suggesting that most, if not all, the future growth of Kenya's power supply should be met by the private sector. The government agreed to offer the Olkaria West fields for private development and to promote private sector participation in conventional thermal power generation plants. A more detailed background of the World Bank and geothermal development in Kenya is available at Annex 4.

4. Lessons Learned and Reflected in the Proposed Project Design

Exploration and performance experience of the Olkaria I and Olkaria II geothermal fields, concerns about the depletion of the geothermal resource, drilling methods and state-of-the-art evaluation, simulation and modeling techniques are being taken into account by ORMAT in the Olkaria III venture. IFC's expert consultant retained during the PDF Block A grant's implementation testified to the high level of performance in the exploration program to date. Lessons learned from development of the other local fields and the general international practice in geothermal exploration are fully reflected in the current exploration program. ORMAT's subcontractors are among the international leaders in the field.

Furthermore, environmental and social guidelines and policies developed by the World Bank during the Olkaria I and II projects are being used in the present project and are envisioned for the overall project implementation. Suitable environmental clearances under World Bank standards and guidelines have already been granted by MIGA for the entire Olkaria III project.

[10] Berney R. (1997) " Kenya: Olkaria Geothermal Engineering project, Olkaria Geothermal Power Project, Olkaria Geothermal Power Expansion Project, Geothermal Exploration Project, Geothermal Development and Energy Pre-investment Project" Report No. 16842, June 1997.

5. Indications of Borrower and Recipient Commitment and Ownership

ORMAT approached IFC's Power Department for financial assistance for the overall project and also requested GEF support through IFC's Environment and Social Development Department in July 2000. Based on this application, IFC submitted a concept note to the GEF Secretariat and consequently obtained approval for an IFC-executed PDF Block A grant to conduct initial due diligence for the project. Initial estimates for GEF support were in the range of US$ 20 million, aiming at a geothermal development of up to 100 MW.

ORMAT has demonstrated clear support and financial commitment to the project by conducting drilling and evaluation operations in the Olkaria III field since February 2000, prior to receiving any clear endorsement or approvals for possible financial assistance from the GEF. ORMAT has been using its own funds and shareholder loans, building up its equity in the project. According to results obtained during this phase of exploration and development, the final size of the power plant has been reduced to 48 MW. The company requested a guarantee facility of a higher amount for the reduced size project; however, based on IFC's appraisal a limit of US$ 5 million in contingent financing from the GEF was agreed.

The Kenyan government has expressed its commitment to the project and provided endorsement for the PDF Block A grant and strongly encouraged IFC to pursue GEF's involvement. Given the private sector nature of the project, no additional active involvement is necessary from government agencies. Letters of endorsement from the Kenyan GEF focal points are attached to this document (see Annex 9). KPLC, as the counterpart and buyer of electricity from the project, has also indicated its full commitment to the project.

6. Value Added of Bank and GEF Support in this Project

The World Bank has been contributing to geothermal development in Kenya for nearly three decades. Lessons learned during these earlier World Bank projects, as well as the clear indication for the need of private sector involvement in the power supply sector and the area of geothermal energy development have been of high value to this project. This is reflected not only in the technical aspects of the development of the geothermal field but also through the incorporation of suitable policies and guidelines for managing the environmental and social aspects of the project.

GEF's contribution to the project at this stage is crucial for helping to mobilize the project's needed commercial financing. Addressing the incremental risks of geothermal

development is a novel use of GEF's funds to support this clean form of energy. The partial guarantee mechanism seems to be the best mechanism to deal with this type of incremental risk and cost, which cannot be accurately estimated before actual project implementation. By involving the private sponsor in sharing the agreed *overrun* cost items *only*, additionality of the project is assured, and a balanced contingent finance instrument is offered to the scheme. On the one hand the project developer is encouraged to actively explore the full extent of the available geothermal resource by having the GEF share in financial losses occurring within defined limits, but, on the other hand, the GEF-funded partial guarantee is a risk and cost-sharing mechanism which shields the project from excessive risk-taking.

E: Issues Requiring Special Attention

1. Economic

The main economic issues for the eventual power plant's success are related to macro-economic considerations in Kenya. While such concerns are not directly relevant to the exploration and development phase for which GEF's funds will be used, they are important for the overall project performance, and are therefore noted here.

There is currently uncertainty about the future performance of the Kenyan economy. Much will depend on the micro-economic reform and country governance, as well as the response of international donors and private investors to expected changes. According to the Economist Intelligence Unit, economic growth for 2001 and 2002 is projected to be around 2% and 3.5% respectively, assuming that donor support resumes in the final quarter of the year and that growth in the tourist industry continues. A significant factor hindering economic growth in the country is the continuing rationing of electric power, which this project will help alleviate in the medium term.

Within the power sector there is also concern within the World Bank Group over the progress of sector reform and the financial capacity of KPLC. The Bank Group's Country Assistance Strategy is focused on supporting governance, privatization and private sector development. Private sector involvement in improving infrastructure services such as power is critical for achieving economic growth and poverty alleviation. These issues are addressed further in the section on risks.

2. Costs Associated with ORMAT's Exploration and Development Program

ORMAT has been implementing a exploratory well drilling program since early 2000 to further develop the Olkaria III geothermal field. Table 2 presents a detailed set of cost and other data for the program to date and projections for the foreseeable future. Four of the possible six additional wells which would be covered by the GEF-funded partial guarantee are presented here. If two additional wells are needed following completion of

the four wells shown in Table 2, they would also be covered by the GEF partial guarantee unless it has been fully utilized.

Incremental costs for the GEF are expected to range from nil to US$ 5 million. Current estimates by IFC's consultants significantly bias the expected value of the incremental project cost to the lower end of the above range. Further detail on the incremental costs may be found in Annex 2.

Table 2 – Actual Incurred and Projected Costs of ORMAT's Exploration and Development Program for Olkaria III

Well Category	ORMAT Serial No.	Well No.	Actual/ Scheduled Start*	Actual / Scheduled Completion*	Well Capacity (MW)	Accumulated Capacity	After the 120% Deduction Factor (From Plant Perspective)	Well/s Cost ($m)	Accumulated Cost ($m)
Old Wells	**NA**	301			4	4.0	**3.3**	-	**-**
	NA	302 & 305			2	6.0	**5.0**	-	**-**
Field Development Consultants and Studies								**0.5**	**0.5**
Appraisal Wells	**1**	A 1	20-Feb-2000	19-Apr-2000	5.0	11.0	**9.2**		
	2	B 1	5-May-2000	13-Jul-2000	3.5	14.5	**12.1**		
	3	B 3	18-Jul-2000	29-Sep-2000	6.0	20.5	**17.1**		
	4	C 2	8-Oct-2000	17-Dec-2000	5.0	25.5	**21.3**		
	5	A 2	29-Dec-2000	26-Feb-2001	***6.0***	31.5	**26.3**	14.4	**14.9**
3 Current Drilled Wells**	**6**	B 7	Mar-01	Aug-01	***4.0***	35.5	**29.6**		
	7	B 8			***4.0***	39.5	**32.9**		
	8	B 9			***4.0***	43.5	**36.3**	**7.0**	**21.9**
Additional Wells***	**9**	1	Sep-01	Oct-01	***4.0***	47.5	**39.6**	**2.0**	**23.9**
	10	2	Nov-01	Dec-01	***2.0***	49.5	**41.3**	**2.0**	**25.9**
	11	3	Jan-02	Feb-02	***4.0***	53.5	**44.6**	**2.0**	**27.9**
	12	4	March-01	Apr-02	***4.0***	57.5	**47.9**	**2.0**	**29.9**
Additional Injection Well (Workover existing Well)	**13**	TBD			NA	NA	NA	**0.4**	**30.3**
Contingencies (10% over the non expended costs)					NA	NA	NA	**1.5**	**31.8**

Legend and Comments

* The Schedule for drilled wells is actual day of start or completion (as the case may be) and for current drilled/planned wells the expected month. The gaps between the wells represent mobilization of the drilling rig between the well pads.

** Wells 6, 7, & 8 are drilled by time sharing, therefore the joint budget and schedule.

*** The less productive (2MW) well was picked randomly.

X *- Forecast*

Y - Budget

3. Technical Aspects of Olkaria III Geothermal Field Exploration

Wells drilled within the Olkaria III concession area have proven a viable liquid-dominated geothermal resource, capable of supporting a maximum plant capacity of 60 to 70 MW. Viability of this resource is supported by the existing 45 MW Olkaria I plant that has been in operation for 20 years, and the 64 MW Olkaria II plant now under construction. The Olkaria III wells intercept a high temperature resource associated with the Olkaria fault, with the heat source and up-flow of the system associated with the Olkaria hill, which is central to the greater Olkaria system. A 64 MW development may have required ten to thirteen additional wells (assuming three pre-existing and five new production wells to date) for start-up and up to 54 wells over a 30 year period, if the long term average production per well is 3.5 MW. If, through directional drilling, it is proven that the long term average is closer to 5.0 MW/well then up to 40 wells could be required over the same period.

Reservoir temperatures extend from 230^{o}C at 1250 masl (500-750 m below surface) to over 300^{o}C at sea level (2000 m depth). The two-phase zone produces high enthalpy fluid (in excess of 2300 kJ/kg), but also appears to be the source of high CO_2 in some of the wells. The high CO_2 concentrations distinguish Olkaria III from Olkaria I and II, and may be related to reservoir boiling. It may increase calcite scaling, while providing silica scale mitigation. This may affect the performance of condensing turbines and lead to higher specific steam consumption. Successful geothermal systems with high CO_2 levels have been developed and exploited (Broadlands, New Zealand; Kizildere, Turkey; and in Iceland). Because CO_2 concentrations, silica and calcite scaling are affected by the production scenario, the fluid geochemistry presents a critical issue in developing an optimal production scenario for this field[11].

For the Olkaria III field the early review of the project by IFC's consultants estimates that the probability that an additional exploration well drilled will be successful during the remaining drilling, exploration and evaluation phases will be about 80%, which is consistent with the overall Olkaria III field experience to date.

4. Social

The project has the potential to provide positive socio-economic benefits to the local Maasai community by providing additional employment opportunities, road improvements, and watering locations. According to the socio-economic survey of the Maasai community performed for the EIA (Section 5.4.0), the Maasai felt that they would benefit from the project but remained concerned about noise, dust, potential displacement and reduction in privacy, possible injuries and other issues primarily related to the industrial nature of the development. There has been recent civil unrest in the project area related to these social issues.

The project will employ a total of about 1,000 mostly local workers during construction and about 45 workers during its operation. As with Olkaria II, the impacts of additional workers on the infrastructure of the Naivasha community are being mitigated by the construction of living quarters outside of the park near Lake Naivasha.

[11] As the Olkaria region is an active fault zone, these CO_2 emissions from the Olkaria III geothermal field would be released to the atmosphere through natural geophysical processes over some longer time scale; therefore this power generation project will not contribute additional net CO_2 emissions to the atmosphere. The CO_2 content mentioned here is therefore primarily a technical factor to be accounted for in the engineering design and operation of the plant.

5. Environmental

An Environmental Impact Assessment (EIA), in a form acceptable to satisfy IFC's environmental and social review requirements, was prepared by experienced local consultants for the Olkaria III Geothermal Power Plant in June 2000. It was prepared at the request of the Kenyan Electrical Regulatory Board (ERB) and was reviewed by the staff of ERB. After commenting and receiving responses, ERB staff accepted the EIA.

For the project's initial environmental review during the project development phase IFC's consultant evaluated the project's EIA as well as the Environmental Assessment Report for the Olkaria II project, conducted a site visit, and held consultations with the Kenya Wildlife Service (KWS). The main environmental issues associated with the proposed project are expected to be: the potential visual and ecological impacts on locations within Hell's Gate National Park, an area designated as a protected natural setting; air emissions; erosion; possible effects on Lake Naivasha; and the socio-economic impact of the project and its project workers within the local community.

The project sponsor has accepted to comply with all recommendations and requirements to mitigate environmental impacts of the project, and all World Bank applicable policies prior to disbursement[12]. Exploration operations that have been performed to date as well as the currently operating 13.5 MW geothermal plant are being managed in compliance with applicable World Bank environmental and social guidelines.

F: Sustainability and Risks

1. Sustainability

Geothermal resource availability is the critical issue for the sustainability of the project, and is directly addressed by this GEF project. A more detailed analysis of this issue is available in section E3 on page 19 and in the risk section below. Given the great demand for electricity in the country and the overall economic and other benefits of this project, it is believed that, once the geothermal resource is proven, the power plant is very likely to have a useful life of at least 25 years, providing additional supplies of clean electricity to Kenya.

2. Critical Risks

Experienced Developer

The parent company of the project developer, ORMAT Industries, through its affiliated companies, is experienced in international geothermal project development, including projects of the size of Olkaria III. ORMAT's experience as an EPC contractor is demonstrated by a number of its recent projects.

[12] The project will comply with the "Geothermal Energy" section of the latest "Industrial Pollution Preventions and Abatement Handbook" and environmental requirements regarding the Air Quality, Liquid and Solid Wastes, Land Disturbance, Visual Aspects and Noise.

Tested Resource

The proving of the geothermal resource is typically one of the major areas of risk for geothermal development. Addressing this risk is the objective of this project. This risk is mitigated by resource exploration and geothermal reservoir engineering analysis of the resource data collected. In the case of Olkaria III the resource risk has been reduced by the successful regional development of Olkaria in general and the initial development of Olkaria III in particular.

Some additional risk remains because the data collection from the first phase of the Olkaria III development is not complete, the differences between the producing Olkaria resource and Olkaria III resource are not clearly defined, and the actual resource requirement of the power generation facility is undefined. This qualification can be addressed and the Olkaria III geothermal resource risk further reduced if a) resource assessment is performed after additional data is collected, and b) the power plant and surface facilities are appropriately designed so that the reservoir can supply the required resource over the life of the project based on that additional assessment. Nonetheless, at this time the resource risk appears relatively low for a geothermal development based on the following:

- Olkaria III is part of the Olkaria geothermal resource area that also contains Olkaria I. Olkaria III is geologically separate from, but somewhat similar to Olkaria I, which has been operating at 30 to 45 MW with high reliability for some 20 years. Resource declines in Olkaria I have stabilized at the level of three percent/year (after introduction of in-field re-injection), suggesting that the Olkaria I resource base is sufficiently similar to the Olkaria III resources and can continue to produce for many more years.

- Exploration wells drilled in Olkaria III have all encountered a high temperature geothermal reservoir providing approximately 8 MW based on results from two injection wells completed to date. Five additional wells have been drilled by ORMAT since. They have a proven capacity of an average of 5.7 MW/ well. Assuming that additional wells average 5 MW (a conservative long term production average for Olkaria is 3.5 MW/well with 5.7 MW from this area, for a rounded average of 5 MW/well) the project could produce approximately 37 MW from existing wells. In addition, these successful drilling results suggest that the reservoir extends over the entire lease, thereby providing for additional reserves.

- The installation of 13.5 MW during the early generation phase also contributes to a reduction in risk, as nearly a year of operating data for several wells will be available prior to achieving financial closure for the entire project, a benefit not often enjoyed by projects of this type.

Location

Compared with other geothermal developments world-wide, the Olkaria location is close to existing, upgraded roads and population, resulting in lower costs and risks associated with infrastructure, employment and housing issues. ORMAT has constructed a residential community, occupied currently by its staff, reducing further these particular risks.

Environmental and Social

Significant environmental and social risks to the project, or to the GEF as a project participant which is dedicated to environmentally and socially sound projects are limited to presently unanticipated or unmitigated impacts. The environmental impact assessment and mitigation performed at geothermal projects around the world have successfully identified potential risks that can be evaluated in this site

specific context and developed appropriate mitigation technologies. Because there has been relatively extensive study of the site for this project, as well as for the other geothermal developments at Olkaria and as a result of the creation of Hell's Gate National Park, the potential impacts are relatively well understood. In addition, the project proponent has displayed a cooperative and voluntary commitment to minimizing adverse environmental impacts of the project though implementation of numerous mitigation measures. Therefore it appears the risk to the project or to GEF from environmental or social impacts of the project is limited. The recent civil unrest will likely compel GoK and ORMAT to initiate a more proactive approach to local jobs creation and community involvement. Careful monitoring of current and changing environmental and social conditions including air and water quality, flora, fauna and local socio-economics along with appropriate community outreach will minimize this risk.

Financial Closure

Financial closure of the project is one of the risks that the GEF intervention is partially addressing by covering the unlikely event of serious financial losses that may be incurred by the sponsors during the exploration phase. It is expected that once the GEF guarantee is in place, the sponsors will find it easier to secure commercial financing arrangements for the project. However, this is not the only project risk. Given the country's overall macro-economic uncertainty, the presently slow pace of sector reform, and the credit risks associated with the off-taker, it will likely be difficult for the sponsors to secure the participation of other investors and commercial banks to help finance the project, particularly as IFC's Power Department has declined to participate.

ANNEX 1. Project Design Summary

Hierarchy of Objectives	Key Performance Indicators	Monitoring and Evaluation	Critical Assumptions
Sector-related CAS Goal: Support the program of privatization and investment promotion in infrastructure development by the private sector(power).	1. Increased investment in private sector geothermal power development in Kenya.	1. Project Completion Report 2. Country Reports	(from Goal to Bank Mission) Progress in the Power sector's reform process
GEF Operational Program: Operational Program 6: Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs			

Project Development Objective: • To provide clean electricity generation in Kenya by facilitating private sector investment for the geothermal power development in the Olkaria III field.	Continuation of the exploration and development of the geothermal resource in Olkaria III. Establishment of enough geothermal capacity to support a power plant with a capacity of 43 to 53 MW. Financial closure for the proposed power plant in Olkaria III.	Project progress reports.	(from Project Development Objective to Sector-related CAS Goal; from Project Global Objective to GEF Operational Program Goal) Completion of the Project's Financing
Project Global Objective: • Avoid Greenhouse Gas Emissions of up to 2.8 million tons of CO_2 • Demonstrate the effect of a financial instrument that addresses the barrier of exploration and development risks for geothermal projects by sharing the incremental risks with private sector developers.			

Output from each Component: • Exploration and Development of the geothermal resource (drilling and resource evaluation activities) • Geothermal capacity at the Olkaria III geothermal is developed to support power plant of 43 to 53 MW • Additional financing for power plant construction and operation is raised from financial institutions and related companies	Drilling and resource evaluation program. Investment commitments by financial institutions for the construction of the power plant.	Project progress reports	(from Outputs to Project Development/Global Objective; Macroeconomic stability Progress in power sector reform KPLC remains creditworthy
Project Components / Subcomponents: • Exploration and Development of the Olkaria III geothermal field. The field development program is aiming to provide enough geothermal resource to support a power plant of 48 MW (+/- 10%). • Additional project financing is pursued with reduced exploration risk.	**Project Inputs:** (budget for each component) 1. Partial Credit Guarantee of up to $5 million to cover overrun costs of the exploration and development geothermal field at Olkaria III. 2. Supervision and Monitoring of the drilling and evaluation activities of the exploration and development program.	1. Disbursement reports 2. Project progress reports.	(from Project Components to Project Outputs) Sufficient geothermal resource

ANNEX 2
Incremental Costs Analysis

1. Broad Development Goal and the Baseline

The project's development objective is to provide clean electricity generation in Kenya by facilitating private sector investment for the geothermal power development in the Olkaria III field. To meet this objective a partial guarantee mechanism, provided by the Global Environment Facility (GEF) will be used to address the exploration and development risks and associated incremental costs of the geothermal resource in the Olkaria III field.

The power demand in Kenya has grown by four to six percent for the last twenty years and is expected to grow by five percent per year in the near future. Load growth declined to 2.7% in 1998 and was almost unchanged in 1999 and 2000. The main issue of late has been scarcity of financing. It was associated with inferior macro-economic performance during that period. The current electric power system in Kenya is made up of about 846 MW of installed capacity with effective generation of about 806 MW. Of this effective capacity, 584 MW are generated by hydroelectric facilities, 177 MW by thermal power and 45 MW by geothermal power generation.

Kenya Electricity Generating Company Ltd. (KenGen), the Government Agency responsible for power generation has identified geothermal as a key source of future power and plans to expand geothermal power generation by an additional 576 MW in the next 20 years while expecting only an additional 313 MW from hydro. The Olkaria geothermal area is thought to have reserves of 220 MW.

Over the past few years Kenya has been experiencing brown-outs and load shedding, and today faces an evening peak shortfall of over 130 MW. The system operates with practically no reserve margin and, with 80% of its capacity coming from hydropower, is particularly vulnerable to hydrological variations. The government of Kenya (GOK) invited the private sector into power generation and in 1997 signed up Kenya's first two stop-gap Independent Power Producers (IPPs)[13]. These were followed by Requests for Proposals (RFPs) for two more IPPs: Kipevu II and Olkaria III. Kipevu II is a diesel plant project partially funded by the International Finance Corporation (IFC), which became operational in September 2001. However, even with this added new capacity is not expected to satisfy electricity demand in the medium term. Persistent load shedding is affecting the productivity of the industrial and agricultural sectors, leading to reduction in economic growth. This project will help mitigate the effects of current power shortages and in the long term provide much needed back-up power to Kenya's largely hydroelectric generation system.

The only practical baseline option to provide equivalent electricity to the system network in a cost-efficient way is fossil fuel based generation. Indeed, diesel plants where shipped in the country at a relative high cost during the summer of 2000 to provide energy and back-up for the predominantly hydro-electric system which due to low rainfall could not meet the demand. Therefore, diesel power plant generation is used as a baseline for the incremental cost calculations of this project.

[13] IberAfrica, a 45MW diesel station was commissioned in June 1997, and Westmont Kenya, a 43 MW barge-mounted gas turbine, started operations in September 1997. Neither project was supported by the WBG.

2. Global Environment Objective

The project's objective falls within the GEF's Operational Program # 6 (OP6), "Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs". The objective of this program is to remove the barriers to the use of commercial or near commercial Renewable Energy Technologies (RET). The RET for this project is geothermal energy, which is a proven and commercially available technology. However, one of the main barriers for its promotion is associated with the exploration and development risk of the geothermal resource. This project is designed to remove this barrier by providing a financing mechanism to partially offset unpredicted excessive costs during the development of the geothermal field.

3. Alternative

The identification and measurement of the geothermal resource needed for power generation is the most important and highest risk aspect of a geothermal project. Drilling costs and rates of exploration success can vary widely. These variations greatly increase the perception of investor risk and further raise the cost of capital. High costs of capital affect significantly the overall project costs, because the initial capital outlays represent a significant part of the total project cost . The GEF funding will be used to address these issues and provide a basis for additional private financing, so that the project can be fully realized with its maximum electrical capacity (53MW) under the power purchase agreement.

Without GEF funding the project is unlikely to reach financial closure and be fully implemented. Thus, GEF support is necessary to render this project financially viable by addressing the barrier of perceived risk in geothermal exploration and the high initial capital cost. The provision of a guarantee that covers unexpected cost overruns lowers the cost of capital for the exploration activities, and effectively reduces the capital costs of the project, so that it will become bankable and attract further private or multilateral investment.

The development of the Olkaria III field and the subsequent power generation plant supported by the geothermal resource is the least-cost option for electricity expansion in Kenya as indicated by the Energy Sector Reform and Power Development project, which has been co-financed by the World Bank. Because of the lack of suitable alternative indigenous resources, the next best alternative to the Olkaria III project would be a diesel power plant of comparable power capacity. The incremental power capacity which this project is aiming to support is up to 17 MW.

4. Scope of the Analysis and Incremental Costs

The true incremental costs of the project will depend on the amount of funds from the GEF guarantee that may be called to cover overrun costs at the end of the drilling development phase, as well as the final results of the drilling and evaluation program. The extent of the actual geothermal resource that can be exploited will define the ultimate power plant capacity. Diesel power plant generation is used as the indicative source of avoided GHG emissions that will result from this project, as that is the marginal source of supply in use today.

Due to the nature of the financing instrument used, there is a range of incremental costs that can only be fully accounted for at the end of the project. These costs are presented below under three scenarios varying

from a worst case scenario where GEF's exposure is greatest and benefits in terms of additional geothermal resource availability are minimal, to a best case where the necessary geothermal resource for the full-scale proposed power plant is reached without incurring any exploration drilling related overrun costs. The three scenarios are:

- Worst Case Scenario: All funds available through the guarantee facility are called and power plant capacity based on the verified geothermal resource reaches 43MW (incremental costs of US$ 5 million).

- Middle Case Scenario: Half of the funds available through the guarantee facility are expended and power plant capacity based on the geothermal resource reaches 48 MW (incremental costs of US$ 2.5 million).

- Best Case Scenario: No GEF funds are used and power plant capacity based on the geothermal resource reaches 53 MW (incremental costs are limited).

5. Incremental Cost Matrix

		Baseline	**Alternative**
Best Case Scenario	**Global Environmental Benefit**	Diesel Power Plant 17 MW	Avoided emissions of up to 2.8 million tons of CO2 (770,000 tons of C)
	Domestic Benefit	Additional 17 MW of electric power installed	Additional 17 MW of electric power installed; Economic and Environmental Benefits (indigenous energy resource use, improved air quality, reduced noise, etc)
	Incremental Cost		US$25,000 (PDFA) - no part of guarantee is called

		Baseline	**Alternative**
Medium Case Scenario	**Global Environmental Benefit**	Diesel Power Plant 12 MW	Avoided emissions of up to 2 million tons of CO2 (543,000 tons of C)
	Domestic Benefit	Additional 12 MW of electric power installed	Additional 12 MW of electric power installed; Economic and Environmental Benefits (indigenous energy resource use, improved air quality, reduced noise, etc)
	Incremental Cost		US$2.5 million + US$25,000 (PDFA) - 50% of guarantee funds are called

		Baseline	**Alternative**
Worst Case Scenario	**Global Environmental Benefit**	Diesel Power Plant 7 MW	Avoided emissions of up to 1.16 million tons of CO2 (317,000 tons of C)
	Domestic Benefit	Additional 7 MW of electric power installed	Additional 7 MW of electric power installed; Economic and Environmental Benefits (indigenous energy resource use, improved air quality, reduced noise, etc)
	Incremental Cost		US$5 million + US$25,000 (PDFA) -100% of guarantee funds are called

ANNEX 3
Technical Issues of Geothermal Exploration

General Geothermal Exploration and Development Risk[14]

Reconnaissance surveys of geothermal areas are frequently undertaken by national research institutions as part of national indigenous resource investigations. Prioritization of resources for development at this reconnaissance stage significantly increases the certainty of success. A survey of geothermal fields in active volcanic regions in the Pacific rim indicates that at the reconnaissance stage the probability that an exploitable geothermal field exists in the area is 50% if even a single hot spring is present. If the spring is boiling, or fumaroles (steam vents) are present, then the probability increases to 70%.

However the more detailed surface exploration studies leading to the pre feasibility stage, may result in expenditure up to US$1 M, which are at risk (30% probability of failure) through not identifying a useable heat resource. The expenditure on exploration drilling (frequently 3 wells) is an order of magnitude greater (US$1.5 - 2 M per well) and this is similarly at risk if the wells do not result in useful production (commonly through low reservoir temperatures or low permeability). Fewer or less costly, shallower wells may be an alternative for smaller developments. Deep exploration drilling risk will increase with decreasing reservoir temperature below about 200°C.

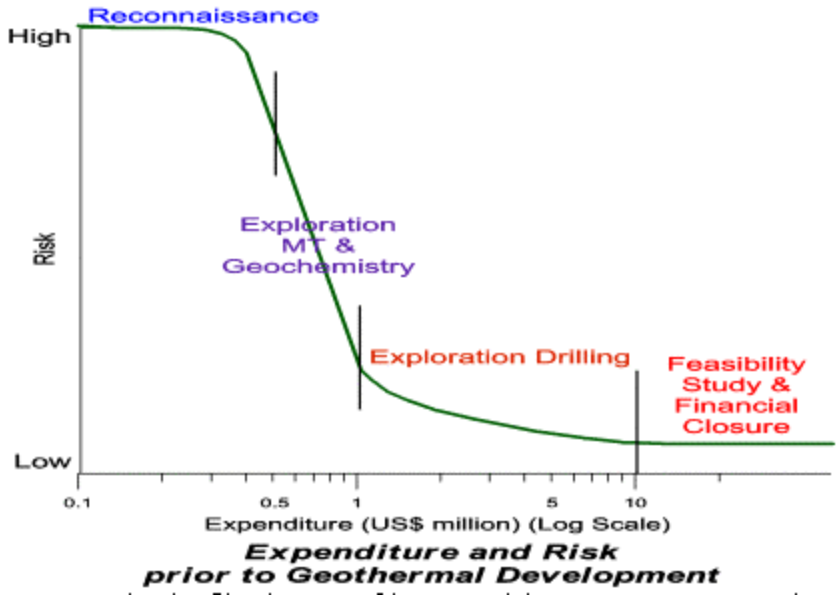

Figure 1. Risk – Expenditure relationship for geothermal resource development (source: World Bank, http://www.worldbank.org/html/fpd/energy/geothermal/index.htm)

[14] This section draws largely from the World Bank's briefing on geothermal energy, available at: http://www.worldbank.org/html/fpd/energy/geothermal/index.htm

Resource prioritization to target the most promising areas and good exploration surveys have proven to deliver high success rates for exploration drilling of high temperature geothermal systems. Such decision making is shown diagrammatically in Figure 1 shown earlier.

The size, and therefore exploitability, of a geothermal reservoir provides another significant risk in geothermal development. A complete understanding of the reservoir can only be obtained by withdrawing fluids from the reservoir over a sustained period, with subsequent computer modeling to assess the performance into the future. It can take several years of production from a field before the reservoir performance can be gauged with confidence since the reservoir rate of decline is frequently exponential in nature with initial high rates of decline.

Assessment of resource size and production capacity (resource assessment) is a critical part of any geothermal development. At the feasibility stage without long term production data, resource assessments rely on the extent of the reservoir, as defined by drilling and geophysical anomalies, and a knowledge of reservoir fluid temperatures. Such assessments can have large errors thus increasing the risk of plant size incompatibility.

Once long term reservoir performance has been established the production capacity will be estimated in terms of MW of energy over a particular time period (frequently taken as 30 years being approximately the life of steam turbines). Such estimates reduce the likelihood of excessive withdrawal of fluids from reservoirs which leads to reservoir pressure decline and reduced well (energy) outputs. Reservoir pressure decline may in turn allow low temperature groundwater to flood the system and cool the reservoir even further. The risk of pressure decline can be mitigated by conservatively sizing the rate of heat extraction (power station size) in comparison to the estimated resource capacity.

ANNEX 4
The World Bank and Geothermal Development in Kenya

Between 1979 and 1989, the Bank approved three loans and two credits, for a total of $117.2 million, to support the development of Kenya's geothermal power program and resources. The five projects, carried out between 1979 and 1996, helped the Kenya Power Company (KPC) install the first geothermal-based power plants in Africa.

The first three projects (approved in 1979, 1980, and 1983) drilled wells, set up transmission facilities, and built a power plant with 45 megawatts of capacity in the Olkaria Geothermal field of Kenya's Rift Valley. After the plant was successfully put into operation, the government decided to greatly expand its geothermal development program, with a view to making it one of the main pillars of its future power generation system. The Bank supported this objective with two credits (approved in 1984 and 1989) for exploration, appraisal, and drilling in other parts of Olkaria and at the extinct volcano of Eburru. The World Bank approved three loans and two credits, for a total of $117.2 million between 1979 and 1989, to support the development of Kenya’s geothermal power program and resources.

The first three projects were completed essentially on time and within cost estimates, though drilling performance was below par. All power generation units operated at or above capacity for a number of years and all are currently operating at their installed capacity without significant operating problems.

However, the fourth project was plagued by poor drilling performance, a problem that had emerged earlier but that the Bank began to address effectively only in 1987, when it organized bilateral aid for a technical assistance program designed to enable Kenyan staff to take over full operation of the program. By early 1988, drilling performance began to improve dramatically.

The fourth and fifth projects drilled 29 wells at Olkaria and demonstrated that the geothermal field there could support a total of 78 MW of steam, which will be used by a power plant currently financed under a Bank-funded follow-up project. The drilling program at Eburru began three years behind schedule and was much less successful, eventually demonstrating that geothermal potential was significantly below expectations.

ANNEX 5

STAP Reviewer Comments[15]

Charles J. Johnson. Ph.D.
Energy Consultant (Energy Economist & Geologist)
14 Martins Lane
Rockville, MD 20850
October 17, 2001

Re: ORMAT Kenya Olkaria III Geothermal Project

(1) Overall Assessment of the Proposal

This project is a good candidate for the use of GEF funds under the GEF Programming Framework (OP#6). The project proposes a "partial risk guarantee facility" to reduce the risks and costs of development drilling of the Olkaria III geothermal field. The financial exposure of GEF is modest at a maximum of $5 million and is only about 3 percent of total estimated project costs.

Among the GEF considerations for this project, three stand out as most important.

(i) The proposed IFC partial risk guarantee is an innovative way for GEF to reduce geothermal exploration risks (an important barrier) at relatively low financial risk to GEF.

(ii) The Olkaria III geothermal field contains considerable CO_2 that will be released to the atmosphere during commercial operations. However, geothermal experts in the GEF Secretariat and acting as consultants for the IFC agree that, because CO_2 is naturally released to the atmosphere from geothermal fields, Olkaria will not create any "new" CO_2 emissions. This is the assumption used in evaluating this proposal.[16]

(iii) The project has relatively low geothermal resource risks, and is a good candidate for the partial risk guarantee facility. There is a high probability of replication of this approach to other geothermal projects around the world, assuming GEF includes this approach in its assistance program. The global implications to greenhouse gas reductions are significant.

(2) Scientific and Technical Soundness of the Project

This project is within the Olkaria geothermal field with almost 40 years of exploration history, and 20 years of commercial production. The 45 MW Olkaria I plant has been in operation for about 20 years, and

[15] The review was undertaken at the request of IFC, and addressed the points specified in the 5 October 2001 Terms of Reference titled: "STAP Review – ORMAT Kenya Olkaria III Terms of Reference".

[16] This assumption is true in the long-term. It is recognized that the commercial development of a geothermal field will accelerate the rate of CO_2 releases. However, it has been confirmed to this reviewer that the implications to global warming are not significant. Therefore, from a global, long-term prospective, it appears reasonable to assume that no net "new" CO_2 emissions occur from geothermal developments.

the larger 64 MW Olkaria II plant is under construction. The characteristics of the three fields within the Olkaria geothermal field are relatively well known. At Olkaria III, accumulated well capacity equals about 75 percent of the requirements for the intended commercial development. The already operating 13.5 MW first phase facility has demonstrated the commercial viability of the Olkaria III field. The (i) high drilling success rate, (ii) above average productivity from the wells drilled at Olkaria III, and (iii) the planned drilling program, are likely to demonstrate sufficient reserves for the planned capacity of 48 MW (+/-10%).

There is significant uncertainty about the distribution of CO_2 within the Olkaria III geothermal field; and the private developer is in the process of mapping the presence of CO_2 in the various layers of the geothermal field. This is expected to allow the developer to reduce CO_2 emissions below original expectations. The developer is following a prudent approach in designing a plant to accommodate steam rich in CO_2, as failure to design a plant to accommodate high CO_2 contents can substantially reduce plant efficiencies. The private developer is using proven, conventional geothermal power generation technology.

The global experience of the developer and the highly experienced staff assigned to this project provide a high degree of confidence that the developers will be able to recognize and effectively address problems encountered in the commercial development of Olkaria III.

However, it is important that the drilling program be completed and the quality and size of the Olkaria III reserves be fully proven prior to proceeding with full development of the project. This is likely to be a requirement of the lenders to the project. The proposed partial risk guarantee facility will help ensure the timely achievement of this necessary goal.

(3) Global Environmental Benefits of the Project

The additional wells that may be drilled using GEF funds are projected to add 17 MW of capacity, and produce avoided CO_2 emissions (compared to a diesel plant) of 2.8 million tons under the assumption that no "new" CO_2 is being released from the geothermal field. This conforms to the views of geothermal specialists of both the GEF Secretariat and the IFC.[17]

The most important global benefit from the Olkaria III project may not be the modest amount of avoided GHGs from a single 48 MW geothermal project, but the potential GHG impacts of a global application of this innovative partial risk guarantee facility to reduce an important barrier to geothermal development (exploration risk).

(4) Project Fit with Respect to GEF Goals

This project fits GEF's Operational Program #6 (OP6), "Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs". Of the many barriers to commercial geothermal developments, the one that is normally not offset by contractual and insurance instruments is "exploration risk". Historically, GEF has avoided providing assistance to energy exploration – a prudent policy given the limitations in available GEF funds. However, GEF participation is recommended where the following criteria are met: (i) more than 50 percent of the necessary geothermal reserves have already been proven by drilling, (ii) the developer has a proven track record of successful geothermal developments, and (iii)

[17] This STAP consultant reviewed correspondence among the project sponsor, IFC and its independent experts and the GEF Secretariat's geothermal specialist, and also discussed the assumptions about CO_2 releases with IFC, whose independent geothermal consultants also confirm that no net "new" CO_2 will be released from Olkaria III.

GEF's financial exposure is limited to the provision of a "partial risk sharing guarantee facility", such as proposed by IFC. The Olkaria III project does not appear to have greater "technical risks" than other typical renewable energy projects that receive GEF assistance.

GEF has the opportunity to participate in an innovative insurance facility that reduces the barrier to geothermal field development (exploration risks), while also limiting GEF's exposure to financial risks. The IFC proposal insures half of potential cost over-runs in drilling wells up to a maximum of $5 million. Since the private developer shares in half the costs of overruns, an essential incentive remains for the private developer to avoid drilling cost over-runs, and to use as little GEF funds as possible. Based on exploration success rates to date, there is substantially less than a 50 percent probability that the private developer will need to use funds provided under the proposed GEF partial risk insurance facility.

(5) Replicability of the Risk-Sharing Approach

It is highly likely that the partial risk guarantee facility proposed for Olkaria III can be replicated in a number of other countries around the world, providing the facility continues to be made available through GEF or another suitable development aid financial institution. The reason for this assessment is that it reduces the most commonly mentioned barrier to geothermal developments. Without an examination of other geothermal projects needing such assistance, it is impossible to quantify the demand for this risk sharing facility on a worldwide basis. However, over the next 10 to 15 years, a minimum of several hundred megawatts of geothermal capacity could be developed using this facility, and perhaps several thousand megawatts, assuming the facility continues to be made available to the geothermal sector.

Risk sharing in energy exploration is very common, and most oil and gas exploration companies sell (farm-out) a percentage of the rights to their exploration projects to other companies, who will then share in the exploration risk. Exploration risk sharing is less common in geothermal projects which tend to be much smaller, have more limited potential for large wind-fall profits, and tend to produce lower returns on investments than oil and gas projects. When compared to other renewable energy projects, wind, solar and hydropower, typical geothermal projects may have higher risks due to the difficulties in establishing sufficient energy reserves.

Exploration and development of geothermal deposits continues to proceed at a slower rate than government plans in many developing countries. Clearly, a range of barriers keeps geothermal exploration and development activity below expectations. Lower prices for alternative petroleum and natural gas from the mid-1980s to the late-1990s shifted the economics in favor of fossil-fueled power plants in many countries. Recent higher petroleum prices appear to be increasing interest in geothermal developments. It is premature to assess the long-term impact of recent terrorist events in the United States; however it may result in renewed interest in developing more indigenous energy resources in some countries, and that would benefit geothermal power. Making available this new partial risk guarantee at this time, will further promote interest in geothermal exploration and development.

If the partial risk facility is adopted and used more widely as suggested in this report, only 25-50 percent of projects covered under the partial risk guarantee facility are likely to actually use GEF funds -- allowing GEF to leverage its limited funds. It is not known whether other aid-related financial institutions will be interested in adopting the proposed guarantee facility, but its successful use at Olkaria III will encourage other aid-related financial institutions to consider such a partial risk facility.

(6) Sustainability of the Project

The plans to develop a 48 MW (+/-10%) geothermal plant Olkaria III are realistic, and supported by the following factors:

(i) The approximately eight wells drilled to date confirm a liquid-dominated geothermal resource capable of supporting an "accumulated capacity" of approximately 43.5 MW. The additional four wells that are planned are likely to prove sufficient reserves to meet the requirements of the planned 48 MW plant. Maintaining the 48 MW for the life of the field the field, including injection wells, will require a timely program of additional wells and workover of existing wells.

(ii) The already operational 13.5 MW of geothermal power at Olkaria III demonstrates commercial viability of the field, and provides added operational data to assist in the final design and implementation of the full size plant.

(iii) The use of directional drilling has contributed to higher than historical productivity of wells, and reasonable assumptions have been made pertaining to productivity of future wells.

(iv) The nearby Olkaria I geothermal field has supplied a 45 MW unit plant for more than twenty years. Past production problems from this field appear to be primarily due to the failure of the operator (Kenya Electricity Generating Company) to undertake adequate facilities maintenance, particularly the failure to add sufficient new wells to offset the normal decline of production wells.

(v) The nearby 64 MW Olkaria II field has been proven and is already under commercial development, a further indication of the size and quality of the Olkaria geothermal area .

(vi) The need for the added electricity is demonstrated by the recent history of electricity shortages (brownouts and an estimated shortfall in generation capacity of about 200 MW), historical growth rates in electricity of 4-6 percent per year, and the small percentage of electrification in Kenya (less than 10 percent of the population have access to electricity).

(vii) A greater risk to project sustainability appears to be associated with uncertainty about the economic performance of the Kenyan economy, and the possibility that the utility power purchaser may not be able to meet the terms of the Power Purchase Agreement (PPA). Kenya is plagued by continued serious macro-economic uncertainty, and there could be periods of no electricity growth (such as at present). Second, there is a significant risk that the buyer may periodically face difficulties in purchasing the agreed amounts of electricity at agreed prices under the PPA. Commercial insurance instruments can partially offset this risk. Third, the combination of macro-economic problems, and the slow pace of planned private power sector reforms is troubling to private investors in power, and increases the difficulties in raising private capital for power projects in Kenya.

(7) Additional Comments

(i) The value of this project to the Kenyan economy may be greater than the direct benefits of the 48 MW of power. Kenya Electricity Generating Company is already sharing/exchanging technical information on their geothermal operations with the private developer. The entry of a private company with global geothermal experience enhances the chances of a more rapid transfer of technology and related management skills to Kenya's geothermal sector.

(ii) The local Masai living in the vicinity of the Olkaria geothermal field reportedly have a number of grievances that were not previously fully addressed by Kenya Electricity Generating Company. The stated interest of the private developer to cooperate in addressing the concerns of the Masai is a positive step to addressing local social concerns related to geothermal developments. Hopefully, the private developer's international experience in addressing geothermal related social problems will facilitate timely resolution of the Masai concerns.

(iv) Adequate plans appear to be underway to address local environmental impacts of Olkaria III. However, the main focus of this STAP review was on the overall technical and scientific soundness of the Olkaria III project and its GHG implications. The recommendation on page 21 of the "Proposal For Review" (Project Number 505590) is strongly supported by this consultant: "Careful monitoring of current and changing environmental and social conditions including air and water quality, flora, fauna and local socio-economics, along with appropriate community outreach, will minimize … risk."

(v) The *Initial Due Diligence Assessment Proposed Geothermal Power Project West Olkaria, Kenya* report (March 2001), prepared by independent geothermal experts for IFC, raises the issue of the high capital costs for the project when compared to U.S. geothermal projects. It is unlikely that comparisons of capital costs of U.S. geothermal projects will be the same as geothermal projects in a developing country setting where capital costs are normally higher. However, the expected capital costs for Olkaria III "appear" to be on the high side of the range of capital costs for geothermal projects. As pointed out in the report, the lack of "arms-length" arrangements within this turnkey project may result in costs above those that can be achieved through arms-length competitive bidding. Nevertheless, the price of electricity from the Olkaria III will still be below the prices possible from the next best alternative, diesel fuel plants.

(vi) The final question that needs to be answered is whether the proposed partial risk guarantee facility is critical to the further commercial development of the Olkaria III project. Based on the review of the two reports provided to this consultant by IFC and several E-mails, it is this consultant's opinion that the private developer will most likely proceed with development of Olkaria III even if the partial risk guarantee facility is not made available. However, without GEF participation, the developer may be forced to delay and/or scale-back the project size due to difficulties in raising sufficient capital.

GEF/IFC participation in Olkaria III contributes to the project's success in two important areas: (1) it directly reduces an important exploration risk (barrier); and (2) GEF/IFC participation increases "the comfort level" for lenders that this is a viable project. GEF participation increases the chances of the timely full-scale development of the Olkaria III project. Given existing serious power shortages in Kenya, and serious capital constraints in their power sector, delays in providing additional electricity generation capacity could have a significant negative impact on the already fragile Kenyan economy.

ANNEX 6
RESPONSES TO COMMENTS BY STAP REVIEWER

1.
Comment (page 34, section 2, paragraph 4):
" However, it is important that the drilling program be completed and the quality and size of the Olkaria III reserves be fully proven prior to proceeding with full development of the project. This is likely to be a requirement of the lenders to the project. The proposed partial risk guarantee facility will help ensure the timely achievement of this necessary goal."

Response
We agree. The STAP reviewer's comments in general reinforce the project brief's concept of using a partial risk guarantee facility to address geothermal exploration risks for the development of the Olkaria III geothermal field. The emphasis of the reviewer on the timely achievement of the necessary exploration is correct, and especially important for raising the private sector project finance commitments required to build a plant of the planned capacity.

2.
Comment (page 35, section 5, paragraph 1)
"… over the next 10 to 15 years, a minimum of several hundred megawatts of geothermal capacity could be developed using this facility, and perhaps several thousand megawatts, assuming the facility continues to be made available to the geothermal sector."
(page 35, section 5, last paragraph)
"… It is not known whether other aid-related financial institutions will be interested in adopting the proposed guarantee facility, but its successful use at Olkaria III will encourage other aid-related financial institutions to consider such a partial risk facility."

Response
We agree. This is an important observation on how this type of GEF financial support could significantly affect geothermal development on a larger scale. The implementation of this project will provide the necessary experience to the GEF and other multilateral agencies, to further support geothermal development through contingent financing. However, at this stage the most valuable contribution of this project will be to test this financing mechanism which would provide maximum leverage for GEF's funds; the replication potential seems to be very high, but unless some actual project experience is accumulated it is premature to raise expectations concerning the scope of possible replication. It is one of the purposes of this proposed project to provide such implementation experience, in order to assess the potential for its replication around the world, and possibly attract additional private funding for these types of activities.

3.
Comment (page 37, section 7, roman numeral (vi), paragraph 1)
"Based on the review of the two reports provided to this consultant by IFC and several E-mails, it is this consultant's opinion that the private developer will most likely proceed with development of Olkaria III even if the partial risk guarantee facility is not made available. However, without GEF participation, the developer may be forced to delay and/or scale-back the project size due to difficulties in raising sufficient capital."

Response

The commitment of the sponsoring company ORMAT to the project is extremely strong and evidenced by the sponsor's existing financial commitments and the current progress in the exploration program. However, it should be noted that the project's final sizing is not yet determined and we believe that the GEF support may be critical to ensure that the developer is able to complete a plant of 48 MW, or possibly greater. Absent the GEF's involvement, the sponsor has indicated that not only may the further exploration and development of the field be scaled down significantly, but also that the overall prospects of achieving financial closure of the greatest possible plant size may suffer, resulting in construction of a smaller plant. This would then represent both a global environmental opportunity cost as well as an opportunity cost to Kenya which would not be able to develop the full economic potential of an indigenous renewable energy resource.

ANNEX 7

Additional Technical Review – ORMAT Kenya Olkaria III
Mike Allen

The Project

The Olkaria III project is part of a significant geothermal program that has been underway in Kenya for almost 25 years. As such, by geothermal development standards, there is considerable data available on the resource, the likely outcome of an extended drilling program and the prognosis for a successful construction and operation of additional generation facilities.

The Olkaria III site lies some distance from Olkaria I and II and indications are that the underground conditions differ from those in the first two areas developed. These differences have however been quantified to a large extent by the initial exploration drilling in this sector of the field and the subsequent production drilling that now supplies the existing 13.5MW early generation facility.

Under its concession ORMAT now plans to expand the power plant to 53MW in capacity. While the overall Olkaria developments have been expensive in comparison to other such geothermal installations (outside Kenya), this is largely due to the low productivity of individual wells, hence requiring a higher cost for the development of the steam field, both in terms of numbers of wells and steam transmission. This is typical of wells drilled throughout the Rift Valley (in Kenya and in Ethiopia). The Olkaria project is designed on a sound scientific and technical basis that has been proven over the many years of operation of Olkaria I and the subsequent drilling and development programs in Olkaria II and III.

The Proposed GEF Funding

The concept of providing a partial guarantee facility for the exploration phase of geothermal developments is a novel approach that should be supported by the GEF. There is no question that it is the exploration phase of a geothermal project that is most difficult to finance. As noted in the project concept document, much of the exploration work on geothermal resources that has been done to date has been undertaken with bilateral and/or government support. There has been limited geothermal exploration in the developing nations that has not been supported in this way. Where extensive exploration has been undertaken, for example by Unocal in Indonesia, this has typically been financed directly by the company. While some private sector financing has been provided for major geothermal developments (for example Credit Suisse, Bank of America and Deutsche Morgan Grenfell in Indonesia) their acceptance of "resource risk" has only been in situations where a moderate level of exploration has already been completed.

To this extent the proposal has the potential to provide ongoing environmental benefits both within Kenya and, if replicated, on an international basis. It should be noted that in any exploration phase it is unlikely that debt financing can be obtained for a significant portion of the work. This phase will typically depend on equity contributions from the sponsor and their partners. The proposed GEF-funded partial guarantee arrangement will help encourage sponsors to consider geothermal developments but would not be expected to provide sufficient resources for an entire exploration program. If this initial guarantee facility is successful, a future consideration could be that it provides a guarantee for a third party loan for partial funding of the exploration phase. This may introduce a higher exposure for the GEF guarantee, but would help address the typical shortage of funding for the exploration phase in a geothermal development.

An issue that may be raised with the present proposal is what level of risk really exists at this stage of development of Olkaria III, given the early generation activities. The experience to date at Olkaria would suggest that the risks are low – this is positive in terms of the exposure that the GEF would have with its funds but, if the guarantee is not drawn down (and as a result the GEF is reluctant to consider further such arrangements), it may result in questioning whether the proposal was a significant test of the (industry wide) need for such an agreement.

The project document makes several references to the difficulty that the project may face in reaching financial closure. The issues here are not directly geothermal resource related or technical but are more those associated with commercial project finance and private power development in Kenya. This risk has been acknowledged in the project document and is reported to be being addressed in detail by ORMAT and potential project finance entities.

The statement is made that the GEF facility will be an encouragement to later stage investors. The GEF support will help provide credibility to the project but the access to exploration stage funding alone will not necessarily influence the final commitment for finance – this will be dependent on the results of the next stage of drilling and resource testing. However, the security that cost overruns can be covered will help, as the cushion of the guarantee will protect ORMAT's equity within the project and in turn enhance the ability for the project to reach financial closure.

The project document does not define the exact structure for the guarantee facility. It is indicated that the funds will be provided for "unforeseen cost overruns" and the statement is made that the funds "will be used to address the incremental costs of the remaining phase of the exploration and development plan…". Neither note defines on what basis the GEF facility will be released. However, it is understood that the facility would be drawn down if a set number of wells do not yield the anticipated additional steam output, with the funds used to drill additional wells. The situation may also arise where the cost of the planned number of wells is above budget due to drilling difficulties/delays in completion (drilling costs are very time sensitive due to the need to pay for equipment on a time basis). In either case it will be important that the definition of the event(s) that trigger a release of the guarantee be clearly defined to avoid any dispute between the parties.

As the partial guarantee arrangement is now proposed, funds would be released on a grant basis to the project. There is no provision for a return on the funds, whatever the outcome of the project (although in the event that the funds are not called they would be returned by IFC to the GEF). If such a guarantee approach is to be used on a broader basis it would seem critical that it be structured so that benefits from one project can be used to offset losses on another. Without this, such guarantee approaches will remain dependent on GEF's grant support indefinitely. A risk-sharing financing approach that can show some return, and hence the possibility of longer term sustainability, will be more valuable to the geothermal industry than "one off" support for a particular project and in due course could draw in other financial support to expand the impact of the concept. The GEF Secretariat should be encouraged to consider such a programmatic approach in future.

Environmental Benefits

The use of geothermal energy as a source of power generation has a number of environmental benefits. In particular it provides for substantial carbon dioxide emission reductions in comparison to fossil fuel based generation of a similar capacity. In this way this proposal will help remove one of the barriers to

geothermal utilization and encourage the development of the resource at Olkaria, and possibly in other fields within Kenya and elsewhere where such potential exists.

The report suggests that Kenya has a potential of some 576MW that could be installed by 2020. This appears to be a somewhat optimistic estimate given the time required so far to bring the Olkaria field into operation with just 45MW. Experience in the wells drilled within the Rift Valley system (Olkaria and Eburru in Kenya and Aluto Langano in Ethiopia) suggest that productivity (3 to 5MW per well) is typically far lower than could be expected in geothermal fields elsewhere, hence the drilling program needed to prove extended resources is significant. This may be the limiting factor in how quickly extensive new geothermal production can be brought on line.

Social Benefits

The development and operation of an additional geothermal plant at Olkaria will provide further local employment in an area that is predominantly rural. There is a growing tourist potential that is linked with the Hell's Gate National Park in which the Olkaria developments are located. To date the development of the resource has been undertaken with minimal disturbance to the local environment with the power installations actually providing an additional attraction, given the unique nature of the project.

Summary

The concept of a GEF-funded partial guarantee arrangement is something that can help support the higher risk exploration phase for the development of geothermal resources and is therefore deserving of support. The focus of this project's partial guarantee arrangement is on exploratory well drilling-related cost over runs. This arrangement in turn may help to protect the sponsor's equity.

If the value of this form of guarantee is demonstrated through this project, a future option could be to provide (separately or in addition) a guarantee facility that would underwrite the provision of a third party loan for the exploration phase of a geothermal resource's development. The limiting factor for many geothermal prospects is that early phase development can only be funded through a sponsor's equity contributions, which tends to exclude many smaller developers because of their limited capital resources.

At Olkaria III there could be some question as to whether the proposal provides a significant test of the real need for this contingent finance arrangement given the stage of the project's development (with a 13.5MW early production facility already in operation) and the experience over nearly 25 years in the adjacent Olkaria I installation.

The environmental and social benefits of such an additional geothermal installation at Olkaria warrant the support of the GEF, given the climate change benefits of geothermal generation and Kenya's limited energy resources.

The economic and financial conditions in Kenya for private power projects suggest that securing adequate funding for the complete project may be a significant issue. This risk will need to be addressed by the private sponsors regardless of the availability of the GEF partial guarantee arrangement .

ANNEX 8
RESPONSES TO ADDITIONAL TECHNICAL REVIEW COMMENTS

1.
Comment (page 40, last paragraph) :
"… If this initial guarantee facility is successful, a future consideration could be that it provides a guarantee for a third party loan for partial funding of the exploration phase. This may introduce a higher exposure for the GEF guarantee, but would help address the typical shortage of funding for the exploration phase in a geothermal development. "

Response
This is a sound suggestion for a possible future evolution of this financing mechanism to assist geothermal development. IFC prefers the partial risk guarantee approach as it is only callable under specific circumstances as the most appropriate approach for this specific project. One of the purposes of the proposed project is to gain the actual implementation experience with such a financial risk-sharing mechanism. Other approaches are not excluded for future projects.

2.
Comment (page 41, paragraph 1)
"An issue that may be raised with the present proposal is what level of risk really exists at the stage of development of Olkaria III, given the early generation activities. The experience to date at Olkaria would suggest that the risks are low – this is positive in terms of the exposure that the GEF would have with its funds but, if the guarantee is not drawn down (and as a result the GEF is reluctant to consider further such arrangements), it may result in questioning whether the proposal was a significant test of the (industry wide) need for such an agreement. "

Response
The comment reflects the uncertain nature of the exploration phase of any geothermal development. It is suggested that should the GEF guarantee not be used following completion of exploration, it may seem that the overall intervention was unnecessary. Nevertheless, it is important to distinguish the point in time when the guarantee funds are made available. While *after* program conclusion such evaluations can be made, this partial risk guarantee arrangement is only appropriate *before* completion of the exploration program, when there can be no definite certainty about the geothermal resource's productivity and extent. Availability of a GEF partial guarantee is still meaningful to the private sponsor both because the project developer can proceed more confidently to finance an incremental expansion of the project, and because the GEF funds would provide some comfort that may serve to attract additional investors to the project.

3.
Comment (page 41, paragraph 4)
"… it is understood that the facility would be drawn down if a set number of wells do not yield the anticipated additional steam output, with the funds used to drill additional wells. The situation may also arise where the cost of the planned number of wells is above budget due to drilling difficulties/delays in completion (drilling costs are very time sensitive due to the need to pay for equipment on a time basis). In either case it will be important that the definition of the event(s) that trigger a release of the guarantee be clearly defined to avoid any dispute between the parties."

Response
We agree. This process will be conducted with input from appropriate geothermal experts and constant monitoring of the project's operations, following the project's endorsement by the GEF Council.

4.
Comment (page 41, paragraph 5)
"As the partial guarantee arrangement is now proposed, funds would be released on a grant basis to the project. There is no provision for a return on the funds, whatever the outcome of the project (although in the event that the funds are not called they would be returned by IFC to the GEF). If such a guarantee approach is to be used on a broader basis it would seem critical that it be structured so that benefits from one project can be used to offset losses on another."

Response
It should be emphasized that costs to the GEF would be incurred only in the event of cost overruns and only for 50% of such costs. The incremental cost analysis indicates the range of possible outcomes through different scenarios. Unused funds of the guarantee facility will be returned to the GEF and made available for other projects following the project's conclusion. It is also correctly suggested that an enlargement of such a geothermal financing activity could be more effective by adopting a portfolio approach aiming to offset project risks by diversifying the allocation of funds in different projects and geographic regions. That however, is a matter to be addressed once experience from this project – and possibly others – is available, and after further consultation with the GEF Secretariat on an appropriate programmatic framework, along with input from the geothermal industry and other financial institutions.

ANNEX 9
Endorsement Letters

From the Deck of

Hon. Mathias B. Keah, E.B.S.,M.P.

Assistant Minister, Ministry of Transport & Communications
Member of Parliament. for Kaloleni Constituency, Kilifi District

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Date:……..

Ref. No..MBK/GEF/2001/jkk…… October 11, 2001
and date

Mr. Dana Younger
Coordinator
International Finance Corporation/GEF
2121 Pennsylvania Ave NW
Washington DC 20433 USA

Fax No. 1-202-974-4349

Dear **Mr. Younger**

ORMAT INTERNATIONAL, OLKARIA III
GEOTHERMAL PR0JECT – GEF ASSISTANCE

Please refer to our telephone conversation today (Younger/Hon Keah) on the Olkaria III Geothermal Project, In my capacity as the GEF Political Focal Point, I confirm my endorsement for the GEF funding of this project in respect of ORMAT International for the exploration works.

Yours sincerely,

HON MATHIAS B KEAH EBS MP
ASSISTANT MINISTER - TRANSPORT & COMMUNICATIONS
GEF POLITICAL FOCAL POINT/GEF MEMBER OF COUNCIL

Copy to: **Mr B K'Omudho – Director, NES**

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Telephone: Kaloleni 0125-33201

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Ref. No. ……
NES/CONF/07/10/Vol. VIII

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22nd October 2001

Mr. Dana Younger
Co-Coordinator
International Finance Corporation/GEF
2121 Pennsylvania Ave, N.W.
Washington D.C. 20444 USA
Fax: 1-202-974-4349

Re: Endorsement Letter for Ormat International, Olkaria III Geothermal

Further to our e-mail message of 9th August 2,001 and to Hon. Keah's letter of October 11th 2001 I wish to confirm that the GEF Operational Focal Point supports the project and hence endorses it for consideration for GEF funding.

Louis C. Boorstin

B. O. K'Omudho
DIRECTOR-NATIONAL ENVIRONMENT SECRETARIAT
GEF OPERATION FOCAL POINT
FOR PERMANENT SECRETARY

c.c.
Hon. Mathias B. Keah EBS, MP
Assistant Minister - Transport & Communications
GEF Political Focal Point/GEF Member Council
P.O. Box 52692
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Manager, Environmental *Projects Unit*
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The Country Representative World Bank
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NAIROBI (Attn Dr. R. Kaguamba)

- Monitoring & Evaluation: please see part C, section 3 *(Institutional and Implementation Arrangements)* on page 11.
- Financing Plan: please see part C, section 1 *(Project Components)* on page 10 and section 2 of part E *(Costs Associated with Ormat's Exploration and Development Program)* on pages 16-18. Please see also sections 4 and 5 of Annex 2 *(Scope of the Analysis* and *Incremental Costs and Incremental Cost Matrix)* on pages 27-29.
- Cost-effectiveness: please see part D section 2 *(Project Alternatives considered and Reasons for Rejection)* on page 13 for the least-cost effectiveness of the project and Annex 2 sections 4 and 5 *(Scope of the Analysis and Incremental Costs* and *Incremental Cost Matrix)* on pages 27-29.
- Core Commitments and Linkages: please see section 1 of part B (*Sector-related CAS Goal Supported by the Project*) on pages 6-7 and part D, section 6 *(Value Added of Bank and GEF Support in this Project)* on pages 15-16.
- Consultation, Coordination and Collaboration between IAs: please see section 3 of part D (*Major Related Projects financed by the Bank and/or other Development Agencies*) on pages 13-14.
- Response to Reviews: The GEF Secretariat has expressed its prior support for this proposal at the Concept Clearance and PDF Block A grant approval stages. The responses to a STAP reviewer and an independent geothermal expert reviewer are found in Annexes 6 and 8.

Please let me know if you require any additional information to complete your review prior to inclusion in the work program. Many thanks.

Distribution:

Messrs.: F. Pinto, UNDP
A. Djoghlaf, UNEP (Nairobi)
K. Elliott, UNEP (Washington, DC)
M. Gadgil, STAP
M. Griffith, STAP (Nairobi)
C. Parker/M. Perdomo, FCCC Secretariat

cc: Messrs./Mmes. G. Murray, L. Boorstin, D. Younger, D. Papathanasiou, G. Schramm, L. Babra, A. Mathur, M. Sharma, T. Kennedy, C. Crepin, R. Khanna, D. Aryal, (ENV); ENVGC ISC, Relevant Regional Files; A. Miller, E. Martinot, A. Merla, (GEFSEC).

MShishak
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