

# AFRICAN DEVELOPMENT BANK GROUP



**COUNTRY : DJIBOUTI**

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## **PROJECT APPRAISAL REPORT**

*June 2013*

**PROJECT : GEOTHERMAL EXPLORATION PROJECT  
IN THE LAKE ASSAL REGION**

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*Translated Document*

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## EXCHANGE RATE

UA 1	USD 1.5
UA 1	EUR 1.2

## FISCAL YEAR

1 January – 31 December

## WEIGHTS, UNITS AND MEASURES

t	tonne = 1 000 kg	GWh	GigaWatt-hour = 1 000 000 000 Wh
kW	kiloWatt = 1 000 Watt	kV	kiloVolt = 1 000 Volts
MW	MegaWatt = 1 000 000 W	kVA	KiloVolt Ampere = 1 000 VA
GW	GigaWatt = 1 000 000 000 W	MVA	MegaVolt Ampere = 1,000,000 VA
kWh	GigaWatt-hour = 1,000 Wh	TOE	Tone of oil equivalent
MWh	MegaWatt-hour = 1,000,000 Wh		

## ACRONYMS AND ABBREVIATIONS

AfDB	African Development Bank
ADF	African Development Fund
AFD	French Development Agency
AC	Advance Contracting
BD	Bidding documents
CDM	Clean Development Mechanism
CSP	Country Strategy Paper
EdD	Djibouti Electricity Corporation ( <i>Électricité de Djibouti</i> )
ESIA	Environmental and Social Impact Assessment
ESMAP	Energy Sector Management Assistance Program
ESMP	Environmental and Social Management Plan
GDP	Gross Domestic Product
GEF	Global Environment Facility
HV	High Voltage
ICB	International Competitive Bidding
IDA	International Development Association
INDS	National Social Development Initiative
IPP	Independent Power Producer
LV	Low Voltage

MDBs	Multilateral Development Banks
MEERN	Ministry of Energy and Water, in charge of Natural Resources
MEFIP	Ministry of Economy and Finance, in charge of Industry and Planning
MTR	Mid-Term Review
MV	Medium Voltage
OFID	OPEC Fund for International Development
PAR	Project Appraisal Report
PCR	Project Completion Report
PIU	Project Implementation Unit
PPP	Public-Private Partnership
RMC	Regional Member Countries
SEFA	Sustainable Energy Fund for Africa
SME	Small and Medium-sized Enterprises
UA	Unit of Account
UNFCCC	United Nations Framework Convention on Climate Change
USD	US Dollar
WB	World Bank

## INFORMATION SHEET

<b>Customer Information</b>	
Donee	Republic of Djibouti
Executing Agency	<i>Électricité de Djibouti</i>

<b>FINANCING PLAN</b>		
<b>Sources</b>	<b>Amount (in UA million)</b>	<b>Instrument</b>
African Development Fund (ADF)	<b>3.531</b>	Grant
African Development Fund (ADF)	<b>0.269</b>	Loan
Sustainable Energy Fund for Africa (SEFA)	<b>1.2</b>	Grant
World Bank (IDA)	<b>4</b>	Loan
Global Environment Facility (GEF)	<b>4</b>	Grant
OPEC Fund for International Development (OFID)	<b>4.7</b>	Loan
French Development Fund (AFD)	<b>2.2</b>	Grant
ESMAP	<b>0.7</b>	Grant
Republic of Djibouti	<b>0.6</b>	Own resources
<b>Total financing</b>	<b>21.2</b>	

<b>FINANCIAL DATA ON ADF GRANT AND LOAN AND SEFA GRANT</b>			
<b>FINANCING</b>	<b>ADF GRANT</b>	<b>ADF LOAN</b>	<b>SEFA GRANT</b>
Currency	UC	N/A	US\$
Type of interest rate	N/A	N/A	N/A
Service charge	N/A	0.75% yearly on the disbursed and outstanding portion of the loan.	N/A
Commitment fee	N/A	0.50% yearly on the undisbursed portion of the loan starting 120 days after the signing of the Loan Agreement.	N/A
Maturity	N/A	50 years	N/A
Grace period	N/A	10 years	N/A

<b>KEY FINANCIAL AND ECONOMIC RESULTS</b>		
	IRR	NPV (in USD million)
Internal rate of return (IRR) and net present value (NPV) – financial analysis	12.8%	37.4
Internal rate of return (IRR) and net present value (NPV) – economic analysis	29%	174.9

<b>DURATION AND MILESTONES</b>	
Concept Note approval	09 May 2012
Project approval	June 2013
Effectiveness	September 2013
Last disbursement	November 2016
Completion	May 2016
Final Reimbursement	N/A

## PROJECT EXECUTIVE SUMMARY

**General Project Overview:** The project is part of a geothermal energy development programme aimed at improving the quality of life for Djibouti's population by increasing access to electricity through an expansion of the national energy production capacity. Structured as a public-private partnership (PPP), the programme will be executed in 3 phases: (i) Phase 1 comprises the exploration of the Lake Assal geothermal vapour field and confirmation of the characteristics of the field's geothermal resources; (ii) Phase 2 involves the development of the geothermal field and construction of a geothermal power station with an installed capacity of 20 MW; and (iii) Phase 3 will involve expanding the capacity of the geothermal power station to 50 MW. Phase 1, which is the subject of this project and will be financed with concessional resources, is aimed at eliminating exploration risks in order to pave the way for private sector participation under Phases 2 and 3.

**Needs Assessment:** Access to electricity remains relatively limited in Djibouti, with only about half of the population (concentrated in the capital) serviced. The production cost for *Électricité de Djibouti* (EdD), the national electricity corporation, could go as high as USD 0.32/kWh, with marginal quality and power supply reliability. Since the main national electricity production sources depend on petroleum products, Djibouti is relatively dependent on diesel fuel and fuel oil imports to meet its energy needs. This generates exorbitant operating costs for EdD. However, since 2011, a 230 kV interconnection line between Ethiopia and Djibouti financed by the Bank has enabled Djibouti to import low-cost hydro-electric power from Ethiopia. Yet, although the power from the interconnection now accounts for nearly 46% of Djibouti's guaranteed electricity production, the power purchase contract between the two countries is not binding. Hence, Djibouti receives low cost energy from Ethiopia only when the latter has surplus energy. Under these circumstances, the Energy Action Plan, prepared in 2009, identified geothermal energy development as the best scenario for diversifying the country's electricity supply, therefore guaranteeing reliable supply at low cost, with a positive impact on the environment.

**Value-added of the Bank:** ADF and Sustainable Energy for Africa (SEFA) resources will be used to raise financing from other donors (World Bank, AFD, OPEC etc.), the Global Environment Facility (GEF) and the private sector, as well as finalise financial arrangements for the project. These resources will serve as a catalyst to rally independent geothermal electricity producers downstream, making it possible to develop the country's abundant geothermal reserves.

**Knowledge Management:** The project's catalytic reproduction effect will originate from the capacity-building and knowledge development that it will encourage in Djibouti and the region. The lessons learnt from geothermal resource development, especially the development of independent geothermal electricity producers, will be disseminated to other Rift Valley countries in sub-Saharan Africa such as Ethiopia, Uganda, Tanzania and Rwanda, which have considerable geothermal resource development potential.

## RESULTS-BASED LOGICAL FRAMEWORK

Country and Project Title: Geothermal Exploration Project in the Lake Assal Region (Djibouti) Project Goal: Increase the green energy production capacity of the Republic of Djibouti to improve access to electricity for the people of Djibouti							
RESULTS CHAIN		PERFORMANCE INDICATORS			MEANS OF VERIFICATION	RISKS/ MITIGATION MEASURES	
		INDICATOR (including ISCs)	BASELINE SITUATION (2012)	Target			
EFFECTS	IMPACT	Increased access to electricity for the people of Djibouti	Electricity access rate (%)	50% in 2012	88% in 2018	- Électricité de Djibouti's annual reports	
	EFFECTS	Reduction of oil imports	Quantity of oil imported (in barrels)	Not applicable	Reduction of 10 million barrels of oil imports per year from 2018	- National statistics - Project post-evaluation report	- Political and macroeconomic risks will be mitigated through government support for the project and the involvement of the international community in Djibouti.
		Reduction of greenhouse gas emissions	Quantity of CO <sub>2</sub> emitted (in tonnes)	Not applicable	Reduction of approximately 11,000,000 tonnes of CO <sub>2</sub> emissions per year from 2018	- Documents of public service companies	
Increase of green energy production capacity	Total guaranteed electricity production in MW (% of green energy)	75 MW (46% of green energy with 35 MW imported from Ethiopia)	220 MW (82% of green energy with 50 MW of geothermal energy, 60 MW of wind energy and 70 MW imported from Ethiopia) in 2018				
OUTCOMES	<b>Component A:</b> Drilling activities	Number of wells drilled	6 wells (unused)	By the end of 2015: 10 wells (of which 3 are productive)	- Audit reports and quarterly progress reports of the project implementation unit - Bank supervision mission reports	- Exploration risk mitigated by: (i) Djibouti's past experience in the area of geothermal exploration; (ii) geological data and other results of past exploration campaigns; (iii) Site prospecting studies were conducted by Iceland GeoSurvey, which is an entity with solid experience in this area; (iv) recourse to modern drilling technologies that make it possible to treat high salinity geothermal resources. - The market risk is mitigated by high demand for electricity and an energy access rate currently limited to 50% - The institutional risk is mitigated by the pledged support of PPIAF and donor	
	<b>Component B:</b> Technical assistance	- Design and management of the drilling project - Experimental design for wells - Certification of test and study results	Not applicable	- Periodic technical reports - Experimental design finalised - Results certified	- The Bank's disbursement reports and financial reports - Project completion report.		

	<b>Component C:</b> Project implementation	Audit reports and quarterly progress reports	Not applicable	Timely reception and acceptance of audit reports and quarterly progress reports		involvement in the next phase of the project, which will exclusively entail the establishment of the regulatory and institutional framework.
	<b>Component D:</b> Environmental and social management	Execution of the environmental and Social Management Plan	Not applicable	By end 2015: The environmental and social management plan is executed		<ul style="list-style-type: none"> <li>- The implementation and operational risks will be mitigated by technical assistance to the project implementation unit for which provision is made under the project</li> <li>- In case there is no private investor to build the power station, the Government of Djibouti is ready to create a specialized company (SPV) to develop the power station</li> <li>- The energy will be evacuated through a power transmission line that will be financed by the European Union</li> </ul>
<b>KEY ACTIVITIES</b>	<b>COMPONENTS</b>				<b>RESOURCES</b>	
	<ul style="list-style-type: none"> <li>A. Drilling activities;</li> <li>B. Technical assistance;</li> <li>C. Project implementation;</li> <li>D. Environmental and social management</li> </ul>				Total cost: UA 21.2 million	

**PROVISIONAL PROJECT IMPLEMENTATION SCHEDULE**

Activities		Duration															
No.	Description	Year + 1				Year + 2				Year + 3							
		1st Qtr	2 <sup>nd</sup> Qtr	3 <sup>rd</sup> Qtr	4 <sup>th</sup> Qtr	1st Qtr	2 <sup>nd</sup> Qtr	3 <sup>rd</sup> Qtr	4 <sup>th</sup> Qtr	1st Qtr	2 <sup>nd</sup> Qtr	3 <sup>rd</sup> Qtr	4 <sup>th</sup> Qtr				
<b>1.</b>	<b>Preparatory Activities</b>																
1.1	Establishment of the PIU and selection of the project manager																
1.2	Procurement of geothermal expertise																
<b>2.</b>	<b>Drilling Programme</b>																
2.1	Development of the drilling programme																
<b>3.</b>	<b>Drilling Activities</b>																
3.1	Implementation of the drilling programme																
<b>4.</b>	<b>Feasibility Study</b>																
4.1	Conduct of the feasibility study																

# **REPORT AND RECOMMENDATIONS FROM MANAGEMENT CONCERNING A PROPOSAL TO AWARD ADF GRANT AND LOAN AS WELL AS A SEFA GRANT TO THE REPUBLIC OF DJIBOUTI**

Management hereby submits this report and recommendations concerning a proposal to award: (i) an ADF grant and loan of UA 3.531 million and UA 0.269 million respectively; and (ii) a Sustainable Energy for Africa (SEFA) grant of USD 1.8 million, to the Republic of Djibouti to finance the geothermal exploration project in the Lake Assal region.

## **1 STRATEGIC THRUSTS AND RATIONALE**

### **1.1 Project Linkages with Country Strategy and Objectives**

1.1.1 The Bank Group's assistance strategy for Djibouti over the 2011-2015 period focuses on a single pillar, namely consolidation of socio-economic infrastructure. This pillar targets the following objectives: (i) improvement of living conditions; (ii) improvement of economic diversification and job creation; and (iii) improvement of the effectiveness of poverty control measures by building the capacity of the planning and monitoring/evaluation system.

1.1.2 The CSP pillar is consistent with Djibouti's development strategy (the National Social Development Initiative - INDS), by selectively targeting: (i) growth, competitiveness and employment through the promotion of socio-economic infrastructure; and (ii) the modernisation of public management, statistical capacity-building and monitoring/evaluation.

1.1.3 The INDS was initiated in 2007 and is regularly updated. However, it has maintained its four initial strategic pillars which focus on: (i) growth, competitiveness and employment; (ii) access to basic social services; (iii) reducing poverty and vulnerabilities; and (iv) public governance. The latest available version of the INDS is for the 2011-2015 period. This project is consistent with the priorities set out in the INDS and the CSP, and is designed to boost growth, productivity and employment by targeting the energy and infrastructure sectors, and promoting an employment-generating private sector.

### **1.2 Rationale for the Bank's Involvement**

1.2.1 Access to electricity remains relatively limited in Djibouti, with only about half of the population (concentrated in the capital) serviced. The production costs for *Électricité de Djibouti* (EdD), the national electricity corporation, could be as high as USD 0.32/kWh with marginal quality and power supply reliability. This cost is very high compared to USD 0.05/kWh in Ethiopia and USD 0.1/kWh in Kenya

1.2.2 This cost difference stems essentially from the fact that Djibouti's main electricity production sources depend on petroleum products. Hence, Djibouti is relatively dependent on diesel fuel and fuel oil imports to meet its energy needs. This generates exorbitant operating costs for EdD. Although EdD has a total installed capacity of approximately 119 MW, its guaranteed production capacity is only approximately 40 MW (mainly due to the obsolescence of its power generation equipment). An average capacity of 35 MW from the Ethiopia-Djibouti power interconnection supplements the 40 MW available. Meanwhile, demand peaks at 63 MW in summer.

1.2.3 From 2011, a new 230 kV interconnection line between Ethiopia and Djibouti, financed by the Bank went operational, enabling Djibouti to import low-cost hydro-electric power from Ethiopia. This new interconnection helps to reduce Djibouti's dependence on

imported fuel products, thus bringing down EdD's electricity supply costs. Yet, although the power from the interconnection now accounts for nearly 46% of Djibouti's guaranteed electricity production, the power purchase contract between the two countries is not binding. As a result, Djibouti receives low-cost energy from Ethiopia only when the latter has surplus energy.

1.2.4 Hence, EdD must diversify its production sources and secure a steady, reliable and inexpensive source. The Energy Action Plan prepared in 2009<sup>1</sup> identified geothermal energy development as the best scenario for diversifying the country's electricity supply, therefore guaranteeing reliable supply at low cost, with a positive impact on the environment. Moreover, in addition to diversifying the country's electricity supply, this indigenous energy will help to ensure the country's energy independence.

1.2.5 In light of the foregoing, the Government of Djibouti (GoD) requested the Bank to partly fund this geothermal exploration project through an ADF grant and loan of UA 3.531 million and UA 0.269 million respectively and a SEFA grant of USD 1.5 million.

### **1.3 Coordination of Various Donors**

1.3.1 Development assistance to Djibouti represents approximately 5% of GDP. However, this assistance is characterized by a lack of coordination and harmonization of the operations and programmes of various development partners. The activities of these partners are indeed hampered by the absence of coordination mechanisms at the national level as well as the low representation of such partners in socio-economic activities initiated in the country.

1.3.2 Donor operations could benefit from greater collaboration to maximize synergies and economies of scale, and thus reduce transaction costs. Within the framework of the proposed project, donors worked closely together to package the financing. Provision has been made for the Bank to finance specific components in accordance with its own rules and procedures. Furthermore, there is provision for the World Bank (WB) and other donors scheduled to jointly finance certain components, to sign a memorandum of understanding that will guide interactions among them and with the Djibouti government. It is also planned that an operational manual for project implementation will be prepared and validated by all donors to ensure coordinated project execution. Lastly, at least one donors' joint supervision mission will be conducted each year.

## **2 PROJECT DESCRIPTION**

2.0.1 The project is part of a programme aimed at improving the quality of life for Djibouti's population by increasing their access to electricity through an expansion of national energy production capacity. Structured as a public-private partnership (PPP), the programme will be executed in 3 phases: (i) Phase 1 comprises the exploration of the Lake Assal geothermal vapour field and confirmation of the characteristics of the field's geothermal resources; (ii) Phase 2 involves the development of the geothermal field and construction of a geothermal power station with an installed capacity of 20 MW; and Phase 3 will involve expanding the capacity of the geothermal power station to 50 MW.

2.0.2 Phase 1, which is the subject of this project and will be financed with concessional resources, is aimed at eliminating exploration risks and thus preparing an enabling environment for private sector participation under Phases II and III. The project will be located in Caldera Fiale, in the Lake Assal region (see Annex IV).

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<sup>1</sup> Report prepared by *Parsons Brinherhoff Power (PB Power)*, one of the internationally renowned engineering consultancy firms in the area of energy.

2.0.3 Phases II and III, aimed at developing the geothermal field and constructing the geothermal power station, should be implemented by an independent power producer (IPP) to be selected through international competitive bidding. Phase I implementation will make it possible to prepare the feasibility study for the geothermal field, which is a prerequisite for international competitive bidding to select the IPP.

## 2.1 Project Components

2.1.1 Phase I of the project will comprise the following components: (A) Drilling activities; (B) Technical assistance; (C) Project implementation; and (D) Environmental and social management. This phase will be executed in 30 months, between now and May 2016. The geothermal power station, which will be developed in Phases II and III, and financed by a private investor, will be implemented between now and 2018 once the geothermal resource has been confirmed by the feasibility study to be conducted during Phase I. Phase I project components and the related costs are presented in Table 2.1.

No.	Component Name	USD	UA	Component Description
A)	Drilling activities	27.8	18.5	Execution of a drilling programme for 4 production wells, including civil engineering works, drilling services, procurement of equipment and testing.
B)	Technical assistance	1.8	1.2	Recruitment of an expert to develop the exploration programme, including drilling, the test set and the feasibility study for the geothermal power station
C)	Project implementation	1.6	1.1	Operation of the Project Implementation Unit (PIU), including costs related to the recruitment of the International Manager of the PIU.
D)	Environmental and social management	0.6	0.4	Execution of the Environmental and Social Management Plan
	<b>Total cost</b>	<b>31.8</b>	<b>21.2</b>	

## 2.2 Technical Solution Adopted and Alternatives Explored

2.2.1 The technical solution adopted entails building 4 (four) production wells in the Caldeira de Fiale zone, in the Lake Assal region, using directional drilling techniques. This choice was made based on the results of previous drillings conducted in the Lake Assal region. Indeed, the wells (Assal 1, 2, 3 and 6) were drilled in an area which, although productive, has a problem of permeability and salinity. Meanwhile, the Assal 5 well drilled in the Caldeira de Fiale region revealed the presence of a magmatic heat source and geothermal fluid. The technical options are presented in Annex B.11 while the locations of the boreholes drilled in the past are presented in Annex IV.

2.2.2 Option “zero” reflects the option in which there is no new national power production project. This option was discarded because, without a new national power production source, the services and coverage rate of EdD will not improve in the medium and long term. Hence, it will be difficult to meet the projected increase in the country’s electricity demand without additional production. Should the Government of Djibouti (GoD) choose to develop its thermal power production capacity instead of developing geothermal energy, Djibouti’s dependence on fossil energy imports will continue with all the attendant economic and environmental consequences such as deterioration of the balance of trade or an increase in greenhouse gas emission. Excessive dependence on hydro-power import from Ethiopia is a risky option for Djibouti and could jeopardize its energy independence. Various technical options were explored and finally rejected for reasons summarized in Table 2.2.

**Table 2.2 : Project Alternatives and Reasons for Rejection**

Technical Criteria	Description of Alternatives	Reasons for Rejection
Drilling areas	Three alternative zones were identified for the drillings: <ul style="list-style-type: none"> <li>▪ Zone for Assal 1, 2, 3 and 6 wells</li> <li>▪ North-North-West Zone</li> <li>▪ Caldeira de Fiale zone</li> </ul>	<ul style="list-style-type: none"> <li>• An analysis of Assal 1, 2, 3 and 6 wells revealed a low permeability coefficient, fluids with high salinity and relatively small reservoirs.</li> <li>• No exploratory drilling was conducted on the North-North-West zone, situated North-North-West of the Assal 1, 2, 3 and 6 zone; its potential therefore remains unknown.</li> <li>• Underground studies conducted in the Caldeira de Fiale zone, where 5 wells were drilled, reveal the presence of a magmatic heat source and hint at the presence of geothermal fluid and replenishment capacity.</li> </ul>
Well diameter	Small diameter wells (small and medium diameter) equipped with alloy casings were considered in order to minimize costs.	<ul style="list-style-type: none"> <li>• Reduced diameter drilling was rejected because of the risk of scale formation, which could rapidly clog up the small-diameter casing.</li> <li>• The flow from small-diameter wells is not enough to evaluate the geothermal reservoir</li> <li>• It was considered that despite the additional cost of USD 6.5 million for the construction of a production well (full-size diameter), this would potentially result in a reduction of USD 16 million in the cost of the production drilling programme in Phase II, since the wells drilled in Phase I could be used for production.</li> </ul>
Drilling technique	The vertical drilling technique is less costly	<ul style="list-style-type: none"> <li>• To ensure optimum success in drilling, the well has to be drilled through the maximum number of fracture zones possible. Directional drilling allows for achieving this objective, as opposed to vertical drilling techniques</li> </ul>
Thermal power	Construction of new thermal power stations	<ul style="list-style-type: none"> <li>• High operation costs</li> <li>• High dependence on the price of fossil fuels, especially oil</li> <li>• Negative environmental and social impact, with high greenhouse gas (CO<sub>2</sub>) emission</li> </ul>
Importing from Ethiopia	Importing hydro-electricity from Ethiopia through the interconnection line	<ul style="list-style-type: none"> <li>• Energy import from Ethiopia is possible only when there is surplus production in Ethiopia, since the power purchase contract with Ethiopia is not binding.</li> <li>• Import capacity through the interconnection is currently limited to 55 MW.</li> <li>• Hydro-electricity is vulnerable to changes in rainfall patterns.</li> <li>• Djibouti's energy independence jeopardized.</li> </ul>

## 2.3 Project Type

The project is jointly financed and will receive grants and loans from the Bank, the World Bank Group (WB), OPEC Fund for International Development (OFID), French Development Agency (AFD), Global Environment Facility (GEF) and ESMAP Fund.

## 2.4 2.4 Project Cost and Financing Plan

2.4.1 The total project cost, net of taxes and customs duties but inclusive of a 19% provision for physical contingencies and price escalation for the drilling component (to reflect the level of risk associated with this component) and 10% for the rest, is estimated at USD 31.8 million (approximately equivalent to UA 21.2 million).

2.4.2 Tables 2.3 and 2.4 present the detailed project costs, including the provision for physical contingencies and price escalation.

**Table 2.3 : Cost by Component**

Component	Sub-component	USD million	UA million
A. Drilling activities	A.1 Civil engineering works	4.4	2.9
	A.2 Drilling services	18.7	12.5
	A.3 Drilling equipment	3.5	2.3
	A.4 Inspection and test	1.2	0.8
	<b>Sub-total:</b>	<b>27.8</b>	<b>18.5</b>
B. Technical assistance	B.1 Geothermal power expert	1.8	1.2
	<b>Sub-total:</b>	<b>1.8</b>	<b>1.2</b>
C. Project implementation	C.1 PIU manager	0.5	0.3
	C.2 PIU operation	1.0	0.7
	C.3 Goods for the PIU	0.1	0.1
	<b>Sub-total:</b>	<b>1.6</b>	<b>1.1</b>
D. Environmental and social management	D.1 Environmental and social management	0.6	0.4
	<b>Sub-total:</b>	<b>0.6</b>	<b>0.4</b>
<b>TOTAL:</b>		<b>31.8</b>	<b>21.2</b>

**Table 2.4 : Cost by Expenditure Category in Foreign Exchange and Local Currency**

Category	Sub-component	USD million			UA million		
		F.E.	L.C.	Total	F.E.	L.C.	Total
<b>E.</b>							
F. Works	A.1 Civil engineering works	4.4	-	4.4	2.9	-	2.9
	<b>Sub-total</b>	<b>4.4</b>	<b>-</b>	<b>4.4</b>	<b>2.9</b>	<b>-</b>	<b>2.9</b>
Goods	A.3 Drilling equipment	3.5	-	3.5	2.3	-	2.3
	C.3 Goods for the PIU	-	0.1	0.1	-	0.1	0.1
	<b>Sub-total</b>	<b>3.5</b>	<b>0.1</b>	<b>3.6</b>	<b>2.3</b>	<b>0.1</b>	<b>2.4</b>
Services other than consultancy services	A.2 Drilling services	18.7	-	18.7	12.5	-	12.5
	A.4 Inspection and testing	1.2	-	1.2	0.8	-	0.8
	<b>Sub-total</b>	<b>19.9</b>	<b>-</b>	<b>19.9</b>	<b>13.3</b>	<b>-</b>	<b>13.3</b>
Consultancy services	B.1 Geothermal power expert	1.8	-	1.8	1.2	-	1.2
	C.1 PIU Manager	0.5	-	0.5	0.3	-	0.3
	<b>Sub-total</b>	<b>2.3</b>	<b>-</b>	<b>2.3</b>	<b>1.5</b>	<b>-</b>	<b>1.5</b>
Operation	C.2 PIU operating costs	-	1.0	1.0	-	0.7	0.7
	<b>Sub-total</b>	<b>-</b>	<b>1.0</b>	<b>1.0</b>	<b>-</b>	<b>0.7</b>	<b>0.7</b>
Others	D.1 Environmental and social management	0.6	0.4	-	-	-	-
	<b>Sub-total</b>	<b>-</b>	<b>0.6</b>	<b>0.6</b>	<b>-</b>	<b>0.4</b>	<b>0.4</b>
<b>TOTAL:</b>		<b>30.1</b>	<b>1.7</b>	<b>31.8</b>	<b>20.1</b>	<b>1.1</b>	<b>21.2</b>

2.4.3 The disbursement schedule is given in Table 2.5.

**Table 2.5**  
**Disbursement Schedule (in UA million)**

Component	2013	2014	2015	Total
A. Drilling activities	1.9	14.8	1.9	<b>18.5</b>
B. Technical assistance	0.4	0.4	0.4	<b>1.2</b>
C. Project implementation	0.4	0.4	0.4	<b>1.1</b>
D. Environmental and social management	0.1	0.1	0.1	<b>0.4</b>
<b>TOTAL:</b>	<b>2.7</b>	<b>15.7</b>	<b>2.7</b>	<b>21.2</b>

2.4.4 The project financing plan is presented in Table 2.6 below. SEFA funds will be managed by the Bank, while GEF, OFID and ESMAP funds will be managed by the World Bank.

**Table 2.6**  
**Financing Plan (in UA million)**

Component	ADB	SEFA	WB	GEF	OFID	AFD	ESMAP	Djibouti	TOTAL
A. Drilling activities	2.9	-	4.0	4.0	4.7	2.2	0.7	-	<b>18.5</b>
B. Technical assistance	-	1.2	-	-	-	-	-	-	<b>1.2</b>
C. Project implementation	0.9	-	-	-	-	-	-	0.2	<b>1.1</b>
D. E&S management	-	-	-	-	-	-	-	0.4	<b>0.4</b>
<b>TOTAL:</b>	<b>3.8</b>	<b>1.2</b>	<b>4.0</b>	<b>4.0</b>	<b>4.7</b>	<b>2.2</b>	<b>0.7</b>	<b>0.6</b>	<b>21.2</b>

2.4.5 The Bank's financing, which represents approximately 24% of total project cost, will come from Djibouti's country allocation under ADF 12 and from the resources released following ADF loan cancellations and SEFA funds. ADF resources will be used to finance the civil engineering contract and part of the PIU's operating expenses. The civil engineering contract essentially covers the reinforcement of access roads, preparation of drilling sites, installation of water pumping stations and the establishment of a workers' camp. PIU operating costs to be financed by the Bank mainly include the procurement of office equipment and fuel costs. SEFA funds will be used to finance the technical assistance component, essentially comprising the recruitment of an expert in charge of developing the exploration programme that includes the boreholes, the test rigs and the feasibility study on the geothermal power station. The counterpart contribution will be used to finance part of the PIU's operating costs, comprising salaries in local currency for PIU staff, office rental costs as well as environmental and social management costs. The Djibouti Government undertook to fill any eventual financing gap or additional costs, if necessary, with the national budget. The ADF loan will be used to finance part of the cost of the drilling activities, while the ADF grant will be used to finance part of the cost of the drilling activities and the cost of the project implementation. Finally, the SEFA financing will be used to finance the cost of the technical assistance.

2.4.6 The detailed project costs and financing plan by component and by donor are presented in Annex B2.

## **2.5 Project Area and Beneficiaries**

2.5.1 The project is situated in the Fiale area (*Caldeira de Fiale*), North of Lava Lake. This zone is located on the southern fringe of the Tadjourah region, approximately 70 km West of Djibouti City (see map in Appendix IV).

2.5.2 Generally, the main project beneficiaries are the entire population of Djibouti since the project will ultimately and substantially increase the production of reliable, clean and

low-cost electricity in the country. With the subsequent reduction in energy costs, poor households will be the direct project beneficiaries.

## **2.6 Participatory Approach**

The participatory approach was followed when conducting the Environmental and Social Impact Assessment (ESIA) and during the project preparation and appraisal missions. Indeed, in addition to the public meeting held on 12 May 2012, several other discussion sessions have taken place with local communities with a view to sensitizing them to the project and gathering their views and concerns. These different meetings provided greater insight into the living conditions of these communities and especially made it possible to gauge the potential impact of the project on their activities. Hence, various measures adopted under the Environmental and Social Management Plan (ESMP) were discussed and validated with the communities.

## **2.7 Bank Group Experience and Lessons Reflected in Project Design**

2.7.1 The Bank's experience in Djibouti's energy sector is relatively limited, with the partial financing of a geothermal project in 1987 and the recent financing of the Ethiopia-Djibouti Interconnection Project.

2.7.2 The main lessons learnt from the 1987 Geothermal Project relate to weaknesses in project design and the lack of coordination among donors, which has prevented the development of Djibouti's geothermal resources since the 1970s. Indeed, the 1987 Geothermal Power Project required the intervention of several donors because limited donor allocations to Djibouti were insufficient to cover the entire cost of a geothermal exploration project. Co-financing requires the smooth coordination of donor operations. In turn, this calls for a highly developed project design. In this project, all the essential components have been defined by international experts and subsequently reviewed in detail by the government and donors. Furthermore, the current project design is more simplified compared to the design adopted for the 1987 Geothermal Project. Phase I of the geothermal power production programme focuses exclusively on financing of the exploration phase and the bidding process for the construction of a geothermal power station with a total capacity of 50 MW. If Phase I of the project is successful, it should arouse the interest of independent power producers to undertake the production phase and the construction of the geothermal power station.

2.7.3 The main parameters in the design of Phase I relate to demarcation of the exploration area, the number of wells to be drilled under the drilling programme, the type of well (small diameter, exploration or production wells) and the type of drilling (vertical or deviated). Based on the lessons learned from the aborted 1987 Geothermal Project and on international best practices, the design of the current project includes four full-sized deviated wells (production wells), with a depth of approximately 2500 metres.

2.7.4 The Project Completion Report (PCR) on the Ethiopia-Djibouti Interconnection Project concluded that project implementation was satisfactory on the whole. However, fulfilment of the conditions precedent to first disbursement and other grant conditions took more time than projected, given the additional financing that became necessary to defray costs noted during the bid opening. For this project, all the grant and loan conditions have been tailored to the country's capacity and realities so that they can be fulfilled within a more reasonable time-limit. Besides, the beneficiary is expected to commence the procurement process, in accordance with the Bank's procurement rules, within the shortest time possible so as to have enough time to appraise bidder credentials.

2.7.5 Lastly, the Bank recently financed a large-scale geothermal development project in Kenya. The Caldeira de Menengai Development Project, approved by the Bank in 2011, is aimed at developing the Menengai geothermal field to generate 400 MW of electricity. This project, which is the first of its kind in Africa, will have a catalytic reproduction effect on geothermal resource development in East African Rift Valley countries like Djibouti that have an enormous geothermal resource development potential. The current project seeks to replicate the innovative model adopted in Kenya, thanks to which it is possible to surmount various risks associated with geothermal development, such as exploratory drilling risk (with the probability of ending up with dry wells during exploration of the geothermal field). This model provides for financing of the exploratory phase of the project, including high risk activities related mainly to drilling, by development financing institutions such as the Bank, using concessional resources. The financing is injected into a specialized company responsible for carrying out drilling activities and therefore bearing most of the drilling risks. This opens the way for private investments to transform vapour into energy by conveying vapour under very high pressure from the geothermal wells to activate the turbines of the geothermal power station. This model renders energy transfer and marketing costs more affordable.

## **2.8 Key Performance Indicators**

2.8.1 Project performance will be measured using the key indicators retained in the logical framework. For project impact, the indicator will be the electricity access rate by 2018 when the geothermal power station will be constructed. As regards programme effects, the indicators will be: (i) the quantity (barrel) of oil imported; (ii) the quantity (tonnes) of CO<sub>2</sub> emitted; and (iii) total electricity production capacity (MW) available in the country. With respect to the outcomes, performance will be measured through: (i) the number of wells drilled; (ii) the design and management of the drilling project; (iii) the experimental design of the wells; (iv) certification of the results of tests and analyses; (v) audit reports and quarterly progress reports; and (vi) execution of the Environmental and Social Management Plan.

2.8.2 The Project Implementation Unit (PIU) will pool all data collected and ensure project monitoring/evaluation. The quarterly project progress reports will include a section on indicator trends.

## **3 PROJECT FEASIBILITY**

### **3.1 Economic and Financial Performance**

3.1.1 The project's financial and economic analysis is based essentially on the model initially designed by the PIU with WB assistance. This model was critically examined by the Bank's project team which improved upon it as appropriate. Although the project proposed by the Bank involves only the exploration phase, the economic and financial analysis was conducted for both the exploration and development phases, including development of the geothermal power station with a total capacity of 50 MW, to evaluate the conditions under which geothermal resources would be commercially viable.

3.1.2 The financial analysis focuses on determining the appropriate rate to be charged for electricity generated by the power station. The power station will be built at the end of Phases II and III by an independent power producer (IPP) that will participate in the project as a private investor. The tariff will be set at a level that makes it possible to cover: (i) the capital cost of initial investment; (ii) the maintenance and operational costs of the power station; and (iii) an appropriate rate of return for the private investor, set at 20% in the baseline scenario.

3.1.3 The results of this analysis show that the project is financially and economically viable. The real financial internal rate of return is estimated at 12.8%. The financial net

present value (FNPV), at the weighted average cost of capital (real discount rate of 9.5%), is USD 37.4 million. The financial results also show that the geothermal power production programme should yield an electricity rate of approximately USD 0.091/kWh with the concessional financing budgeted for the exploratory phase. This rate will enable the IPP to recoup all its capital investment as well as the operational and maintenance costs of the power station, while ensuring that it gets a 20% return on equity. These results are obtained on the assumption that the conditional grants of GEF and ESMAP, as well as the IDA and OFID loans will eventually be repaid by the IPP.

3.1.4 Meanwhile, the economic analysis considers the benefits of the project for the entire Djibouti economy. The analysis compares the benefits of energy generated by the project and injected into the power grid with those of other alternative power generation sources available to Djibouti. Power production costs include the investment costs for the exploration phase, the investment costs for the production phase (including construction of the geothermal power station), as well as the power station’s operating and maintenance costs. The average cost of alternative sources (essentially thermal) is estimated at approximately USD 0.26/kWh during peak periods (USD 0.21/kWh for fuel as well as operating and maintenance costs, and USD 0.05/kWh for annualised capital costs). The average cost during the off-peak period is estimated at USD 0.21/kWh, based on the cost of fuel as well as the operating and maintenance costs of old and already amortized thermal power stations.

3.1.5 The results of the economic analysis attest to the economic viability of the project and show that it is able to provide the system with electricity at very competitive rates, thus helping to diversify the supply sources of Djibouti’s electric power system and reduce dependence on oil-fired thermal sources. The economic net present value (ENPV), calculated at a 12% economic opportunity cost of capital in real terms, is estimated at USD 174.9 million. The real economic internal rate of return (EIRR) is 29%.

3.1.6 The main financial and economic results are summarized in Table 3.1 below, while the detailed calculations and assumptions are presented in Annex B7.

<b>Table 3.1</b>		
<b>Main Financial and Economic Results</b>		
	IRR (%)	NPV (in USD million)
Internal rate of return (IRR) and net present value (NPV) – financial analysis	12.8%	37.4
Internal rate of return (IRR) and net present value (NPV) – economic analysis	29%	174.9

3.1.7 Sensitivity tests were also conducted on the basis of the risk parameters that can negatively affect the project’s economic and financial viability. The main risk parameters that have an impact on electricity tariffs and the project’s overall viability include additional investment costs, the rate of return on equity requested by the private investor and the terms of the sources of financing for the exploration phase (concessional terms or otherwise). The results of the sensitivity tests show that the economic and financial results are robust even under unfavourable conditions. The sensitivity tests are presented in detail in Annex B7.

## 3.2 Environmental and Social Impact

3.2.1 The project concerns a programme to drill 4 geothermal exploration wells. The drilling area is uninhabited and free of vegetation, given the volcanic composition of its soil. The project is likely to generate environmental (polluted geothermal fluids, solid waste from drilling mud, eruption risk, etc.) and social impacts (mainly the temporary loss of pastureland and a tourist track) that can be mitigated with adequate countervailing measures. Considering that the project area is uninhabited and free of vegetation because of the volcanic composition of its soils, the project was classified under Category 2 in compliance with the Bank's environmental and social assessment procedures.

3.2.2 **Environmental Impact:** The sole environmental impact on the project area will be felt in the two lakes located near the drilling site, namely, Lake Assal situated more than 4 km from the site and Lake Ghoubet situated less than 2 km away. Because of its special aquatic life, Lake Ghoubet will be protected by the new law being validated by the authorities of Djibouti. Special attention will be paid to this sensitive ecosystem in the detailed Environmental and Social Management Plan (ESMP). The drilling works will at least have the following potential impacts:

- Pollution resulting from construction of the access road and operation of the gravel pit: environmental, health/safety best practices will be applied by the consultant geothermal expert.
- Pollution from drilling mud: depending on the type of mud (oil mud, watery mud or foam), the mode of treatment will be different. Although the Bank and Djibouti's environmental authorities recommend the use of watery mud, waste mud will be treated prior to disposal.
- Production of geothermal fluids: by analogy with the results of previous campaigns, it appears highly probable that the geothermal fluids of the new wells will contain heavy metals (lead, zinc, etc.). Geothermal fluids will be treated prior to reinjection into their reservoir of origin or into shallow wells, and/or prior to disposal in nature.
- Geothermal gas emissions, including H<sub>2</sub>S, could be generated during drilling. Strict gas detection and health/safety measures will be applied by the drilling consultant.
- Production of solid waste (drill-bit cuttings, precipitate produced during testing, residue from geothermal fluid residue, etc.).
- Pressure on water resources will come solely from drilling water needs. This water will be tapped either from existing wells or from Lake Ghoubet using underground pipes.
- Drilling activities will generate other inconveniences such as noise pollution and security concerns for local communities caused by increased road traffic resulting from the project. However, these inconveniences can be mitigated through specific measures.

3.2.3 **Climate Change:** Emissions may be produced during drilling and testing. The geothermal gases that could be generated are carbon dioxide (CO<sub>2</sub> – approximately 100 ppm), with traces of sulphur dioxide (lower than 0.2 ppm) and methane (CH<sub>4</sub> – 0.1 ppm). The

concentrations shown are those found during previous drilling in the same area. These concentrations remain very low. Besides, geothermal power station emissions are generally negligible compared to emissions from power stations running on fossil fuels. Hence, the project will lead to a potential reduction of 11,000,000 tonnes in CO<sub>2</sub> emission per year from 2018, the date on which the geothermal power station will be commissioned.

3.2.4 **Gender:** In accordance with the Bank's gender policy, the project intends to initiate some specific actions for women in the project area. The ESIA and the various meetings with the communities during project appraisal allowed for identification of certain priority and strategic needs of women. Consideration of some of these actions will help to alleviate some of the hardship experienced by girls and women in their daily chores, especially through the creation of a drinking water point and the development of income-generating activities using a revolving credit line. The implementation of these actions was discussed with the Directorate for Water Resources and the Djibouti Agency for Social Development. Nevertheless, considering that the Bank is designing a rural water supply project in Djibouti, synergies will be developed in this regard so that this component will be integrated into the project.

3.2.5 **Social Impact:** The project has no negative social impact on the project area or the local communities. Nevertheless, its positive impact is obvious in terms of job creation, although the demand for skilled labour remains very low because of the nature of the activities to be implemented. Furthermore, the project's success will ultimately have a very strong social impact not only with regard to access to electricity for poor households, but also in terms of cost.

3.2.6 **Involuntary Resettlement:** The project will not result in community displacement because the project area is uninhabited. However, transhumant communities periodically roam this area. Hence, to avoid blocking the transhumance corridor, support measures have been recommended to either leave it open or deviate it into an old track. The deviation path has already been selected in consultation with the local communities and the authorities. Support measures (trail markers, information and sensitization) have already been provided for under the ESMP.

3.2.7 Additional information is provided in Annex B8.

## **4 PROJECT IMPLEMENTATION**

### **4.1 Implementation Arrangements**

4.1.1 **Institutional Arrangements:** A Project Implementation Unit (PIU) was created and placed under the supervision of *Électricité de Djibouti*. Although donors are generally favourable to the use of existing structures to manage public investment projects in order to minimize fiduciary risk and build existing capacity, in accordance with the Paris Declaration, the weaknesses noticed in existing national structures justify the creation of a new PIU to manage this project.

4.1.2 A Steering Committee comprising the Secretary-General (SG) of the Government (Committee Chair), the SG of MEERN, the SG of the Ministry of Energy and Water in charge of Natural Resources (MEERN), the SG of the Ministry of Economy and Finance in charge of Industry and Planning (MEFIP), the SG of the Ministry of Higher Education and Research (MESR), the Director-General of the Djibouti Centre for Studies and Research (CERD) and the Director-General of *Électricité de Djibouti* (EdD) was set up to solve any problem likely to arise during project design and implementation.

4.1.3 Although the PIU has already been created by decree, its composition has not yet been completed. Hence, at project appraisal, the PIU only comprised a local project coordinator, an assistant local coordinator, an accountant and a procurement expert. Ultimately, the PIU will have a staff strength of 8 (eight) professionals and will be headed by an international project manager (IPM) who will take all operational decisions and assume fiduciary responsibilities. In that capacity, the IPM will supervise the Djibouti team which will comprise a local project coordinator, an assistant local coordinator, an accountant, a procurement expert, an environmentalist, a socio-economist and an administrative assistant. The PIU will also be assisted by a geothermal expert consultant (GEC) for the design of the geothermal exploration programme.

4.1.4 The PIU will prepare a project operations manual that will be validated by donors before the project becomes effective. The PIU will also be responsible for preparing the periodic reports of the steering committee as well as the quarterly monitoring reports for submission to donors.

4.1.5 Details of the project's institutional arrangements are presented in Annex B.3, which includes the PIU organisation chart.

4.1.6 **Procurement Arrangements:** The various donors opted for parallel co-financing. Hence, the Bank and other donors, including the World Bank especially, will finance clearly different components of the project, each adopting its own rules and procurement procedures. The ADF and SEFA funds that will be administered by the Bank will finance contracts relating to civil engineering works, technical assistance and project management, while the other donors will finance the component related to drilling services. However, the various donors will engage in high-level coordination and collaboration to ensure perfect project execution.

4.1.7 All goods, works and consultancy services financed with resources administered by the Bank (including SEFA funds) shall be procured in accordance with the *Rules of Procedure for Procurement of Goods and Works* (May 2008 edition, revised in July 2012), or the *Rules of Procedure for the Use of Consultants* (May 2008 edition, revised in July 2012), as the case may be, using the appropriate standard Bank bidding documents. The PIU will be responsible for the procurement of goods, works, services and other items as described in Annex B5. A review of the resources, capacity, expertise and experience of the provisional PIU points to the need to strengthen this entity in the area of procurement. With regard to the mitigation of fiduciary risks, it has been proposed that an experienced procurement expert be recruited to strengthen the procurement capacity of the PIU. A procurement plan was prepared during the appraisal mission and will be regularly updated during the project execution phase. Procurement arrangements are presented in Annex B5.

4.1.8 **Financial Management Arrangements:** The existing financial management systems in the PIU are generally not satisfactory and the overall fiduciary risk is substantial (see detailed analysis in the annex) due to: (i) the non-existence of a budget and work plan; (ii) the lack of qualifications and experience by the accounting and financial staff; (iii) the operation of an inappropriate organizational structure; (iv) the absence of an operations manual for the project; (v) the absence of salary and mission statements; (vi) the absence of a fixed assets register; (vii) the non-existence of an analytical and budget accounting plan; (viii) the non-existence of accounting software; (ix) the non-existence of a cash-flow plan; and (x) the absence of interim financial statements.

4.1.9 Consequently, it is recommended to the PIU to: (i) establish a budget plan coupled with the projected schedule of activities; (ii) recruit a consultant to design the project's operations manual, part of which will deal with administrative, financial and accounting procedures; (iii) prepare a monitoring report on missions, a monitoring report on salaries and

a fixed assets register which is paginated, initialled and bearing the number, description, amount and location of the mission; (iv) recruit a competent accountant placed under the supervision of the IPM; (v) establish a cost and budget accounting plan; (vi) procure accounting software containing modules on general and cost accounting as well as budget management and that allows for generating accounting ledgers, the general ledger, balances and financial statements; (vii) include a training and maintenance component in the contract during procurement of the accounting software; (viii) have the accountant trained in the Bank's procedures; (ix) establish a cash-flow plan; (x) prepare a six-monthly progress report that includes interim financial statements; and (xi) recruit an external audit firm. Financial management arrangements are presented in Annex B4.1.

4.1.10 **Disbursements:** Three disbursement methods have been retained. The first is the direct payment method, which will be used to make direct payments for suppliers' contracts for goods, works or services at the request of the PIU. The second is the revolving fund or Special Account whereby the Bank provides the PIU with an advance, paid into the Special Account devoted exclusively for expenditure eligible for ADF grant and loan as well as SEFA grant resources. This method will be used for disbursements under the *Operation and Miscellaneous* expenditure categories. The third method involves reimbursing eligible expenditures already committed and paid by the Donee with own resources. For the rolling fund or special account method, disbursements will be done based on a programme of activities acceptable to the Bank and after justification of at least 50% of the previous payment.

4.1.11 **Audit:** The PIU will be subject to an internal audit by EdD. The internal audit will report to the Steering Committee at least every quarter. The external audit will be contracted out to a private firm approved by the Bank. The audits will be conducted in accordance with the International Accounting Audit Standards. The standard terms of reference will be provided by the Bank to the PIU. The audit report, accompanied by a management report, will be submitted to the Bank by EdD within six months following closure of the fiscal year. Provision is made for a mid-term technical audit of the project. It should be noted that only one and the same audit report will be prepared for all donors.

4.1.12 Details of the financial management, disbursement and audit arrangements are presented in Annexes B4 and B6.

## 4.2 Project Monitoring

The main stages of the programme are presented in Table 4.1 below:

Duration	Stages	Monitoring Activities/Feedback Loop
6 months	Signature and effectiveness	<b><i>Grant and loan approval</i></b>
		General procurement notice
		<b><i>Signature of loan agreement and grant protocol agreements</i></b>
		AfDB launching mission
		<b><i>Effectiveness of loan agreement and grant protocol agreements</i></b>
Variable	Procurement	Launching of the bidding process and award of contracts
Variable, depending on the sub- component concerned	Physical implementation of the project	Execution of supplies and works contracts
		Preparation of periodic project progress reports
		Supervision missions from the Bank
		Project environmental and social monitoring
		Mid-term review by the Bank
120 days	Project accounts audit	Recruitment of the auditor
		Execution of annual audits
70 days	Project completion	Donee's project completion report
		Preparation of the Bank's project completion report

### 4.3 Governance

The project will be executed by the PIU whose financial management systems should be improved prior to the commencement of activities. The Project Manager, who will be recruited internationally, shall be in charge of the daily management of the project. The EdD internal audit department will assist in monitoring/evaluation to ensure compliance with internal controls. The Bank will also engage in monitoring during supervision missions. All anti-corruption measures taken by the State of Djibouti will be applied to this project.

### 4.4 Sustainability

4.4.1 The project design includes key elements aimed at guaranteeing technical, financial, environmental and social sustainability:

- **Technical:** Technical sustainability will be guaranteed through precise evaluation of the quality and quantity of the geothermal resource in Caldeira de Fiale, which will in turn make it possible to optimize the vapour collection system and the design
- **Financial:** The financial viability of the project will be assessed by a transactions advisor who will be recruited prior to commencement of the second phase and who will guarantee financial sustainability mainly through the design of an appropriate Power Purchase Agreement.
- **Environmental and Social:** Appropriate measures will be taken to mitigate the project's environmental and social impact.

4.4.2 Besides, Djibouti's Energy Action Plan provides for massive investments in electricity distribution, totalling approximately USD 80 million, to ensure the durability of production and thus bring about a sustainable improvement in the people's access to electricity.

### 4.5 Risk Management

Project implementation may encounter a number of risks. The main risks and their mitigation measures have been identified in Table 4.2. In general, the project's risk level is relatively high. However, the mitigation measures proposed will contribute to the effective management of such risks.

**Table 4.2  
Risks and Mitigation Measures**

<b>Risk</b>	<b>Description</b>	<b>Level</b>	<b>Mitigation Measures</b>
Political and macroeconomic	Risks related to the chronic instability in the region and the Government's macroeconomic policy	M	<ul style="list-style-type: none"> <li>▪ Government support for the project and the involvement of the international community in Djibouti</li> </ul>
Exploration	There is the risk that the resources of Lake Assal may turn out to be insufficient in quantity and quality for large-scale generation of electricity. This could lead to a reduction in the size of the project and/or cost or time overruns resulting from efforts deployed to address the resource deficit.	M	<ul style="list-style-type: none"> <li>▪ The results of the first drilling campaigns conducted in the 1980s revealed the existence of geothermal resources that can be tapped in the project area.</li> <li>▪ Considering the existing geological data and previous drilling programmes, a well's chances of success in the exploration phase is 70%.</li> <li>▪ Site prospection studies were conducted by internationally renowned world firms in this domain (Iceland GeoSurvey – ISOR: the geothermal industry's scientific and technical leader)</li> <li>▪ Appropriate technologies currently exist for treating geothermal resources having high salinity, a high brine content and other solid matter to prevent the clogging of wells.</li> </ul>
Market	Current demand for electricity in Djibouti may not be sufficiently high to absorb the 50 MW targeted for the project.	L	<ul style="list-style-type: none"> <li>▪ EdD is unable to fully meet Djibouti's current energy demand</li> <li>▪ Demand is growing in Djibouti and the most cautious estimates show that demand should rise sharply by the time the power station is built.</li> <li>▪ In addition to covering the needs of the local market, geothermal energy could be exported via the Djibouti-Ethiopia interconnection network during the dry season in Ethiopia. Furthermore, Ethiopia is establishing interconnections with Sudan and Kenya, which could also be used to export electricity from Djibouti.</li> </ul>
Institutional	There is no regulatory framework governing independent electricity producers in Djibouti	H.	<ul style="list-style-type: none"> <li>▪ The Djibouti government requested the assistance of PPIAF to prepare a legal and regulatory framework that will encourage independent electricity producers to enter the market. PPIAF responded favourably to this request and entrusted the mission to a consultant working under the supervision of the World Bank.</li> <li>▪ Furthermore, the involvement of donors in the next phase of the project will exclusively entail the establishment of the above-mentioned regulatory framework.</li> </ul>
Execution and operation	The PIU's lack of capacity is a major obstacle to the execution and operation of the project	H.	<ul style="list-style-type: none"> <li>▪ The project is designed to substantially strengthen the future PIU. The PIU will indeed benefit from the support of an international project manager who will be responsible for the efficient preparation, negotiation and administration of the contract and budget control of the project.</li> <li>▪ Furthermore, the PIU will benefit from the recruitment of an accountant who will</li> </ul>

			<p>be responsible for aligning fiduciary practices on donor standards.</p> <ul style="list-style-type: none"> <li>▪ The entire team of the PMU will receive in-depth training in fiduciary management and safeguard mechanisms.</li> </ul>
Selection of the private investor	Various factors, some of which are beyond Djibouti's control (such as delays in the bidding process and the securing of financing by private investors) could lead to delays in the conclusion of contracts as well as the construction and commissioning of the power station by private investors	M	<ul style="list-style-type: none"> <li>▪ The preliminary interest expressed by private investors and the participation of a transactions advisor in the project will mitigate this risk.</li> <li>▪ A rigorous process to select the private investor, which will be conducted by the transactions advisor and the project manager, both of whom have vast experience in the domain, will help to mitigate this risk.</li> <li>▪ In case of failure, the Government of Djibouti is ready to create a specialized company (SPV) for the development of geothermal projects in Djibouti, through which the financing needed for construction of the power station would be channelled.</li> </ul>
Energy evacuation	There is the risk that the transmission line will not be built on time to evacuate the energy generated by the power station	M	<ul style="list-style-type: none"> <li>▪ <i>Électricité de Djibouti</i> has already conducted a preliminary study and already planned the construction of the line.</li> <li>▪ The European Union will finance a wind farm in the project area as well as the transmission line connected thereto. This line which has a capacity of 230 kV (initially operated at 63 kV), can therefore be used for evacuating energy from the power station</li> </ul>

L: Low                      M: Moderate                      H: High

#### 4.6 Knowledge Building

The project will generate a catalytic reproduction effect that will stem from: (i) the mobilisation of financing and investment resources; and (ii) learning and demonstration:

- a. **Resource Mobilisation:** ADF and SEFA resources will be used to raise financing from other donors (e.g. the World Bank, AFD, OPEC, etc.), the Global Environment Facility (GEF) and the private sector, and will help to wrap up financing for the project. These resources will serve as a catalyst that rallies independent geothermal electricity producers downstream, making it possible to develop enormous geothermal capacity in the country.
- b. **Learning and Demonstration:** Furthermore, the project's catalytic reproduction effect will stem from the capacity-building and knowledge development that it will encourage in Djibouti and the region. The lessons learnt from geothermal resource development, especially the development of independent geothermal electricity producers, will be disseminated in other Rift Valley countries in sub-Saharan Africa such as Ethiopia, Uganda, Tanzania and Rwanda, which have considerable geothermal resource development potential.

## **5 LEGAL FRAMEWORK**

### **5.1 Legal Instrument**

To finance this project, the Bank will use ADF grant and loan as well as a SEFA grant awarded to the Republic of Djibouti.

### **5.2 Conditions Associated with Bank's Intervention**

#### **A) Conditions Precedent to Effectiveness of the ADF Grant and Loan and SEFA Grant**

5.2.1 The ADF grant and loan agreements as well as the SEFA grant agreement shall become effective on signature by the respective parties.

#### **B) Conditions Precedent to First Disbursement of the ADF Grant and Loan and SEFA Grant Resources**

5.2.2 Apart from entry into force of the above agreements, the Bank and the Fund shall only proceed with the first disbursement of the ADF grant and loan as well as SEFA grant resources if the Donee fulfils the following conditions and commitments to the Bank and the Fund's satisfaction:

- (i) Provide the Fund with evidence of opening of a special account in the name of the project in a bank acceptable to the Fund, intended to receive ADF grant resources;
- (ii) Present to the Fund and the Bank the Order allocating lands to the project for implementing project activities;
- (iii) Provide the Bank and the Fund with confirmation that the lands on which operations financed by the Bank and the Fund will be conducted are no longer subject to contractual commitments or operating licenses or permits granted to other private or public entities.

#### **Other Conditions**

Furthermore, the Donee / Borrower shall fulfil the following conditions to the Fund's satisfaction:

- (i) Present to the Fund latest twelve (12) months following the signature of this Grant Protocol Agreement, the project's detailed Environmental and Social Management Plan (ESMP); and
- (ii) Latest twelve (12) months following the first disbursement: (a) prepare a budget plan combined with the provisional activity schedule; (b) recruit a consultant charged with preparing the project operations manual, part of which will address administrative, financial and accounting procedures; (c) prepare a mission monitoring template, a salary monitoring template and a fixed assets register numbered and initialled, and containing the number, designation, amount and location of the mission; (d) recruit a competent accountant to be assigned to the Project Implementation Unit; (e) prepare an analytical and

budgetary accounting plan; (f) procure accounting software comprising modules in general/analytic accounting and general budget management, and allowing the production of accounting ledgers, general ledgers, balances and financial statements; (g) during procurement of the accounting software, include training and maintenance clauses in the contract; (h) provide training to the accountant on the Bank's procedures; and (i) prepare a liquidity plan.

## **Undertaking**

The Donee / Borrower undertakes to do as follows, to the Fund's satisfaction:

- (i) Execute the Environmental and Social Management Plan (ESMP) and have its contractors execute them in accordance with national laws, recommendations, requirements and procedures contained in the ESMP, as well as the relevant Fund rules and procedures.

### **5.3 Compliance with Bank Policies**

This project complies with all applicable Bank policies.

## **6 RECOMMENDATION**

Management recommends that the Boards of Directors approve: (i) an ADF grant and loan of UA 3.531 million and UA 0.269 million respectively; and (ii) a Sustainable Energy Fund for Africa (SEFA) grant of USD 1.8 million, in favour of the Government of Djibouti for use in financing the Geothermal Exploration Project in the Lake Assal Region.

Djibouti - Development Indicators				
Social Indicators	Djibouti		Africa	Developing countries
	1990	2011 *		
Area ( '000 Km²)	23		30 323	98 461
Total Population (millions)	0,6	0,9	1 044,3	5 733,7
Population growth (annual %)	5,0	1,9	2,3	1,3
Life expectancy at birth, total (years)	51,4	57,9	57,7	77,7
Mortality rate, infant (per 1,000 live births)	113,1	77,0	76,0	44,7
Physicians per 100,000 People	16,2	22,9	57,8	112,0
Births attended by skilled health staff (% of total)	...	92,9	53,7	65,3
Immunization, measles (% of children ages 12-23 months)	85,0	85,0	78,5	84,3
School enrollment, primary (% gross)	35,6	59,1	101,4	107,8
Ratio of girls to boys in primary education (%)	73,4	90,2	88,6	...
Literacy rate, adult total (% of people ages 15 and above)	...	...	67,0	80,3
Access to Safe Water (% of Population)	78,0	88,0	65,7	86,3
Access to Sanitation (% of Population)	66,0	50,0	39,8	56,1
Human Develop. (HDI) (0 to 1)	0,4	0,4	0,5	...
Human Poverty Index (% of Population)	...	25,6	33,9	...
Djibouti				
Economy	2000	2009	2010	2011
GNI per capita, Atlas method (current US\$)	750	1 270	1 311	...
GDP (current Million US\$)	556	1 016	983	1 244
GDP growth (annual %)	0,4	5,0	3,5	3,5
Per capita GDP growth (annual %)	-2,3	3,0	1,6	1,6
Gross Domestic Investment (% of GDP)	8,8	17,7	17,2	17,2
Inflation (annual %)	1,6	1,7	4,0	5,1
Budget surplus/deficit (% of GDP)	-1,8	-4,7	-0,6	-0,5
Trade, External Debt & Financial Flows	2000	2009	2010	2011
Export Growth, volume (%)	12,7	2,7	2,8	49,8
Import Growth, volume (%)	4,4	-28,3	-18,0	37,2
Terms of Trade (% change from previous year)	0,0	0,0	3,3	-21,6
Trade Balance ( mn US\$)	-175	-373	-283	-414
Trade balance (% of GDP)	-31,5	-36,7	-28,8	-33,3
Current Account ( mn US\$)	-27	-95	-54	-86
Current Account (% of GDP)	-4,8	-9,4	-5,5	-6,9
Debt Service (% of Exports)	7,6	7,3	9,0	8,0
External Debt (% of GDP)	52,0	61,7	64,4	52,1
Net Total Inflows ( mn US\$)	92	333	106	...
Net Total Official Development Assistance (mn US\$)	72	167	132	...
Foreign Direct Investment Inflows (mn US\$)	3	100	27	...
External reserves (in month of imports)	2,3	3,2	3,9	...
Private Sector Development & Infrastructure	2000	2009	2010	2011
Time required to start a business (days)	...	37	37	37
Investor Protection Index (0-10)	...	2,3	2,3	2,3
Main Telephone Lines (per 1000 people)	13,3	19,3	20,8	...
Mobile Cellular Subscribers (per 1000 people)	0,3	147,7	186,4	...
Internet users (000)	1,9	39,6	64,3	...
Roads, paved (% of total roads)	45,0	...	...	...
Railways, goods transported (million ton-km)	...	...	...	...

Source: ADB Statistics Department, based on various national and international sources

\* Most recent year

Last Update: May 2012

## Bank Group's Asset Portfolio Situation in Djibouti

Sector	Project Name	Project ID	Status	Loan No.	Date of Approval	Date of Signat.	Date of Effectiv.	Closing Date	Period Sign-App (month)	Period Eff-Sign (month)	Total Period Eff-Appr (month)	Project Age (year)	Net Amount in Loan currency (000)	Net Amount (000 UAC)	Cumulative Disburs. as at 15 September 12 (000 UAC)	Undisburs. Balance in (000 UAC)	Disburs. Rate (%)	Nb. of Disburs. Deadline Extension	Cumulat. period of extension (month)
<b>Social sector</b>														<b>11,620 UAC</b>	<b>5,188 UAC</b>	<b>6,432 UAC</b>	<b>44.65%</b>		
1	PROJET EDUCATION III **	P-DJ-IA0-002	OnGo	2100150007897	14-Jul-04	28-Sep-04	08-Jul-06	30-Dec-12	2.5	21.6	24.1	8.5	4,630 UAC	4,630 UAC	3,043 UAC	1,587 UAC	65.72%	2	18
	PROJET EDUCATION III **	P-DJ-IA0-002	OnGo	2100155002671	14-Jul-04	28-Sep-04	08-Jul-06	30-Dec-12	2.5	21.6	24.1	8.5	370 UAC	370 UAC	234 UAC	136 UAC	63.26%	2	18
2	PROJET DE REDUCTION DE LA PAUVRETE **	P-DJ-IE0-002	OnGo	2100155013273	17-Oct-08	13-Nov-08	08-May-09	30-Jun-14	0.9	5.9	6.8	4.2	5,820 UAC	5,820 UAC	1,318 UAC	4,502 UAC	22.65%	0	0
	PROJET DE REDUCTION DE LA PAUVRETE II**	P-DJ-IE0-003	OnGo	2100155019717	31-Jan-11	19-Mar-11	11-Jan-12	31-Dec-13	1.6	9.9	11.5	1.9	800 UAC	800 UAC	594 UAC	206 UAC	74.19%		
<b>Water and Sanitation sector</b>														<b>8,136 UAC</b>	<b>6,809 UAC</b>	<b>1,327 UAC</b>	<b>83.69%</b>		
3	PROJET D'ASSAINISSEMENT DE LA VILLE DE DJIBOUTI **	P-DJ-E00-001	OnGo	2100155010868	18-Dec-07	04-Feb-08	07-Apr-08	31-Dec-12	1.6	2.1	3.7	5.0	6,500 UAC	6,500 UAC	5,664 UAC	836 UAC	87.14%	0	0
4	MOBILISATION EAUX DE SURFACE - (FAE)	P-DJ-EAZ-001	OnGo	5600155001001	29-Jan-08	04-Feb-08	13-May-08	31-Dec-12	0.2	3.3	3.5	4.9	1,937 EUR	1,636 UAC	1,145 UAC	491 UAC	70.00%	0	0
<b>Private sector</b>														<b>57,660 UAC</b>	<b>57,660 UAC</b>	<b>0 UAC</b>	<b>100.00%</b>		
5	DORALEH CONTAINER TERMINAL	P-DJ-D00-001	OnGo	2000120001819	24-Sep-08	15-Nov-09	15-Dec-09	16-Dec-09	13.9	1.0	14.9	4.3	79,343 USD	51,206 UAC	51,206 UAC	-	100.00%		
6	DJIBOUTI BULK TERMINAL PROJECT	P-DJ-DD0-001	OnGo	2000120000115	03-Dec-03	11-Jun-06	23-Nov-06	11-Jun-08	30.7	5.5	36.2	9.1	10,000 USD	6,454 UAC	6,454 UAC	-	100.00%		
<b>Emergency relief assistance grants</b>														<b>655 UAC</b>	<b>655 UAC</b>	<b>0 UAC</b>	<b>100.00%</b>		
	AIDE D'URGENCE A LUX POPULATIONS VICTIMES DE LA SECHERESSE	P-DJ-AAZ-002	OnGo	5000199002518	14-Nov-11	16-May-12	16-May-12	31-Mar-13	6.1	0.0	6.1	1.1	1,000 USD	655 UAC	655 UAC	0 UAC	100.00%		
<b>Total FAD **</b>														<b>18,120 UAC</b>	<b>10,853 UAC</b>	<b>7,267 UAC</b>	<b>59.89%</b>		
<b>Net Total Amount (UAC)</b>														<b>78,071 UAC</b>					
<b>Total Amount Disbursed (UAC)</b>														<b>70,313 UAC</b>					
<b>Disbursement Rate / Net amount approved</b>																		<b>90.1%</b>	
<b>Disbursement Rate / Net amount approved without non effective operations</b>																		<b>90.1%</b>	

**Development Partner Operations in Djibouti's Energy Sector**

<b>Energy Sector</b>	<b>Donors</b>	<b>Type of Financing</b>	<b>Cost (in millions of Djiboutian Francs)</b>	<b>Withdrawals as of 30 Dec. 2011</b>	<b>Withdrawals as of 10 Dec. 2012</b>
Water/Energy Project	IDA	LOAN	1 239	1 240	39
Additional Financing Project for Energy	IDA	GRANT	1 066	53	169
Reinforcement of the Electric Interconnection	EDF	GRANT	3 036	0	0
Solar Energy Project	UNDP	GRANT	8	4	0
Clean Energy Promotion Project – Photovoltaic Solar System	Japan	GRANT	1 193	360	833

### Map of the Project Area

#### Geographic Location of the Site



#### Geological Map Showing Wells Drilled in Previous Campaigns (A1 to A6)

