PROJECT INFORMATION DOCUMENT (PID)
APPRAISAL STAGE

Report No.: AB1277

Project Name	MA- Integrated Solar Combined Cycle Power
Region	MIDDLE EAST AND NORTH AFRICA
Sector	Renewable energy (20%);Power (80%)
Project ID	P041396
GEF Focal Area	
Borrower(s)	N.A.
Implementing Agency	OFFICE NATIONAL DE L'ELECTICITE (O.N.E)
Environment Category	[ ] A [X] B [ ] C [ ] FI [ ] TBD (to be determined)
Safeguard Classification	[ ] S_1 [X] S_2 [ ] S_3 [ ] S_F [ ] TBD (to be determined)
Date PID Prepared	February 15, 2006
Date of Appraisal Authorization	June 19, 2006
Date of Board Approval	September 7, 2006

1. Country and sector issues

Due to a growing population and economic development, Morocco's electricity demand is increasing rapidly. Between 1983 and 2003, electricity consumption grew an average of 6% per year and was met by domestic production and imports from Spain, Algeria and other countries. Morocco's electricity sector has traditionally been the responsibility of the state-owned Office National de l'Electricité (ONE). The need for additional capacity and a desire to control public spending have led the Moroccan government to call more on the private sector to meet the country's power needs.

The main issues include the need for capacity to meet the demands of a growing economy and improved access and whose cost the country should minimize with measures both on the demand and supply sides, the use of imported natural gas for power generation and domestic uses, the lack of resources to finance energy programs and the uncertainties and vulnerabilities created by the over-dependence on imported energy.

Taking these issues into account, the Government has taken a number of measures to address them:

- On the supply side, several privately owned power plants, among which are Jorf Lasfar and Tahaddart power plants were successfully completed. On the demand side, however, there is no coordinated program of energy efficiency and demand management. An ESMAP mission that visited Morocco recently has agreed with the government on a number of studies that should lead to a well coordinated program of energy efficiency and energy conservation in Morocco.
- The restructuring of the power sector:
    - Under the reform proposal, ONE would be transformed into a joint stock company and broken into several entities. Some of ONE's activities will operate in the free market (non-regulated generation and commercial activities) while others will be regulated (regulated generation, transmission and distribution).

Third party access tariffs will be established to encourage the free access to the transmission and distribution networks.

- Imports of natural gas present both opportunities and challenges: Natural gas is gradually being introduced in power generation because it is a cheaper and cleaner fuel compared to alternatives. New power stations are gas fired and the government is evaluating the opportunity of converting older power stations (especially coal fired) to gas firing as well. The challenge is to mitigate the risks attached to a single supply source and the uncertainties attached to the price of gas, especially in a period of volatile oil prices. The energy strategy, to be prepared by the government and financed by ESMAP, would look at possible mitigation measures.
- Reducing vulnerabilities and uncertainties through diversification of sources of supply and supply mix but also through the use of renewable energy and a better use of existing supplies of energy.

Morocco ratified the United Nations Framework Convention on Climate Change (UNFCCC) on the 28th of December 1995. In addition, Morocco hosted the seventh Conference of the Parties to the UNFCCC in November 2001 and ratified the Kyoto Protocol as of January 25, 2002. As a non-Annex I country, Morocco is eligible for financing from the GEF through the mechanisms established by the Convention. The Project has received the endorsement from the GEF Operational Focal Point and is formulated in accordance with national priorities.

2. Project development objective and key indicators

The main objective of the project is to demonstrate and encourage replication of integrated solar combined cycle (ISCC) power generation technology in Morocco and elsewhere in the world.

The proposed project is one of a number of similar projects in the world to be supported by GEF as part of a program to accelerate cost reduction and commercial adoption of large-scale non-carbon emitting generation technologies.

The main global benefits of the project are: (a) the demonstration of the operational viability of hybrid solar thermal power generation in Morocco; (b) contribution to accelerated market penetration of large-scale backstop power generation technologies; and (c) reduction of greenhouse gas emissions from power generation. The carbon savings of the project are estimated at about 575,000 tons of CO_2 over the 25-year economic life of the plant.

The project would also add much needed capacity to the power grid to help cope with the sustained growth in electricity demand, and increase the contribution of renewable energy sources in Morocco's energy mix.

To evaluate the performance of the project in achieving its objectives, the following indicators have been chosen::

- Has the integration of solar thermal power and conventional combined cycle been successful and what have we learned?
- Total electricity generated from solar energy (GWh / year);
- Solar output as a percentage of total energy produced by the hybrid plant (%).
- Cost of solar thermal power (¢ / kWh)
- Reduction in CO_2 emissions (tons / year

3. Rationale for Bank involvement

The Bank's strategy in Morocco is to support policies and investments that encourage economic growth and efficiency through social development, public and private capital investments, environmentally-friendly projects and sound public sector management. In particular, the CAS (2005) identifies the support to the development and quality improvement of infrastructure as a focus for Bank assistance. The proposed Solar Thermal Power Project is specifically mentioned in the CAS as an instrument for furthering this objective. The CAS also put focus on enhancing the conditions for rapid and sustained economic growth and job creation. In a country where the economy is expanding rapidly, a sustained growth is based on the availability of reliable and affordable energy, including electricity. The proposed project would add a much needed generation capacity to the power sector and contribute to the reduction of greenhouse gas emissions (GHG). It is co-financed with the African Development Bank (AfDB), a major partner of the Moroccan power sector. AfDB has already approved a loan of about $160 million towards the financing of the combined cycle power plant which is a major part of the proposed project.

The bidding documents have already been issued by ONE to pre-qualified firms and Bank involvement has attracted serious bidders because of the assurance of a fair competitive process. GEF financial commitment to the project is critical to the removal of barriers to the adoption of grid based solar technologies because of: (a) its significantly higher cost per kW installed, relative to conventional power plants, which is a consequence of the small number of solar thermal power plants that have been constructed, all of them in developed countries; and (b) its technical performance risks, due to limited design and operational experience, none of which is in a developing country context.

Over the long run, it is expected that the cost of the technology will come down due to technical progress and lessons learned from earlier deployment (as in the case of the proposed project). In the Northern Mediterranean "sunbelt", several STP projects are already being planned in Greece, Spain, and Italy through national programs and the support of the EU. Bulk electrical STP transmission from high insulation sites in Southern Mediterranean countries, such as Algeria, Libya, Egypt, Morocco and Tunisia, may also open wider opportunities for European utilities to finance solar plants in that region for electricity consumed in Europe. Reform of electricity sectors across Europe, the rising demand for "green power", and the possibility of gaining carbon credits are increasing the viability of such projects. Finally, research and development work continues in Europe and the United States to further reduce costs by improving such elements as the collector field, receiver tubes, mirrors, etc.

4. Project components

The project includes the integration of a solar trough collector field (of about 200,000 m2) producing a minimum energy output with a traditional natural gas-based power generating unit. The proposed project will be implemented in two phases. The first phase, now well under way, entails the engagement of specialized consultants to prepare a feasibility study, bidding documents, draft contracts, and to advise ONE during the evaluation of proposals. The following phase involves the construction and operation of a solar/fossil fuel hybrid power station of about 200-250 MW with an expected annual net production of 1,538 GWh per year. The solar output is estimated at 2 % of the annual production representing 38 GWh per year. It is expected that the solar thermal power plant will be in service in 2009.

Following an unsatisfactory response to competitive bidding for an IPP, Morocco's public power utility has decided to finance the solar thermal plant itself through an EPC (Engineer, Procure and

Construct) cum O&M (Operation and Maintenance) contract. ONE will thus be the owner of the plant. The O&M contract will last 5 years and include appropriate incentives to ensure an efficient operation of the plant, particularly the solar field.

The timeline up to construction is as follows:

1. Pre-qualification - Done
2. Preparation of bid documents - Done
3. Preparation and submissions of bids (6 months) - Underway
4. Technical and commercial evaluation of offers – May 2006
5. Contract negotiations – June 2006

5. Financing

Source:	($m)
O.N.E.	12
GLOBAL ENVIRONMENTAL FACILITY	50
African Development Bank (AfDB)	154
Total	243

6. Implementation

Consultants partially financed under a GEF PDF C grant, now closed, have assisted ONE in the preparation of bidding documents, draft EPC and O&M contracts and will advise ONE during the evaluation of proposals. This phase, which is still ongoing, is being carried out by ONE's Directorate of Development following an agreed timetable.

The construction and operation of the ISCC power plant will be implemented by an EPC cum O&M arrangement to be secured through international competitive bidding. ONE will have the responsibility for overall project management and ensure the coordination, and the technical and administrative management of the project. The project will be under the general supervision of the Production Department of O.N.E. The Procurement department will work in close collaboration with: (i) the Supply and Markets Department for the procurement aspects; (ii) the Environment and Quality Department for the coordination of the studies and the monitoring of environmental measures; and (iii) the Technical Department for the controls on investment. The Financial Department will be in charge of the project financial management, and the coordination with the various loan/grant providers.

The World Bank will supervise and monitor the implementation of the activities through regular supervision missions and regular contacts with ONE.

7. Sustainability

The higher capital cost of the hybrid plant will be offset by the proposed GEF incremental cost grant and will not require increases in tariffs to consumers. The integration of the solar field with a CCGT is the most efficient technology available. The hybrid power plant is expected to operate sustainably as an integral part of the Moroccan power system. The incentive structure for the EPC cum O&M will ensure optimal design for integration of the solar thermal with the gas-fired plant and maximize solar output from the plant when in operation. Dissemination of information about this demonstration project will contribute to future replication in Morocco and elsewhere and help refine GEF strategy regarding this technology.

The Government is currently engaged in the implementation of strong policy measures that would: (i) open up the electricity market; (ii) rationalize energy pricing to increase the competitiveness of firms; and (iii) promote renewable energy and energy efficiency to reduce the country's energy dependence.

ONE has devoted considerable effort to preparing the proposed project to address growing concerns in Morocco about the adverse environmental impacts of SO_2 and CO_2 emissions from conventional power plants. The Moroccan Government and ONE that will be directly responsible for the project are fully committed to the project's success and sustainability and have already collected a considerable volume of information and data on the construction, operation and maintenance of solar thermal power plants in the US and Europe. ONE power plant staff will be trained in the requisite skills for operating and maintaining a hybrid solar combined cycle power plant during construction and the operation of the plant.

For the proposed project, a large part of the experience gained in operating ISCC projects in the US and Europe will be made available through GEF support. However, implementation and operation of the technology in a developing country still carries appreciable risks. The plant availability factor may be lower during the first year or two than those achieved in overseas projects. Nevertheless, the chance of ultimate success for the project is high as are the global benefits from the dissemination of the technology in Morocco and other countries. The success of the proposed project, which GEF support would promote, is the critical first step in Morocco's and the Northern Africa region's gradual approach for adopting and developing ISSC technology on a large scale. GEF support is also critical to strengthening and speeding up the dissemination and replication strategy.

8. Lessons learned from past operations in the country/sector

No large scale thermal power plants have been built in developing countries to date. GEF-supported projects are now in preparation in Morocco, Mexico and Egypt. The most significant solar thermal installations are in California where 354 MW of parabolic troughs, with backed-up gas fired steam boilers, have been generating electricity and selling it to the utility for about 15 years.

To meet the cost reduction objective of the project, it is necessary to move beyond the trough/back-up boiler design upon which the California project is based. The purpose is to permit higher thermal efficiencies, improve the dispatching of the plant and encourage greater competition in the design and supply of the equipment. Such a plant would be more attractive to utilities, thus increasing the market size. For this reason the project includes the following features: (i) bidders will be allowed to choose among manufacturers for the parabolic trough designs and the gas-fired power equipment; (ii) competition will be key, to ensure that the lowest electricity cost possible and, whenever possible, locally manufactured components; and (iii) the contractor will have incentives to maximize output from the solar field, which will bring about a focus on O&M costs, thus bringing down life-cycle costs.

To accelerate utility acceptance of a power generation technology based on intermittent energy sources such as solar or wind energy, a way must be found to provide reliable backup and enable the delivery of firm power. The project integrates the STP plant with a gas-fired power plant such that continuous generation by the hybrid plant is possible regardless of the solar radiation intensity at any particular time. Furthermore, more efficient construction, financing and operation can also be expected as a result of private sector involvement in the EPC and operation and maintenance contracts.

9. Safeguard Policies (including public consultation)

Safeguard Policies Triggered by the Project	Yes	No
Environmental Assessment (OP/BP/GP 4.01)	[X]	[ ]
Natural Habitats (OP/BP 4.04)	[ ]	[X]
Pest Management (OP 4.09)	[ ]	[X]
Cultural Property (OPN 11.03, being revised as OP 4.11)	[ ]	[X]
Involuntary Resettlement (OP/BP 4.12)	[X]	[]
Indigenous Peoples (OD 4.20, being revised as OP 4.10)	[ ]	[X]
Forests (OP/BP 4.36)	[ ]	[X]
Safety of Dams (OP/BP 4.37)	[ ]	[X]
Projects in Disputed Areas (OP/BP/GP 7.60)*	[ ]	[X]
Projects on International Waterways (OP/BP/GP 7.50)	[ ]	[X]

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* *By supporting the proposed project, the Bank does not intend to prejudice the final determination of the parties' claims on the disputed areas*