PROJECT EXECUTIVE SUMMARY 39070

REQUEST FOR CEO ENDORSEMENT

GEFSEC PROJECT ID: 647
AGENCY'S PROJECT ID: P041396
COUNTRY: Morocco
PROJECT TITLE: Integrated Solar Combined Cycle Power Plant
GEF IA/ExA: The World Bank
OTHER PROJECT EXECUTING AGENCY(IES): Office National de l'Electricite (O.N.E.)
DURATION: 6 years
GEF FOCAL AREA: Climate Change
GEF STRATEGIC OBJECTIVES: S5
GEF OPERATIONAL PROGRAM: OP 7
COUNCIL APPROVAL DATE: May 1999
COUNCIL APPROVED AMOUNT*: 43.2 M
CEO ENDORSEMENT AMOUNT*:43.2 M
ESTIMATED STARTING DATE: February 2007

FINANCING PLAN ($)			
		PDF	Project
GEF	A		43,200,000
	B		
	C	700,000	
GEF Total		700,000	43,200,000
Co-financing		(provide details in Section b: Co-financing)	
GEF IA/ExA			
O.N.E.			16,280,000
AfDB			160,130,000
Co-financing Total			176,410,000
Total		700,000	219,610,000
Financing for Associated Activities If Any:			

Approved on behalf of the *World Bank*. This proposal has been prepared in accordance with GEF policies and procedures and meets the standards of the GEF Project Review Criteria for CEO endorsement.

Steve Gorman
GEF Executive Coordinator
Date: November 15, 2006

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1. **FINANCING**

a) Financing Plan

Sources of Fund	
Classification	**Amount ($)**
GEF Grant	43200000
Bilateral/Multi-lateral donors	160130000
Implementing/Executing Agency	16280000
Total Sources of Funds	219610000

Uses of Fund			
Project Components/Outcomes	**GEF ($)**	**Co-financing ($)**	**Total ($)**
EPC cum O&M contract	43200000	142190000	185390000
Transmission lines		11240000	11240000
Substations		9040000	9040000
Access Road		3800000	3800000
Boreholes		350000	350000
Land acquisition		870000	870000
Gas pipeline		1510000	1510000
Environment and social dev. & Mangt		2310000	2310000
Consulting services		5090000	5090000
Total Uses of Funds	43200000	176410000	219610000

b) **Co-financing** (indicate if cash or in-kind)

Name of Co-financiers (source)	Classification	Type	At Work Program (million $)	At CEO Endorsement ($ million)*
IA	Multilat. Agency	Cash	0,35	0
Other International	Multilat. Agency	Cash	0.53	0
Government	Nat'l government	Cash	0.18	0
Private sector	Private sector	Cash	69.40	0
O.N.E.	Exec. Agency	Cash		16.28
African Development Bank	Multilat. Agency	Cash		160.13
Total Co-financing			70.46	176.41

* Reflect the final commitment amount of co-financiers and attach documents from co-financiers confirming co-financing commitments. Describe any difference of final commitment compared to those expressions of interest at concept stage or at work program inclusion.

2. RESPONSE TO REVIEWS

a) COUNCIL

The replicability is considered very high but I feel that this is too optimistic given the low fossil fuel prices. As the STAP review suggests, the costs per ton CO2 emissions avoided are over US$170 and thus extremely high. The capital costs are also very high and it is debatable whether a substantial decrease would be possible. In this respect, I would like to note that the GEF response to the STAP Technical Review is acceptable except the point on the likely medium to longer term cost reductions which can be expected for this technology.. From the point of view of GEF procedures and criteria, there is no reason to withhold approval of the project. The Council comment was made in 1999 when oil prices were low. The picture has since dramatically changed with persistently high oil prices. The price of oil has more than doubled between 2000 and 2006 by moving from $30 a barrel in 2000 to about $70 a barrel in 2006. As more ISCC power plants come on stream, the high capital cost is likely to go down due to learning and economies of scale. The prospects of capital cost reduction are analyzed in a recent study[1] undertaken by the World Bank GEF Program which is summarized in Annex 18 of the Project Document. The three projects being supported by GEF are not an isolated experience, as other projects are being developed worldwide. For example, Algeria has recently signed a contract with a Spanish firm to build, own and operate a hybrid solar combined cycle power plant and several ISCC plants are under development in Spain. Many factors have an effect on the cost of power: plant configuration, including size, location, solar resource, financing structure, and tax incentives. While, for example, increasing plant size offers the easiest opportunity for reducing the cost of power, there are a number of technological advances that are coming on stream that can also reduce costs significantly such as increasing the collector size (if sufficient land is available) and improvements in receiver coatings, etc. (paras. A2 and B6, and Annex 18 of the GEF Project Document, pp. 8-9).

Providing a 40% contribution for a plant with a capacity of 150 MW seems incompatible with the general guidelines for government intervention in the electric power sector. OECD members as a whole have ceased to develop such plants, because individual countries cannot afford them. The plants are likely to prove economically non-viable in light of current prices per barrel and probable price trends over the next 10 years. Consequently, the World Bank should provide further justifications and arguments in support of its decision, and a project such as this needs to be modified, because as it stands it has more to do with very long-term research than with the development of a beneficiary country. The size of the plant is 227 MW and is co-financed by O.N.E., the African Development Bank (AfDB) and GEF. Their respective share in the financing of the project is 7, 73 and 20 percent. OECD countries such as Spain and the United States are developing solar thermal as well as hybrid solar thermal combined cycle power plants. As stated earlier, the current price of the barrel of oil is quite high and the latest price projections predict that they will remain high. Furthermore, the solar thermal and the combined cycle power technologies are well proven and in use in several parts of the world. Their integration does not pose a special technical problem and the technology is well past the research stage. The technology is slowly being integrated in power sector expansion plans. As already

[1] World Bank GEF Program: *Assessment of the World Bank/GEF Strategy for the Market Development of Concentrating Solar Thermal Power*, Washington D.C. 2006

mentioned, Algeria has recently signed a contract with a Spanish firm for an IPP based on the hybrid integrated solar combined cycle power technology. (para. 3 of the GEF Project Document, pp.4)

Solar thermal power has been proven technologically viable in California (about 354 MW installed and operated since the mid 80's which compares to the total 120 NEW SPV potential production per year. There it serves as a peak generation power production (cooling loads are maximum during day). Its cost per unit of peak power installed is significantly less than Solar Photovoltaic. For various reasons, this technology has not been replicated on a large scale in recent years. There are various developments at research stage for different technologies of solar thermal based power generation as well as system integration.

Solar thermal power generation is a very promising technology for the 21st Century.

Main Concerns

1) Fossil fuel cost:

- *Located on the gas pipeline, the gas is actually extremely cheap. The incentive to run a solar plant are somewhat artificial. A contract will define conditions for the minimal solar output to be met. With the present political willingness, it may work fine, but it may change.* As stressed earlier, oil prices are high and rising and there is therefore a very strong incentive to maximize generation from the solar component. Furthermore, there are penalties in the EPC cum O&M contract for not meeting target generation from the solar component (Para. B4 and B5 of the GEF Project Document, pp. 6 and 8). As part of the bidding process, firms are obligated to fill out and submit a detailed technical and financial model that includes penalties for not meeting operating and performance targets for the solar component).

2*) Site selection:*

- *The foreseen location shows about 20-25 % less solar irradiation than the optimal sites in Morocco. Even if preliminary studies show that the site is optimal, it would be of interest to reconsider that when performing a detailed feasibility study. No integration of the power plant with any large scale industry requiring heating/cooling has been mentioned.* The pre-feasibility study financed by the European Community (EC) provided the economic analysis for the 11 alternatives studied at the Jerada and Ain Beni Mathar sites. The alternative at Ain Beni Mathar (about 80 km south of Oujda), which provided the lowest levelized tariff and the highest rate of return, was selected. The selection also included criteria about the sun level, the availability of cooling water, and the location with regards to the electricity grid and gas network. The solar field is integrated with a combined cycle power plant to produce more electricity to feed into the grid to satisfy demand. (para. B6, pp.8 of the GEF Project Document). The solar thermal technology could be used separately (i.e. without the combined cycle power plant) to supply industries requiring heating or cooling in their process. This is however not the case in this project. The main purpose of the heat generated by the solar field of the Morocco Integrated Solar Combined Cycle Power Plant is to generate electricity. This

electricity is fed into the national grid and used by a variety of domestic, commercial and industrial users and is not intended to meet a specific industry's requirements.

3) Information exchange:

- *For a project of this size, and with such GEF contribution, no systematic exchange of information has been described (to the knowledge of reader). There are other similar projects in the pipeline (India, Egypt, …) which would ideally be coordinated with this one. For practical reasons (different national mechanisms) it may be difficult to do so, but at least monitoring and lessons learned out of the various projects should-be shared.* Dissemination of experience and lessons learned and encouraging the sharing of knowledge about the construction and operation of the proposed Morocco Integrated Solar Combined Cycle Power Plant is at the heart of the comprehensive monitoring and evaluation plan, including quantitative and qualitative indicators, that has been put in place. (Paras. B2 and B3, pp. 5 and 6; Para C3, pp. 10 and 11, and Annex 3, pp. 29, 30 and 31 of the GEF Project Document).. Furthermore, the three Bank teams involved in the preparation of the Mexico, Egypt and Morocco projects are closely working together and exchanging their respective experience as they prepare these projects for GEF approval.

4) Technological choice, bidding process:

- *The technological choice will be left to the project developer. This bears an important risk. The normal procedure is to award the contract to the lowest bid. In such a project, and depending on the technical options, the lowest bid may not be the best choice.* The bidding for the project was done in two stages: In the first stage, bidders responded to broad specifications of the desired power plant. A conference was held with the bidders at the end of which new specifications, representing a broad consensus, were issued to bidders who were invited to submit technical and commercial proposals for the second stage. Concerning the contract award, the normal procedure is to award the contract to the lowest ***evaluated*** bid. This means, in particular, that the bid with the lowest price will not necessarily be awarded the contract because there are technical and commercial conditions to be met as well. Therefore, having the lowest price is no guarantee that a bid will win a contract. (Para. A2, pp. 3 and B6 of the GEF Project Document, pp. 9)

5) Impact in the region:

A project of this size should not hamper the development of other smaller scale initiatives in the same technology. Integration of power plant with industrial processes even though difficult at a large scale present a bright future for solar thermal power generation with cogeneration applications. We agree with the Council member's concern that the project should not hamper the development of other smaller scale initiatives using the same technology. However, we do not, for our part, see a crowding out of smaller uses of the technology which is at a very early stage of development in Morocco. We also agree with Council that the integration of solar thermal with a combined cycle power plant to produce more electricity is only a first step in the use of a very promising technology.

b) REVIEW BY EXPERT FROM STAP ROSTER

" ……the O&M contract should contain appropriate incentive structure for both maximizing the total plan reliability as well as maximizing the utilization of the solar field over the long term. The PAD only discusses the latter issue, but the O&M contract will need to address both issues…" See Section B. Para. 4 and 5 of the GEF Project Document. Please see also our answer to the council member's concern on fossil fuel cost above.

" ……Finally, the use of only pre-qualified bidders is likely to allow the selected EPC contractor and key suppliers to capture technology and organizational learning effects that are essential to achieving long-term cost reductions for solar thermal power." See Section C. Replicability. Long-term cost reductions in solar thermal power will result from three factors: reduced component costs due to increased manufacturing volume, economies of scale from increased plant size, and technological improvements. The experience gained by one EPC contractor has a minor effect on competition and cost reduction over the long term.

"……One question that this reviewer could not assess from the PAD is whether the bidder prequalification includes the potential manufacturers of the solar collectors and heat collection elements." The prequalification of consortia that have both combined cycle and solar thermal power experience ensures the effective integration of the solar field and the combined cycle power plant. Section A. Para 2 and Section B, Para. 4.

"….As the technology selection will be left to the EPC Bidders, who will all be pre-qualified, the bid documents must establish minimum requirements for the solar thermal steam raising component to ensure that the minimum solar share target can be met. Effective integration of the steam systems for the solar thermal field and the gas-fired combined cycle plant is essential to achieving significant cost reductions and proper performance of the power plant." Section B. Para. 4. Please see also our answers to the council member's concern on fossil fuel cost and to STAP reviewer's question 12 below.

" ….. The selection process should review plant designs to ensure that the plant operates effectively in all modes. In particular, integration and control of the system should allow the solar contribution to be consistently maximized. In addition, the system should allow power to be efficiently generated on natural gas only, if required (during nighttime or if the solar field is not operational)." Included in the bidding documents and the Engineer, Procure and Construct (EPC) and Operation and Maintenance (O&M) contract.

"……. the O&M contract should contain appropriate incentive structure for both maximizing the total plant reliability as well as maximizing the utilization of the solar field over the long term. " See Section B. Para. 4 and 5, pp. 6 and 8 of the GEF Project Document. Please see also our answer to the council member's concern on fossil fuel cost above.

"……...strong importance needs to be placed on training of O.N.E. power plant staff in the requisite skills for operating and maintaining an ISCC power plant during the construction and initial operation of the plant." We agree. A strong emphasis has been placed on O.N.E.'s staff training in various aspects of the ISCC technology and an indicator has been included in the

monitoring and evaluation (M&E) plan. Staff training is included in the EPC cum O&M contract. Section B. Para. 3 and 4, and Annex 3.

"……. In addition, successful implementation of the Project should provide local manufacturing and job opportunities within the region," Agree. The project provides jobs and economic activities in the region. The development of local manufacturing should be left to the private sector and is likely to evolve over time.

3. MAJOR CHANGE SINCE WORK PROGRAM ENTRY

The project was approved in May 1999 as an independent power producer (IPP) scheme. The major change that has occurred is that following an unsatisfactory response to a competitive bid for an IPP, Morocco's public power utility decided to finance the integrated solar thermal combined cycle power plant itself through an Engineer, Procure and Construct (EPC) cum Operation and Maintenance (O&M) contract. The actors have therefore changed and so have the scope and the cost of the project. The capacity to be installed at work program was 150 MW. Demand for electricity has increased substantially since then and the new capacity of the combined cycle power plant is now 227 MW. The total cost of the project has nearly doubled. It was expected to be $114.36 million at work program entry, and it is now estimated at $219.61 million. The co-financing from other sources has more than doubled. It was estimated at $70.46 million at work program. It is now about $176.4 million.

4. REQUIRED ATTACHMENTS

a) Project Appraisal Document
b) Confirmed letters of commitments from co-financiers (with English translations)