



Global Environment Facility

GEF/C.23/Inf.9
April 22, 2004

GEF Council
May 19-21, 2004

SOLAR THERMAL PORTFOLIO: A STATUS REPORT

(Prepared by the World Bank)

World Bank-GEF Solar Thermal Portfolio: A Status Report

Introduction

1. Given the concerns expressed within the GEF Council, the GEF Secretariat, and the World Bank regarding the slow preparation of the GEF co-financed solar thermal project portfolio, the World Bank has prepared this status report.
2. Solar thermal technology has been demonstrated, for example in California, over the past 15 years. However, integration with a combined cycle gas turbine (CCGT) – the preferred choice for a hybrid in the World Bank-GEF solar thermal portfolio– has not been demonstrated. Such integration is important commercially, since it enables continuous operation (of the hybrid) regardless of solar radiation conditions and offers higher efficiencies than other hybrid options.
3. A cost reduction study for solar thermal power plants (Enermodal Engineering, May 1999) was commissioned in collaboration with the GEF Secretariat to determine the viability of long-term cost reductions for the solar thermal technology. The study concluded that a phased approach for market development should be adopted, in which projects would benchmark the costs and provide an initial opportunity for cost reduction. The study estimated that a target solar levelized energy cost (LEC) of 10-11 US cents/kWh could be reached for solar thermal projects during the first phase.
4. The World Bank-GEF solar thermal portfolio consists of projects in four countries – Egypt, Morocco, India, and Mexico – with a total solar capacity of around 120 MW.

Paper Objectives

5. The main objectives of this note are to (a) provide Council with an update on the progress of each of the four projects; (b) establish a firm timetable for the steps needed to complete preparation and appraisal; and, (c) assess whether and how the portfolio would achieve the objectives of GEF Operational Program #7.

Current Status of Portfolio Projects

India Solar Thermal Power Project (The Mathania Project):

6. The project entered the GEF work program in 1996 (GEF grant of \$49 million). It was endorsed by the GEF CEO in 2002. In September 2003, the Rajasthan Renewable Energy Corporation (RREC), with KfW's assistance, came to the end of an 18-month long bidding process, without receiving any proposals to build the Mathania project -- the International Competitive Bidding (ICB) for the project Engineer-Procure-Construct (EPC) had already been postponed four times at the request of the bidders. Initially, there were three consortia, but one dropped out in February 2003. The remaining two interested consortia had the same company providing the solar portion.

7. In parallel, the Bank completed its appraisal of the proposed Mathania project in February 2004, which raised questions about whether the project is economic or cost-effective. The information provided to the Bank, in the course of appraisal, indicated that the investment for the project is twice as much as the equivalent conventional cycle power plant and the resulting overall levelized energy cost (LEC) is approximately 40% higher than the energy produced by a conventional combined cycle gas plant in India.

8. In the Bank's assessment, the grant provided by GEF for the Mathania project would not be sufficient to reduce the resulting overall LEC to competitive prices. The overall LEC for the project, including the GEF grant, would be about INR 3.49 per unit, while the competitive price in the region is INR 2.5 per unit. In order for the power from Mathania to be competitively priced, a substantial further subsidy, in addition to the GEF grant, would be required. However, this is significantly due to the factors specific to locating a CCGT power generation plant in Mathania.

9. Discussions are currently underway between the Bank and KfW on finalizing the appraisal. The decision by Bank management to present the project to the Board would be taken if the concerned parties submit additional information that modifies the basis for the Bank's appraisal.

Morocco Solar Thermal Project

10. The Morocco project entered the GEF work program in May 1999 (with a GEF grant of \$44 million). The project is now being developed on an EPC basis with an O&M contract, following a lack of response to the request for expressions of interest on an Independent Power Production (IPP) basis. The GEF Secretariat was informed of this change of design, as compared to the project brief approved by the GEF Council, and has communicated its no-objection to this change. The African Development Bank (AfDB) has indicated its strong interest in financing this project and discussions are currently underway. The consultant contract has been amended to reflect the change from IPP to the EPC model and work is ongoing on the preparation of the pre-qualification document and bid document for the EPC and O&M contracts. Pre-qualification documents are to be issued by May 2004 and the bid documents will be issued by October 15.

Mexico Solar Thermal Project

11. The Mexico solar thermal hybrid project entered the GEF work program (with a GEF grant of \$49 million) in December 1999 as an IPP project at a specific site in Mexicali to be procured in conjunction with the planned Mexicali II Combined Cycle Gas Turbine (CCGT) Project IPP. As the Corporación Federal de Electricidad (CFE) prepared the details related to the bidding process and package, the project suffered significant delays due to (a) Mexico's constitutional least-cost requirement prohibiting *ex-ante* commitment to procuring a solar-thermal hybrid; (b) incompatibilities between the CFE bidding procedures for IPPs and the Bank procurement guidelines; (c) delays in the need for the Mexicali II project due to lower than anticipated power demand growth and, (d) Mexico's legal requirement that CFE cannot put a

package out for bid until there are assurances that the required financing (including the GEF grant) has been committed.

12. Government of Mexico is now proposing a public sector solar-thermal hybrid under CFE's "Obra Publica Financiada" (OPF) scheme. OPF is essentially a build-transfer scheme, where CFE contracts for the engineering-construction-commissioning of the plant under detailed specifications and then buys the asset from the builder upon commencement of operations. Under this scheme, the turn-key contractor is responsible for securing construction finance

Egypt Solar Thermal Project

13. The Egypt project design, also specified in the concept stage as an IPP, has incorporated the lessons learned in the other examples, and has been modified to an EPC approach with an O&M contract for the first 5 years of operation to mitigate the technological risks for the owner of the plant. The Government of Egypt remains very committed to the project as evidenced from the inclusion of the project in its least cost expansion plan and understands that the changed concept is subject to securing public financing (the Government of Egypt has entered into advanced discussions with KfW, EIB, JBIC and IBRD). The EPC/O&M contractor would be selected under international competitive bidding procedures. This project has been submitted for inclusion in the May 2004 Work program (with a GEF grant of \$50 million).

Portfolio Assessment

14. The following section reviews the solar thermal portfolio to assess the progress towards the goals of Operational Program #7 (OP7). A recent STAP review has concluded that the original guidance on OP7 failed to consider that all projects with innovative low-GHG technologies under OP7, in addition to the technological hurdles, are also exposed to the typical barriers that occur with the more established low-GHG technologies under Operational Programs 5 and 6. The neglect of these barriers resulted in a focus of many projects on the financing aspects, rather than a balanced removal of all barriers, including the remaining transactional, informational, and capacity-related aspects. In this respect, the solar thermal portfolio offers a variety of lessons:

(a) Project preparation: All projects have taken a very long time for project preparation as Independent Power Projects (IPPs) and are now being developed or proposed as public sector power plants. Three of the projects (India, Morocco and Egypt) would be built on an EPC basis with O&M contracts, and the fourth project (Mexico) would use a modified EPC approach –the successful bidder would arrange project financing and build the plant which would then be transferred to CFE. The lack of success of the IPP approach seems to be the result of risk aversion to this new technology (requiring relatively high investment for the hybrid projects) in the private-sector, coupled with the general global decline in IPP interest in developing countries.

(b) Co-financing: Securing full co-financing is a key feature, as all projects are now being developed as public sector power plants. Of the four projects, three (Mexico, Morocco, Egypt)

have yet to finalize co-financing arrangements, although Morocco and Egypt have reached advanced stages of securing co-financing. The India project still faces a potentially significant financing gap despite KfW and GEF's funding commitments.

(c) Procurement: There are a limited number of consulting firms and suppliers in the solar thermal technology industry. This is evidenced by the fact that the engineering design of three of the four projects is being carried out by the same firm. In addition, consultations carried out by the four utilities, as well as their requests for interest, and the experience with the India ICB suggest that there are probably only one or two suppliers of the solar thermal power technology. In this regard, it is also worth noting that about 15% by value of the solar thermal components is covered under intellectual property protection. This would imply that procurement could become a major issue in these projects. In the case of the India project, the reluctance of power-plant bidders to assume the liability for under-performance of the solar thermal component has resulted in no bids being received, and could become a constraint in the other three projects as well. Since the solar contribution in all the projects is in the 6-10% range, the lead in all the bids for these hybrid projects would be taken by mainstream power generation firms. Consequently, an assessment of the risk perception of the bidders, and of possible risk reduction strategies would be required. Considerable transactional experience has been and is being provided by the India project and the other project teams are constantly absorbing these lessons.

(d) Progress Towards Cost Reduction: The experience thus far has increased the knowledge base related to development of solar thermal projects in developing countries. But progress towards cost-reduction can only be evaluated with a fair degree of confidence when the contracts are negotiated and awarded to selected bidders. Preliminary information suggests that phase 1 targets for cost reduction (i.e, solar LEC of US\$ 10-11 cents/kWh) set-out in the cost reduction study are achievable for Egypt, Mexico, and Morocco and that the overall LEC is likely to be competitive and meet financial appraisal criteria.

Project Milestones

15. World Bank management, as part of its portfolio oversight and quality assurance responsibility, has expressed concerns about keeping the four solar thermal projects in the pipeline in the light of their lengthy preparation period. The World Bank and GEF Secretariat have agreed that, although preparation has been longer than normal, the potential impact of the solar thermal projects is also significantly greater and that there are important lessons to be learned by continuing with the preparation of the projects.

16. Nonetheless, it is also necessary to assess the feasibility and cost-effectiveness of further developing the projects, given the delays and costs incurred. Prudent portfolio management suggests that there be no further delays. To that end, the World Bank undertakes to deliver a firm timetable for the steps needed to complete the preparation and appraisal of the projects, with the understanding that if any milestones are significantly delayed, consideration would be given to dropping the project. Three key milestones have been considered in preparing this timetable: (1) securing full co-financing; (2) selection of the bidder for the EPC contract; and (3) presentation of the project to the Board of Executive Directors of the World Bank.

17. The World Bank will also assess the cost implications of pursuing the solar thermal portfolio. The average elapsed time for the World Bank-GEF portfolio, from GEF Council approval to Board approval is 1.6 years. The average elapsed time for the solar thermal projects is likely to range from six to eight years and they could substantially exceed the average cost of project preparation and appraisal. As progress and costs against the milestones are monitored, the World Bank may seek Council's approval for supplemental fees for the solar thermal portfolio.

| Project | Co-financing in place | Selection of Bidder | Board Date |
|---|------------------------------|----------------------------|---------------------------|
| India : Mathania Integrated Solar Thermal Project | June 30, 2004 | TBD | TBD |
| México: Hybrid Solar-Thermal | September 30, 2004* | March 30, 2005** | September 30, 2005 |
| Egypt: Solar Thermal Hybrid Project | October 31, 2004 | October 15, 2005 | December 31, 2005 |
| Morocco: Solar Thermal Project | September 30, 2004 | September 15, 2005 | November 30, 2005 |

* For the Mexico project, formal designation of CFE as the project sponsor would be the first milestone

** For the Mexico project, appraisal of the OPF bid package precedes the bidding process