

Project Name Mexico-Hybrid Solar Thermal Power Plant(@)

Region Latin America and Caribbean Region

Sector Energy

Project ID MXGE66426

Borrower(s) Government of Mexico

Implementation Agency Comision Federal de Electricidad
Reforma 164
Col. Juarez
06600 Mexico, D.F.
Eduardo Arriola Valdes
Senior Vice-President
Phone: (525) 705-38-98

Environment Category B

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Country and Sector Background:

The recently published CAS emphasizes the need for greater competition in the provision of the infrastructure services, especially electricity, and to improve the financing base of the environment. A major objective is to remove obstacles to sustainable growth and to maintain macroeconomic stability with the context of globalization. Removing impediments to private sector growth and competitiveness and ensuring the provision of quality infrastructure are seen as important contributors to this objective. The project will act as an important vehicle for the Bank Group to perform in its role as a catalyst for progress towards structural reform in the electricity subsector both directly and with the provision of a supporting advisory and institutional development work. It also contributes to the environmental objectives set out in the CAS, which seeks to identify 'win-win' investment opportunities that have global environment as well as national economic benefits.

Project Objectives:

The domestic development objectives of the project are to: (a) increase the contribution of renewable energy sources in Mexico's future energy mix, (b) enhance participation of the private sector in Mexico's power development plan in general and in innovative approaches to power production in particular, and (c) position Mexico as a world leader in the commercialization of a major environmentally benign technology and as a potential source of expertise, equipment and technology for future Solar Thermal Power (STP) projects.

The global environmental objective is to reduce greenhouse gas emissions in power generation by accelerating the commercialization of the STP industry globally. The project would contribute to this goal by demonstrating the technical viability and environmental benefits of a solar thermal/combined

cycle hybrid power plant under normal utility-based operational conditions.

Project Description:

The proposed project would involve the construction of a solar thermal/natural gas-fired hybrid power plant in Baja California Norte with a total net installed capacity of about 300 MW, including about 30 MW for the solar component. The plant would be part of Comision Federal de Electricidad (CFE) system expansion plan under which up to 500 MW each of combined cycle gas turbine systems would come online in year 2004 in the sites of Laguna or Hermosillo, and in 2005 in Cerro Prieto. The proposed hybrid power plant would be developed by an IPP through a Build Own Operate (BOO) contract with CFE, which will purchase capacity and energy under an appropriate Power Purchase Agreement (PPA). CFE will require prospective bidders for the planned conventional combined cycle plant to add a solar field to the plant, for which up to US\$50 million of grant assistance from GEF would be made available.

Project Financing:

On a preliminary basis, it is estimated that the total cost of the project will be about US\$180 million, of which about US\$50 million would be provided as a grant by the Global Environment Facility (GEF) to the selected private company and \$1 million to the Government for capacity building activities. The balance of investment costs would be the responsibility of the private company. No Bank loan will be provided. The grant will be provided under GEF's Operational Program 7 that deals with the reduction of the long-term costs of low greenhouse-gas emitting technologies. The Program aims to accelerate market penetration of several large-scale backstop technologies, such as solar thermal power and wind power, that presently are constrained by high capital costs and high commercial risks.

Project Implementation:

Several activities have been undertaken in Mexico relevant to the preparation of the proposed project. In the period 1994-96, the American consulting firm Spencer Management Associates (SMA) prepared for CFE a pre-feasibility and then a financial and technical feasibility for five possible plant configurations ranging from 128 MW to 326 MW, located in Northern Mexico. This study was updated by CFE in 1998, using more recent component and fuel costs. The Renewable Energy Department of CFE has installed in the period 1991 to 1996 ten solar monitoring stations in Northern and Central Mexico, which record hourly information on solar radiation. The information is processed periodically and compared with information from US solar stations located in Southern California and Texas. In 1999, a GEF PDF-B preparation grant of US\$350,000 was obtained, largely for a new consultant study that would update the SMA study for the specific plant scale and site, as well as to provide expert assistance to CFE in the preparation of bidding documents for the hybrid plant.

Project Sustainability:

The hybrid scheme would have a generation cost at least 10% higher than a pure combined cycle plant. However, it is estimated that generation cost parity could be achieved by providing a grant of about US\$50 million to the project which effectively finances the uneconomic portion. Therefore, operation of the

hybrid plant would be financially sustainable. Technically, the project is not expected to have any problems. It will utilize the parabolic trough technology, which has been technically proved through operation for over a decade of more than 350 MW of Solar Electric Generating Stations (SEGS) in California.

Bids for the project would be solicited in mid-2000. Independent Power Producers (IPP) bidders will be provided all information generated by the 1999 consultant study, as well as the previous SMA and CFE studies. CFE will require that the plant to be built include a solar component for which a grant of up to \$50 million would be provided to the selected company. The contract will be awarded in 2001 for the plant in Laguna or Hermosillo and programmed to come online in 2004. Project appraisal will be made after the IPP is selected in mid-2001.

Lessons Learned from Past Operations:

No large-scale solar thermal power plants have been installed in developing countries so far. However, GEF-assisted demonstration STP projects are currently being prepared in India, Morocco and Egypt. The most significant STP installations are in California where 354 MW of solar parabolic troughs backed up by gas-fired boilers have been generating electricity and selling it to the utility for at least a decade. From this experience and other of a broader nature, the following lessons have been learned and reflected in the proposed project:

a) 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.

b) To achieve cost reductions in STP technology and hence accelerate their commercialization, there is need to move beyond the original LUZ design of a hybrid Rankine cycle plant to one with much higher thermal efficiency.

A number of technical improvements have been made to the original LUZ-designed solar parabolic trough field, in which lead to lower capital cost, improved availability, reliability and performance and reduced O&M costs. Further improvements to costs will be achieved by better hybridization designs, including the Integrated Solar Combined Cycle system design which employs a gas turbine operating in combined cycle mode. More efficient construction, financing and operation can also be expected as a result of private sector involvement.

c) The GOM recognizes that the continuing investment required in Mexico's power sector is unsustainable with public borrowings alone. It had begun to open up the sector to limited private investments in 1992 and has recently proposed allowing full private participation in generation, transmission and distribution of electricity.

The project will be designed as an Independent Power Producer (IPP) project under a Build-Own-Operate (BOO) scheme. Bidders will be informed in advance

that GEF grant assistance will be provide to finance the incremental cost of adding a solar component to the CCGT plant.

d) To achieve significant reductions in the capital cost of STP plants, an effort must be made to maximize local manufacture of plant components.

Mexico has well-developed industrial base and has the potential to locally manufacture up to 40% of the plant components (Spencer Management Associates 1994). Mexican companies are already manufacturing parabolic collectors for the LUZ installations in California.

Environmental Aspects:

The construction of the proposed project will not require any forced displacement of people in the area, as the selected sites are located away from populated areas. The project will not have any indirect negative social impacts in the surrounding areas either. The benefits to the environment include the avoidance of emissions of green houses associated with fossil fuel-based thermo-electric generation, including CO₂, SO₂, NO_x, methane, suspended particles, etc, which have local and global repercussions. As part of the final studies to be executed prior to solicitation of proposals, CFE will prepare social and environmental studies, following Mexican requirements and World Bank guidelines for thermal electric power plants. The proposed project has been cleared by the Bank's Quality Assurance Team for an EA Category "B", subject to certain provisions.

Program Objective Category:

Environmentally Sustainable Development, and Economic Management -

Poverty Category: This project will not be included in the Program of Targeted Interventions.

Contact Points:

The InfoShop
The World Bank
1818 H Street, NW
Washington, D.C. 20433
Telephone: (202) 458-5454
Fax: (202) 522-1500

Task Manager
Ernesto Terrado
The World Bank
1818 H Street, NW
Washington, D.C. 20433
Telephone: (202) 473-3252
Personal Fax: (202) 614-0239

Note: This is information on an evolving project. Certain components may not be necessarily included in the final project.

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Annex

Because this is a Category B project, it may be required that the borrower prepare a separate EA report. If a separate EA report is required, once it is prepared and submitted to the Bank, in accordance with OP 4.01, Environmental Assessment, it will be filed as an annex to the Public Information Document (PID) .

If no separate EA report is required, the PID will not contain an EA annex; the findings and recommendations of the EA will be reflected in the body of the PID.