REToolKit Case Study

México: Large Scale Renewable Energy Development Project

(Phase 1 -$25M, Phase II - $45M)

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1. Introduction

The World Bank, with GEF assistance, is working with the Government of México to accelerate the commercialization of renewable energy applications and markets, particularly at the grid-connected level, in order to reduce greenhouse gas (GHG) and other emissions while responding to increasing energy demand and energy diversification imperatives necessary for sustainable economic growth. This project stemmed from project architecture described in the WB/GEF Strategic Partnership for Renewable Energy, which sought to explore larger-scale, more programmatic approaches to Renewable Energy projects (OP6) through combining policy interventions with technical and market approaches, and supporting them over an adequate period of time to encourage technology experience and market development. Although the country has not yet determined itself to adopt an energy policy requiring a mandated market share for renewable energy, the intent of the program is otherwise somewhat analogous to the China CRESP project, also undertaken under the WB/GEF Strategic Partnership. Together, these two projects will significant broaden World Bank and GEF experience in stimulating grid-scale renewable energy technology and policy.

2. Project Design: The project supports a long-term, two-phased approach to the development of sustainable grid-scale renewable energy investments in México by:

- Opening avenues for direct IPP sales to CFE at prices that increasingly recognize the full value of renewable resources - including intermittent resources - to the system.
- Removing risks and transactions costs barriers currently limiting private projects serving municipals under self-generation markets.

To achieve these objectives, the project proposes a two-phase approach to address key policy and tariff issues currently hindering renewable energy development, and facilitate initial investments in grid connected wind energy:

- A “Fondo Verde” (Green Fund) to support initial projects and stimulate organizational learning and cost reduction,. This fund will provide approximately US$17-20 million in energy production incentives offered in conjunction with a CFE competitive solicitation for IPP wind power; and
- Technical Assistance activities of approximately US$6-7 million to address analytical and policy barriers, and provide business development assistance to stimulate and facilitate project investment and overcome initial investment barriers.

Analysis being completed under project preparation is helping CFE determine a ‘reference price’ that reflects their short-term marginal costs for energy and capacity, thus complying with their mandate for acquiring least-cost power. GEF support for the Fondo Verde would be delivered on

a competitive 'reverse auction' basis in conjunction with a CFE-issued tender for an Independent Power Project (IPP) for a wind project of 70-100 MW. Private IPP project sponsors responding to the tender will bid their least cost requirement, which is expected to be above CFE's reference price, but within a U.S. 1.5 cent per kilowatt hour differential that will be paid by the GEF-supported fund. This tariff support - of up to 1.5 cents per kWh -would be payable for the first 5 years of generation, thus addressing key up-front financing barriers for project sponsors. The expected outcome of this approach was that initial wind projects could be solicited on a competitive basis that minimizes costs to both CFE and GEF.

For CFE, a key thrust of the technical assistance will be software and training to facilitate more detailed assessment of their cost structure over time to include long-term marginal costs, plus the benefits of portfolio diversification benefits and the incorporation of some environmental externalities. Other analysis will include potential for conjunctive operation of wind and hydro resources to maximize firm capacity from these resources.

The key performance indicators include: renewable energy generation, generation, capacity, emissions reductions, and technology cost reductions (and reduction in the need for subsidy or tariff support over time). Additional indicators and development contributions will include industrial development, local manufacture of some components, employment, and other social benefits resulting from land leasing for wind farms.

Based on an adequate framework and market entry in the 3-year, $25 Million Phase I, the project would continue project replication and cost reduction with additional renewable energy technologies in an anticipated $45 million Phase II, which is expected to include additional renewable energy technologies. It should be noted that the project was initially conceived as a single program utilizing up to $145 million in GEF funds, before GEF concerns over total resource availability scaled the program back.

3. Policy and Regulatory Considerations

México has developed a modern electricity system serving over 95 percent of the population. However, electricity consumption 2001-2010 is projected to grow at annual rate of 6.3%, greater than the annual GDP of 5.2%. This will require an increase in capacity of some 32,219 MW during this period, but only 1/3 committed or under construction. The majority of capacity built or contracted by the public sector during the period 2001-2010 will be provided through combined cycle gas turbines, resulting in gas-based generation accounting for 52.1% of total generation by 2010, up from 9.2% in 2001, while conventional thermal generation (fuel oil based) will reduce its contribution from 46.6% to 13.8%. Under a business-as-usual scenario, México will need to import 25 percent of its natural gas needs in the next decade.

Thus, diversification of the CFE generation mix is seen as a crucial factor to protect against price and supply disruptions and ensure sustainable economic growth. The country has available a broad array of renewable energy potential, including at least 5 GW of world class wind sites, several dozen GW of small hydro, biomass, and solar resources. However, CFE's strict adherence to its Constitutionally-based mandate to procure least cost power has resulted in a concentration in conventional fossil generation (most recently combined cycle gas), and has limited their recognition of potential portfolio diversification that could be achieved by developing its broad renewable resources.

4. Business Models

The project seeks to open new avenues for IPP renewable energy projects to augment other approaches that, to date, have been slow to develop grid connected renewables in México:

- Self-Generation Market: In project design, it was decided to not place primary focus on the 'self-generation' market niche enabled by the 1991 México Energy Law. Under this provision, municipal governments and industry (who currently pay relatively high CFE tariffs), may seek supply through renewable generators by purchasing a share or shares in a generation activity, thus qualifying as a 'self-generator". While providing an initial opening, the transaction and structuring costs of such projects are high and uncertainties remain in the regulatory and wheeling arrangements required, and this market has been slow to evolve. Further, it may not be permanent, and was not viewed by the project team or SENER as a suitable alternative to a commercially based IPP market. However, projects taking this approach are expected to receive market development assistance through the GEF project., limiting their value as a critical mass for a sustainable market.

- Internal Projects: CFE is proceeding with its own internal 100 MW wind project, designated La Venta II. This project will be implemented through an Obra Financiamiento Publica (OPF) turn-key arrangement, using funds provided by Hacienda to procure a privately constructed plant which would be returned to CFE for operation. While some units within CFE are supportive of exploring IPP approaches, others prefer this OPF approach to maintain control of the market and gain initial experience with the technology before pursuing broader IPP efforts. While this preference is understandable, it could delay private sector experience and cost reduction. The initial procurement for this project failed due to no bids coming at or below CFE's maximum 'reference price, and will be re-released in late 2005.

- It is not expected that carbon emission reductions will be sold for the GEF-supported projects, at least not for the first 5 years that they receive GEF support. Carbon sales are anticipated for CFE's La Venta II project, and should yield approximately 3- to 4-tenths of a cent per kWh. In this context, it should be reiterated that, even with up to 1.5 cents per kWh available through the GEF project, it remains a challenge to stimulate projects that CFE feels are within its least-cost procurement mandate. Carbon finance contributions will remain insufficient to make wind projects in Mexico financially viable until technology costs are reduced or other considerations are included in assessing prices and costs.

5. Financing mechanisms

The Fondo Verde will provide incentive support delivered through a competitive tender for a CFE IPP project of 70-100 MW of wind installations. Incentive support, delivered through reverse Designed to get projects off the ground, clarify their entry; real thrust is to get CFE to engage with clear rules that reflected a fair value of wind energy into the system. Nominally, $17-20 million will be provided for tariff support through the Green Fund in order to support an initial wind farm of 70-100 MW, with the remaining funds used for technical assistance.

Wind energy has been the fastest growing electricity production technology for the last few years at annual rates of more than 30%, and annual sales of about $5 billion. Observed learning rates observed in the last five years show a reduction of about 18% in prices for every doubling of capacity, which if it continues at the same pace should bring global prices at an average of $820/kW in 2005-2006 and $650/kW in 2008-2009. Adjusting for a projected inflation of 2%, international nominal prices would be $890 in 2005-2006 and $750 in 2008-2009. In addition to capital cost reduction, accumulated experience in producing and using wind turbines resulted a

trend toward much larger turbines, improved wind capture, improved electronic controls, and introduction of new materials. Availability of wind power plants has reached 98%, and lifetimes of turbines are now estimated at 20 to 25 years. O&M costs have also declined from 2-3% of investment costs to approximately 1%. Actual wind energy cost reductions in México will be a function of how fast the market grows, and the expected learning rate for the local wind energy industry.

Given the currently limited installed base in México, cost estimates for early projects are based on communications with project developers proposing projects in the 'self-generation' markets. Their expected capital project costs are about $1,200/MW, with approximately 75% of this cost related to the cost of wind turbines. A model assuming an initial capital cost of $1,200/MW, an average price reduction of 20% for every doubling of capacity and an annual growth rate of 30% would result in costs of $1,000/MW in 2005-2006, and around $720/MW by 2009. In nominal figures assuming an inflation rate of about 2%, these would be $1,000 in 2005-2006 and $750 in 2009. Assuming a robust rate of growth of installed capacity in México, at the best wind sites in México it is to anticipate electricity prices from wind at approximately 3.5 US¢/kWh by 2009. While these estimates have already been shown to be volatile due to increased steel costs and Euro appreciation, it is expected that with gas price increases, wind will be within or quite close to CFE's marginal cost by the end of the project.

6. Institutional Arrangements

The Secretaría de Energía (SENER) will assume primary project implementation responsibility, with continuing advice by the Bank on execution of the electricity sector technical assistance components. SENER's Unit of Investment Promotion (UPI) will serve as the primary interface with CFE and private sector investors, providing a 'One Stop Shop' for business advisory services. A Mexican development bank (NAFIN) will be designated to serve as the Financial Intermediary responsible for procurement of technical assistance activities and payment of tariff support awards.

7. Technical issues

Key technical issues at this juncture include possible system and dispatch impacts, distribution constraints (as well as determining equitable allocation of costs for distribution and control improvements); these issues are being assessed during project preparation and further work will be completed during implementation as part of system operation. Very high wind speeds will require turbines specifically suited to the resource.

8. Impacts and results

The project is expected to be appraised in early Fall 2005, with Appraisal in June 2005, and Board Approval and CEO endorsement in early FY2006. However, despite the fact that the project is not yet in implementation, several positive policy developments taken at the initiative of SENER and other agencies have already emerged as a result of project preparation:

- Renewable Energy Law - A draft renewable energy law was tabled in the *Camara de Diputados* of the Congress on April 19, 2005, and is considered to have good prospects for passage later in 2005. The proposed law encapsulates a number of reforms sought-after under this GEF project, and includes provisions for establishment of non-binding targets for renewable energy in México, definition of conditions for dispatch and valuing the energy and

capacity contributions for renewables, and establishment of a *Fondo Verde* (to be initially capitalized at approximatelyUS$90 million).

- A 100% first year Accelerated Depreciation clause has recently been introduced that can measurably reduce a sponsor's tariff requirement while potentially easing project financing requirements by reducing tax liabilities in the projects' early years. Based on market experience with distortions resulting from allowing depreciation on hardware investment only, this provision permits depreciation only for generation units in service, which should minimize the distortions that can result from tax credit schemes that stimulate construction but not energy production. As the depreciation benefit must be claimed for one year and cannot be carried over, this clause may also help attract larger scale financing partners with sufficient tax liability to take maximum advantage of this provision.

The social assessment framework being developed for the project builds on earlier work done by Winrock International which pays particular attention to providing information to local Ejido other communities in the region objective information on the types and agreements and contracts typically used in developing wind farms, including magnitude of payments, structure of agreements, and methods for verifying generation and power sales. Concurrently, these communities wanted to improve their understanding of local impacts, employment opportunities, and impacts on local land use and mixed-uses compatible with wind farms.

In terms of replicability, the project is designed to create a favorable environment for initial market activity in renewables, to stimulate investments through targeted and competitive incentive support, and repeat this process through subsequent 'reverse auctions' that will result in organizational learning and cost reduction over time. Parallel activities in 'self-generation' markets will build additional experience in project development, finance, and operation, further supporting replicability within México. Further, as a regional technology and market leader, México is well positioned to help effect broader replicability of project experience and cost reductions throughout Latin America.

9. Key Lessons Learned

The project experience to date indicates that, even with a strong renewable energy resource and capable technical and market players, developing project policy for renewable energy with a central utility remains very challenging. In addition to the 'least cost' mandate in México, project design was influenced by several conditions that are typical of developing countries. Significant government funds were not available to stimulate the market, and it was not viewed as politically practical to generate a financial pool for renewables from a ratepayer surcharge, limiting stimulus funds to those available from GEF and other bi-lateral sources, and indirect revenues. Development of a mandated market policy based on a renewable energy portfolio standard currently was considered impractical for México as the existence of only a single utility entity (CFE) leaves no basis for effective trading among different utilities to seek least cost resources. A more traditional approach of packaging a set of pre-identified sub-projects, individually appraised, with a GEF incremental cost analysis developed for each one, was not viewed as setting México on a path toward aggregating scale, policy leverage, or significant competition.

Stimulus efforts need to be provided in a stable manner to maintain clear signals to industry/investors and avoid stop-start impacts that can slow learning and price reductions. Further, financial support and incentives need to be accompanied by a clear set of policies, tariff structures, and capacity development to facilitate sustainable mainstreaming of renewable

technologies into the countries' portfolio. Cumulative regulatory/operations experience will be required to mainstream continued CFE engagement, and it is expected that the longer-term, multiple-phase approach taken by this project will permit evolution of this experience and provide stronger results that a single project.

Given the increased concentration in gas IGCC generation that México is experiencing (and which is representative of a number of utilities worldwide), the portfolio diversification analysis being undertaken as part of project preparation and implementation has proven to be a key tool in stabling a case for CFE that renewables can be a least-cost option if fuel supply risks are considered. By broadening thinking on how 'least-cost' can be interpreted, this approach also offers promise for introducing valuation of environmental externalities as well.

A significant implementation challenge in the context of the least-cost mandate was encountered in developing the project tender approach. Under this competitive tender, CFE is expected to offer a 'reference price' equivalent to its short term marginal system costs to maintain its 'least-cost' position, with this tariff would be augmented by GEF support of up to US 1.5 cents per kWh. The initial objective was to also minimize the GEF expenditure by seeking competitive bids that met the CFE reference price but also sought the lowest GEF support level. However, by essentially combining two competitive solicitations within one tender, this approach raised issues of allocation of any savings resulting from competition. Various formulas to allocate price exposure were explored, but it was ultimately agreed that the full GEF support level would be payable so that any 'excess rents; would accrued to CFE and thus ensure that they were indeed meeting their least-cost mandate.

This experience reiterates the difficulty of comparing renewable energy resources (higher initial costs, low operating costs, diversification and environmental benefits) with conventional ones (lower initial capital cost but ongoing and uncertain fuel costs, as well as environmental impacts). Particularly in developing countries, efforts to insert renewables will require an ongoing commitment by the country and donors to accommodate additional financial costs and further incorporate them in economic analysis.