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# MEXICO WIND FARM CASE STUDY

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## **Disclaimer**

This case study was completed under a contract with the International Institute of Education and HMW International. The lead author was Peter Banner of Support Resources, Inc. The views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

## TABLE OF CONTENTS

<b>DESCRIPTION OF PROJECT – LA VENTOSA WIND FARM, MEXICO.....</b>	<b>1</b>
<b>BACKGROUND.....</b>	<b>2</b>
Mexico’s Energy Sector .....	2
Mexico’s Experience with Wind Power .....	3
Installed Capacity .....	3
Relations with Local Communities .....	3
Quality of the Resource.....	3
<b>PROJECT DEVELOPMENT AND IMPLEMENTATION.....</b>	<b>4</b>
History .....	4
Off-takers .....	5
Power Purchase Agreement (PPA) .....	5
Political Uncertainties .....	5
Construction and Logistics .....	6
Transmission Infrastructure .....	6
<b>LESSONS LEARNED AND FUTURE OPPORTUNITIES .....</b>	<b>7</b>
Lessons Learned .....	7
Future Opportunities .....	7
Development of Domestic Wind Equipment Manufacturing .....	8
Renewable Energy Policy.....	8
<b>REFERENCES .....</b>	<b>8</b>

## DESCRIPTION OF PROJECT – LA VENTOSA WIND FARM, MEXICO

The La Ventosa Wind Farm was developed to exploit the considerable wind resource in Mexico's Oaxaca peninsula. It is the third large-scale wind farm to be developed in the area by private-sector interests.

**Location** – La Ventosa, Tehuantepec Isthmus in Oaxaca, Mexico

**Size** – 67.5 MW

**Equipment** – (27) 2.5 MW V-89 Clipper wind turbines, US manufactured

**Owner(s)** – EDF Energies Nouvelles subsidiary Eléctrica del Valle de Mexico 75%, an individual Mexican national 20%, Asociados Pan Americanos 5% (a joint venture between US and Mexican groups that worked with the initiating Mexican national and introduced EDF to the project) and Wal-Mart de Mexico, S.A.B. de C.V.

**Other Partners** – EDF subsidiary enXco providing project management and O&M

**Projected Plant Capacity Factor** – 49%

**Off-takers** – Wal-Mart de Mexico, S.A.B. de C.V.

**Expected Date of Operation** – 4th quarter of 2009

**Total Cost** – approximately €150 million (US \$209 million)

**Source of Financing** – Equity being provided by EDF. In June 2009, the European Investment Bank approved debt investment in the project of €75 million (US \$104,528,000). The sale of carbon credits under the Kyoto Protocol will also be used as a financing enhancement.



Location of La Ventosa Wind Farm in the southern province of Oaxaca

## **BACKGROUND**

### **Mexico's Energy Sector**

The Constitution of Mexico empowers the Comisión Federal de Electricidad (CFE) as the sole provider of electricity in the country. CFE controls all development, distribution, and sales of electrical energy in Mexico, except for Mexico City and some outlying areas where municipalities manage the utilities. Private-sector companies have constructed and operated power generation plants, but 100 percent of the power from these plants is sold to CFE and the return on investment is dictated by CFE.

In 1992, reforms in the sector allowed private power generation for self supply. Any excess electricity must be sold to CFE. The passing of the North America Free Trade Agreement (NAFTA) in 1993 further opened the door to the possibility for independent energy producers in Mexico and foreign investment in this sector. Section 6 of NAFTA states that "...an enterprise may acquire, establish, and/or operate an electrical generating facility in Mexico to meet the enterprise's own supply needs."

Under the existing regulations, off-takers for privately generated power can be "self generators," municipalities, or the CFE itself. A self generator does not necessarily have to be located adjacent to the power plant, but may be located anywhere on the CFE system. CFE oversees and controls, for all intent and purpose, the self-generator projects, facilitating the wheeling and banking of electricity generated in a self-generation arrangement. Self generators to date have been large commercial/industrial consumers. Allowing a commercial operation to build and operate its own generating plants enables CFE to bring more power into the grid without incurring additional debt and violating its constitutional mandate.

Though municipalities are an accepted alternative off-taker for power under the self-generation regulation, to date there do not appear to be any instances of a renewable energy project entering into a power sales agreement with a municipality. The principal concern for a developer in relying upon electricity sales to a municipality is that municipalities do not generally have good track records when it comes to prompt payment to CFE. Many municipalities owe large amounts of money to CFE, and would only be allowed to switch providers providing they settle their outstanding balances.

CFE is legally required to purchase power from the least cost source available. The financial formula utilized does not factor in the environmental value/benefits of power generated from clean energy sources, making it extremely difficult to build or purchase power from a clean energy source, since such energy is generally more expensive than CFE's current fossil sources. The only incentive Mexico currently offers for development of renewable energy projects is 100 percent depreciation on equipment in the first year of operation.

CFE's retail price of electricity to residential customers is on average under US \$0.07/kWh. The price to industrial customers is in the US \$0.06 range, and to commercial customers in the US \$0.14 range. Public entities, such as municipalities, are charged an average of US \$0.11/kWh. At this point in time, the only renewable energy projects that have entered into agreements to sell their power exclusively to CFE have

had their pricing subsidized through various international programs aimed at promoting the development of clean power.

### **Mexico's Experience with Wind Power**

Installed Capacity – Mexico has seen slow development of wind energy projects, and only recently has it begun to develop this resource in any significant amount. There were only 85 MW of installed wind capacity in all of Mexico through 2008. In January 2009, 30 MW of the 79.9 MW Iberdrola project came online, as did the first stage of the 250 MW Acciona Energy and Eurus S.A. wind park project. The EDF La Ventosa project will be the third project developed by private-sector interests.

The first wind farm project in Oaxaca was developed by CFE. It was a small project (1.575 MW – 1/60th the size of the La Ventosa project) and there appears to have been minimal local opposition to it. This may be due to the small size of the project, the fact that it was developed by the government, or perhaps the anticipated economic benefits that were promised should more wind energy development take place. However, over the last few years, local opposition to large wind farm projects has been increasing.

Relations with Local Communities – The majority of land in many of Mexico's rural areas is controlled by local indigenous cooperatives known as Ejidos. The cooperatives may hold the lands communally, distribute land to the cooperative members, or sell some or all of the property. The administration and ownership records of the Ejido lands are often incomplete and convoluted. Poor record keeping by the states, corruption, and unsettled disputes often cloud ownership. The majority of the developable wind properties in Oaxaca appear to be held by Ejidos. Though the early wind farm projects secured development rights sufficient for government approval, local opposition or protests still occurred, with locals alleging failure of the developer(s) to fulfill promises, pay fair royalty rates, and/or take sufficient care in the development process. Language and cultural differences have exacerbated the difficulty of educating the members of Ejidos as to exactly what rights are being sold and the impact a project might have on their way of life. Instances of a few individuals making decisions for the majority, without sufficient consensus, have occurred. The lack of knowledge and sophistication on the part of the local people caused early signers to receive considerably lower lease percentages than the later signers (and by international standards, land lease rates appear to be relatively low).

Quality of the Resource – The Oaxaca isthmus has one of the best wind resources in the world. Forecasted plant capacity factors are in the high 40 percentiles for many sites, making the cost of generating power extremely competitive with generation from fossil fuels if environmental factors are taken into consideration. A 2003 USAID-funded wind resources study of Oaxaca conducted by the United States National Renewable Energy Laboratory (NREL) identified numerous Class 5 to 7 wind sites, representing approximately 6,600 km<sup>2</sup> of windy land with good-to-excellent wind resources—potentially 33,000 MW of developable resource (see *Wind Resource Map*).

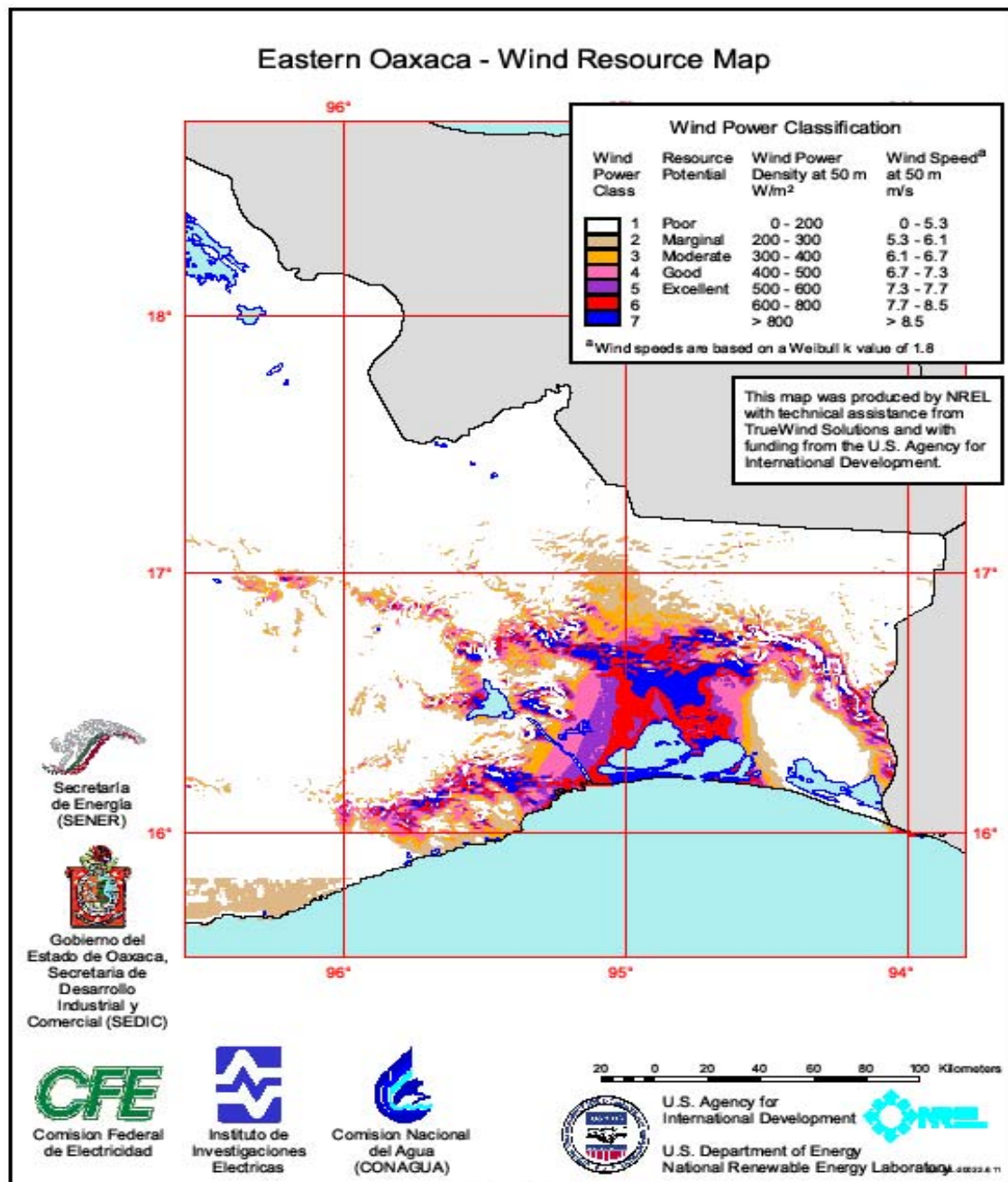


Figure 6-11

## PROJECT DEVELOPMENT AND IMPLEMENTATION

History – The La Ventosa project was initiated in 2000 by a Mexican national who had been involved with the first Oaxaca wind farm project built by CFE in 1992 (the 1.575

MW project). He approached some US-based individuals for assistance in developing the proposed project, and these individuals brought the project to the attention of Électricité de France (EDF). A joint venture was established between these individuals and EDF to proceed with the development of the La Ventosa project in 2001. The properties involved for the project are controlled by two Ejidos, cooperatives of indigenous farmers, as well as individuals, and required 60 land lease contracts. During the planning process, it was determined that the Ejidos had not been registered properly with the Mexican authorities, so perfecting legal control over the property required clarification of the Ejidos' ownership. The whole process to secure development rights, perfect the Ejidos, and secure the necessary permits and contracts to develop the project took over seven years. Four years of wind data were collected for the site to validate the wind resource. The lease term for the land is for 30 years.

Off-takers – Initially the project explored the possibility of having the off-taker be a local municipality that operated streetlights. This option was pursued for two to three years but was eventually dropped. Though the municipalities have the right to purchase power from an entity other than CFE, and they have an incentive to do so because of the high tariff rates charged them by CFE, most of them are in debt to CFE. Many of them have a history of paying slowly or not at all, and they would have to retire their debt to CFE before being allowed to purchase power from an alternate supplier.

The genesis of the idea of Wal-Mart as an off-taker came to the president of EDF after reading an article that the CEO of Wal-Mart had announced in October of 2005 that he wanted to have Wal-Mart supplied 100 percent by renewable energy. With the recently passed law allowing self generation in Mexico, he saw an opportunity for a viable off-taker. The final agreement provided Wal-Mart with 60 percent of their power at a price that is higher than wholesale but lower than retail (the exact details are proprietary).

Power Purchase Agreement (PPA) – Securing a financeable PPA with CFE presented a major hurdle for the project. The initial PPAs being offered had a number of onerous terms that presented unacceptable risk to the financing community, and the rates CFE was willing to pay for the electricity made the project uneconomical without subsidies. The price Wal-Mart was willing to pay for electricity made the project financially viable. The project entered into a contract with CFE to utilize its transmission lines and have CFE handle the banking of electricity accounting, with the provision that CFE will purchase any power not consumed by the principal off-taker. The methodology and established process for determining pricing for this excess power was not particularly transparent. Power under self generation can be banked with CFE, but any excess power that is generated is sold to CFE at 85 percent of the short-term cost of power (i.e., wholesale price), in the range of US\$ 0.035/kWh.

Political Uncertainties – Due to the length of time it took to put together the La Ventosa project, the proposal had to weather two presidential elections and numerous local city and state council elections. The state of Oaxaca has been experiencing considerable political turmoil over the last few years, with riots in the capital city of Oaxaca in 2006. The local government is controlled by the PRI, while the federal government is controlled by the opposition PAN party. Each time there was a change in the local political situation, the incoming political and regulatory officials would review what the previous administration had approved.

Construction and Logistics – Management for the project is being undertaken by the enXco subsidiary of EDF. It has contracted locally for civil works associated with the development of roads, electrical, and foundation work, but is bringing expertise from the United States to perform tower erection, placement of turbines, and commissioning, due to a lack of skilled local workers. Civil works and the associated labor involved generally represent 15 to 20% of the cost of a project. The local unions are quite strong in the area and must be taken into consideration when constructing any project. The project has been hiring as many locals as possible.

Experienced enXco personnel will initially provide operation and management for the project though these responsibilities may transition to Mexican staff once they have gained sufficient experience. The project has experienced delays in clearing customs for the importation of certain components that are coming via ships, but components coming via truck from the United States have cleared customs quickly. To date there have been no undue logistical difficulties.

Securing debt financing has been difficult under current economic conditions. However, in June 2009 the European Investment Bank approved a debt investment in the project of €75 million (US \$104,528,000). The bank’s stated objectives were: “Contributing to i) support of the EU presence in Latin America through foreign direct investment and ii) support environmental sustainability and climate change mitigation.”



**Wind turbines being installed at the La Ventosa site.**

*Photo courtesy of Peter Banner*

Transmission Infrastructure – The infrastructure in Oaxaca needs to be upgraded to accommodate the numerous proposed wind energy projects in the area. The existing transmission lines have traditionally transported hydroelectric power from the south to the north. Currently, CFE has released a tender to upgrade the existing 400 KV and 115 KV transmission

lines servicing the area. The La Ventosa project has had to pay fees to CFE to reserve line capacity on existing and “to be built” transmission lines, and will be paying ongoing fees for wheeling of the electricity from the wind farm to the off-taker (approximately \$0.017/kWh). The project paid approximately \$130,000 per MW to reserve capacity on the existing transmission lines.

## **LESSONS LEARNED AND FUTURE OPPORTUNITIES**

### **Lessons Learned**

Once the matter of land control and securing a viable off-taker had been resolved, the project seems to have progressed with minimal difficulty. However, the history of local opposition to wind projects in Mexico is one that cannot be ignored. Developers must ensure that local communities experience tangible benefits such as jobs, lower electricity prices and improved infrastructure. In Mexico, the local communities are benefiting through jobs and in at least one case the developer has built a nursery and a library equipped with computers; established scholarships; and made promises of electrical infrastructure improvements for the local communities and for the Ejido.

One of the lessons from wind development in India, which has a more advanced wind industry than Mexico, was that whoever was supplying equipment would come in, provide assistance in construction of the project, but then not adequately train the local people to maintain the equipment. The result was low operational performance. The lack of local qualified and trained installers as well as maintenance people can also cause problems. Developers know they are going to be constructing a project years before they actually begin. The developer should identify local contractors early in the project timeline and train them before the actual construction takes place. Arranging for workers to receive training by working on a similar project at another locale for a month or more would be ideal.

### **Future Opportunities**

Future wind power development in Mexico is unlikely to be driven by domestic demand. Mexico has generation capacity of over 50,000 MW, which is estimated to be 40% over current load. At present, the country lacks a policy environment conducive to large-scale development of renewable energy; the “remote self generation” model described in this case study is unlikely to be economic outside Oaxaca, where the quality of the wind resource makes it possible to pay the wheeling and other CFE fees.

However, what may drive increased development of renewables in Mexico is the export market. CFE has signed export agreements to sell power to Belize, Guatemala, and Los Angeles, California. Being able to export renewable-generated electricity could be quite attractive financially to Mexico. Projects developed in Mexico qualify for world marketable carbon credits, and the proximity of Mexico to the United States, especially California, where the utilities are under mandate to reach a renewable energy portfolio standard of 20% by 2010-13, presents a lucrative market opportunity. A number of projects are reported to be under development in Baja to take advantage of the US

market. In addition, the 1,800 km Siepac transmission line currently under construction will connect Mexico's grid with Costa Rica, El Salvador, Honduras, Nicaragua, and Panama. The line is expected to be completed by 2010. This line will enable Mexico to greatly increase its exports and provides an incentive to develop power projects.

Development of Domestic Wind Equipment Manufacturing – Mexico has an excellent manufacturing base that could easily tool up to manufacture wind turbine components and/or complete wind turbines. As the wind energy industry develops in Mexico, the establishment of manufacturing plants in Mexico by recognized turbine manufactures might proceed in the way it has occurred in the United States, where many of the European turbine manufactures have set up manufacturing facilities over the last few years. Due to the large size of the wind turbines being used in wind farm applications, there is a benefit to having manufacturing plants close to where the equipment will be installed, reducing transportation costs and related greenhouse gas effects.

Renewable Energy Policy – As a result of the energy reforms passed by the Mexican Congress in November 2008, there is an active discussion under way about how to implement a policy providing incentives for renewable energy, as the law requires. The country has also announced carbon reduction targets, which may provide further incentives to alter its current renewable energy policies. It will take some time for this process to play out and see what changes may result.

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