

Chapter 13

Mexico

13.1 INTRODUCTION

Estimates indicate that Mexico's most viable wind resources would be sufficient for the installation of 3,000 MW to 5,000 MW of wind power. These figures are based on rough regional estimates – detailed evaluations of wind resources have yet to be carried out. Other sources indicate there are many areas in the country with moderate wind resources that could eventually be efficiently tapped using improved wind turbine technologies. Based on the experiences of other countries, it is reasonable to expect that extensive exploration and improved wind-speed measurements throughout the country will result in higher estimates of Mexico's wind energy potential.

Mexico's strongest wind energy resource is found in a sizeable region (about 3,000 km²) known as La Ventosa, located on the Isthmus of Tehuantepec in the State of Oaxaca (see Figure 13.1). Average annual wind speeds in this region range from 7 m/s to 10 m/s, measured at 30 m above the ground. Estimates show that up to 2,000 MW of wind power could be commercially tapped in La Ventosa, given the favorable characteristics of the region, its topography in particular. In fact, a 1.6-MW pilot plant, located in one of the best windy sites in the region (La Venta), has operated at an average capacity of approximately 40% for six and a half years, which compares favorably to wind power plants located in the best windy inland sites in the world. However, until now, implementation of wind power in Mexico has been incipient

and inconsequential in view of the fact that a number of barriers exist.

Jointly, a number of actors from the public and private sectors are carrying out some actions to remove the major barriers. Negotiations are still in progress by the Global Environment Facility (GEF), through the United Nations Development Programme (UNDP), to support an Action Plan for Removing Barriers to the Full Scale Implementation of Wind Power in Mexico, which will be lead by the Ministry of Energy.

13.2 NATIONAL POLICY

In 2001, the Ministers of Energy and Environment and their respective staff met to discuss issues to jointly develop a policy on sustainable development for the Mexican Energy Sector. The purpose of this first step is to coordinate common objectives and to establish a shared vision concerning common goals and challenges, with global climate change being among the main concerns. The meeting concluded that energy supply must be guaranteed in accordance with sustainable energy policy, which in turn must take into account social, economic, and environmental sustainability. National programs on energy and environment must be aligned and coordinated to ensure fulfillment of environmental goals on the basis of a shared vision and strategy.

Conclusions from the meeting also emphasize the need to foster the use of alternative energy sources by means of voluntary programs on renewable energy, long-term contracts, and incentives for the development of energy sources by private investment. Consequently, the National Programme for the Energy Sector (2001 to 2006) is aimed at securing energy supply to go with projected economic development on the basis of in-

creasing actions to protect the environment and stimulate sustainable development.

National consumption of electricity is expected to increase at an average annual rate of 5.6% from 2002 to 2011. This growth translates into a projected requirement of 291 TWh in 2011 for total electricity generation, which represents an increase of 122 TWh and an estimated required new capacity of 30 GW. Of this, 14.4 GW is already under construction or planned, the majority of which uses combined-cycle, gas-turbine technology in addition to several new hydro and geothermal plants. The remaining 15.6 GW will be supplied through new projects, with an expected 1.4 GW to be built for self-supply within both the private and public sector. An opportunity niche therefore exists for supplying a reasonable portion of the non-committed 15.6 GW of new capacity using Mexico's wind energy resource. Unfortunately, there are a number of barriers that have to be removed in order for wind power development in Mexico to become a reality.

Strategy

By the end of 2002, GEF's Council approved to include the Mexican Project Action Plan for Removing Barriers to the Commercial Implementation of Wind power in Mexico in its 2003 work plan. In order for the project to begin, paperwork is expected to be completed by the middle of 2003. Phase 1 of the project, scheduled to last two years, will launch a comprehensive and systematic effort to reduce identified barriers to wind energy development, beginning with a coordinated initiative aimed at revising the institutional and regulatory frameworks affecting on-grid wind power development so that a wind power market is established. Simultaneously, a number of scenarios will be evaluated and promoted in order to

implement a voluntary wind power market within the industrial sector.

Additionally, special attention will be put on the implementation of the Clean Development Mechanism as an important element to complement domestic incentives. An educational campaign, geared towards raising awareness among government officials to the benefits of wind energy, will be carried out simultaneously. Technical information and human resource barriers will be addressed through the creation of a regional center for wind energy technology. At this center, local technicians and engineers will obtain hands-on experience in the operation of a diverse range of wind turbines, wind energy equipment will be assessed for operation under local conditions, and international standards and best practices will be applied and adapted for Mexico.

A preliminary assessment and mapping of wind energy resources at the most promising sites in the country will also be carried out in Phase 1 in order to obtain the wind resource data essential to the development of commercial projects. A set of comprehensive feasibility studies will be developed in Phase 1, in conjunction with any required preparatory activities, all geared towards the formulation of business-demonstration wind power plants.

Phase 2 of the project will begin by launching a competitive bidding process for three model projects that will be supported with GEF resources to emulate temporary production incentives. Next, the technical and economical performance of commercial wind power plants will be monitored and documented; suitable financial mechanisms will be established; and finally, lessons learned, best practices, and specialized human resources will be the basis for a national campaign aimed at consolidating a sound wind power market. This project will

be a major first step that could be consolidated with a strategic partnership, which is currently under negotiation between the Ministry of Energy and the World Bank.

Progress Towards National Targets

Until now, the federal government has not stated any specific national target regarding wind power capacity to be installed. Nevertheless, important officials are talking about a strategic goal of 1,000 MW to be completed within the next five years. The Oaxaca state government is active in promoting the development of wind power in La Ventosa on the basis of economic and social development.

In November 2002, a meeting called the Third Colloquium on Opportunities for Wind-Power Development in La Ventosa, Oaxaca, was held under the auspices of the state government. Approximately 100 people attended the colloquium, including important policy makers from the Ministry of Energy, the National Commission for Energy Conservation, the Federal Electricity Commission, and the Energy Regulatory Commission, as well as local authorities and landowners and a number of wind project developers from Finland, France, Germany, Mexico, Spain, and the United States. This meeting is currently the country's most important wind energy event. This meeting recognized that one of the main challenges is

to establish a suitable framework for negotiating and securing wind rights, since agrarian communities called *ejidos* are the owners of most of the land in Mexico.

13.3 COMMERCIAL IMPLEMENTATION

During 2002, additional wind power capacity was not installed. The total installed capacity of wind turbines in Mexico decreased to 2.2 MW because a privately owned 550-kW wind turbine in Ramos Arizpe caught fire (see Table 13.1 and Figure 13.1). As a result, the rate of wind power development declined, although the contribution to national electricity demand from wind power remains negligible. Trends are unpredictable – a number of wind project developers are trying to go forward, but several different kinds of barriers hold back the initiatives. Despite these barriers, most project developers plan to start construction of their respective projects soon, although project dates tend to continually be delayed.

13.4 MARKET DEVELOPMENT AND STIMULATION

Main Support Initiatives and Market Stimulation Incentives

In September 2001, the federal government, through the Regulatory Energy Commission, issued the first incentive for renewable energy. Embedded in the existing legal and

Location	Manufacturer	Wind turbines (kW)	Capacity (MW)	Commissioning date	Owner
La Venta, Oax.	Vestas	7 x 225	1.57	1994	CFE
Ramos Arizpe, Coah.	Zond	1 x 550	0.55	1997 (2)	(1)
Guerrero Negro, B.C.S.	Gamesa Eolica	1 x 600	0.60	1998	CFE
TOTAL		9	2.2		

- (1) Cementos Apasco (Cement factory).
 (2) In mid 2002 this machine caught fire.

Table 13.1 Wind turbine installations in Mexico at the end of 2002

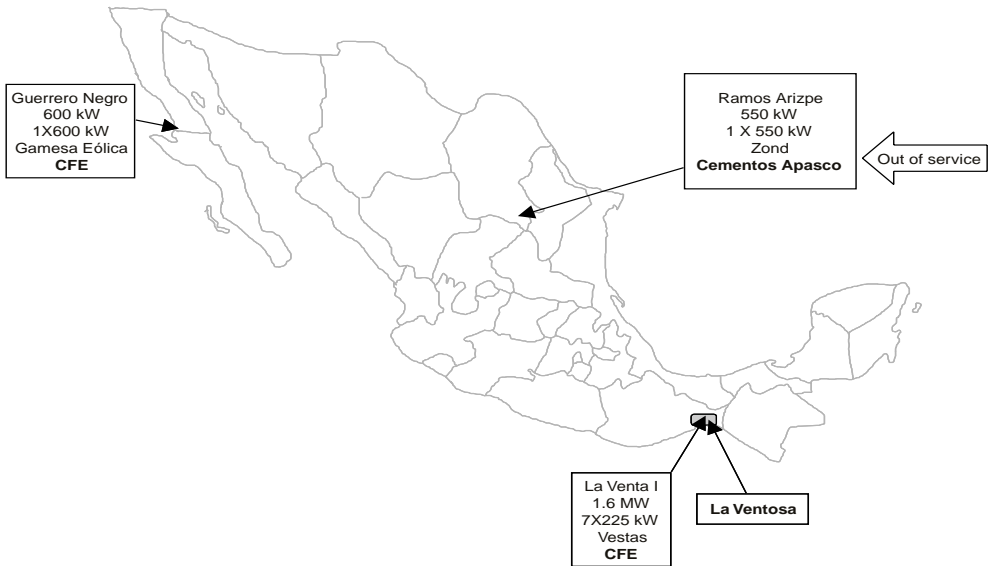


Figure 13.1 Locations of wind turbines installed in Mexico as of December 2002

regulatory frameworks, this new incentive consists of a model of agreement for the interconnection of renewable energy power plants to the national electrical system. It allows self-supply generators to interchange electricity between different billing periods (e.g., base to peak). In this fashion, self-suppliers do not necessarily have to sell surplus electricity to the Federal Electricity Commission because generation delivered to the grid during certain periods can be credited for energy extracted from the grid during different periods. The interchange is allowed on the basis of the ratio of the marginal costs between different billing periods; therefore, it is required to generate more than 1 kWh during a base period in order to match the 1 kWh required in a peak period.

This administrative incentive improves the economic feasibility of some self-supply wind power projects, especially those for municipal public lighting, where a considerable quantity of electricity could be generated during the daylight period when

no electricity is required. Furthermore, previous to the new incentive, electricity transmission charges for a renewable energy self-supply project were computed on the basis of its rated capacity; today these charges are reduced to the power plant capacity factor level. The new agreement model is expected to facilitate some self-supply wind power projects that have been waiting for better regulatory conditions for years. Unfortunately, a year has passed since the incentive was issued, and there are still no projects under this modality.

13.5 DEPLOYMENT AND CONSTRAINTS

Wind Turbines Deployed

There were no additional wind turbines installed during 2002. The number of wind turbines installed in Mexico has decreased to eight (see Table 13.1).

Operational Experience

During 2002, electricity production from the La Venta wind power station was 6.0 GWh. The facility operated with an annual capacity factor of 43%, and its overall availability was 99%, according to Carlos García Aguilar, General Manager of the La Venta Wind Power Station.

Preliminary data reveal that the 600-kW wind turbine installed at Guerrero Negro operated at a capacity factor of 25%. Annual average wind speed at this site is approximately 8 m/s at 50 m above ground.

Detailed information was not released about the destruction of the 550-kW wind turbine installed in Ramos Arizpe. The nacelle of the wind turbine was reportedly in flames for hours after lighting presumably caught it on fire. At the end of 2002 the machine was still out of service. It has been said that Cementos Apasco is considering installing a new machine.

Main Constraints on Market Development

The following are the main constraints on wind power market development in Mexico.

- Current regulatory framework does not facilitate commercial development of wind power.
- Electricity for the industrial sector is subsidized.
- A critical need exists to cultivate a confident and stable business environment that can provide appropriate guarantees to international and national financial institutions on the viability and profitability of wind power projects.
- A national program on wind power implementation does not exist.
- Specialized human resources on the subject do not exist.
- Financial mechanisms do not fit.

13.6 ECONOMICS

Electricity prices to consumers vary depending on the region, time of day, and voltage. For electricity billing purposes, the country is divided into eight regions. Each region has its own timetable for electric tariffs throughout the day. Table 13.2 shows the average price for electricity in different sectors.

It is clear that a niche of economic opportunity for wind energy already exists in the commercial and public service scenarios. The challenge is to figure out and implement the appropriated strategy for creating a convenient wind power market. At present, a special buy-back price for wind energy has not been set in Mexico.

13.7 INDUSTRY

A 5-kW turbine of Mexican design is currently manufactured in Mexico, primarily for export markets. A Mexican company has manufactured a number of 750-kW electric generators for an international wind turbine manufacturer. According to the status of Mexican industry, a number of wind turbine components – including towers, generators, gears, conductors, and transformers – could

Sector	Average price (Mexican Pesos/kWh)
Industrial	0.550
Agriculture	0.313
Residential	0.607
Commercial	1.303
Public services	1.133

Table 13.2 Electricity prices in Mexico as of January 2001

all be manufactured in Mexico using existing infrastructure. More than 200 Mexican companies have been identified as having the capacity for manufacturing parts required for wind turbines and for wind power plants. The country also has excellent technical expertise in civil, mechanical, and electrical engineering, which could be tapped for plant design and construction.

13.8 GOVERNMENT-SPONSORED R,D&D

In 1994, the La Venta 1.6-MW wind power plant was the first demonstrative project sponsored by the Mexican government. Next, a 600-kW wind turbine was installed at Guerrero Negro in 1998. The Federal Electricity Commission operates both of these projects. During 2002, the Mexican government did not sponsor the construction of any additional wind power facilities for demonstration or local capacity building.

Under the auspices of the Ministry of Energy, the Electrical Research Institute is in charge of formulating an Action Plan for Removing Barriers to the Full Scale Implementation of Wind Power in Mexico. This plan includes the construction and operation of a regional center for wind energy technology, which aims to offer the following provisions.

- Support to interested wind turbine manufacturers for the characterization of their products under local conditions of La Ventosa.
- A means to train local technicians for operation and maintenance of a diversified range of wind turbines.
- An easily accessible national technology display, facilitating the encounter between wind manufacturers and Mexican industries, thus promoting the identification of possible shared business ventures.
- A modern and flexible installation to obtain hard operational data on the interaction of specific types of wind turbines with the electrical system.
- A means to understand international standards and certifications (issued abroad) in order to detect additional requirements to fit local conditions.
- A way to increase the playing level of national research and technology development, including joint projects or specific collaboration activities with prestigious overseas research and development institutions.

Furthermore, major concerns exist because wind data currently available in Mexico is scarce, except for a few sites, and therefore wind energy resources in several promising areas have not been evaluated. In addition, planning the adequate deployment of wind power at the national level is considered a primary requisite in order to create a sound wind power market instead of a rushed and problematic one. Therefore, the action plan to open a wind power market in Mexico will be focused on removing regulatory and economic barriers because local capacity building will be addressed comprehensively by the Electrical Research Institute and associated parties.

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