

## Best Practice Model for Sustainable Energy Solutions in Mexico

*Jorge Islas Samperio, Ana María Gómez Solares, Ashley Warriner*

### Executive Summary

This Best Practice Model (BPM) is BIC's contribution to the consultation process of World Bank's new Energy Strategy. It is part of a set of BPMs whose objective is to offer the Bank examples of how it can invest in energy for impoverished and marginalized populations without sacrificing environmental sustainability.

### Why Mexico?

**Background** During the last 40 years the Mexican energy sector has been based on the production and consumption of hydrocarbons, which currently represent approximately 80% of gross internal supply. However, this pattern of energy production and consumption seems to have reached its limit. Proven reserves of petroleum in Mexico have fallen substantially in recent years, while national production continues to decline. To add to the problem, national energy consumption continues to grow considerably. Under the current scenario, Mexico has enough proven crude reserves for just 9.3 years if current rates of production and consumption remain steady. All of this puts Mexico at risk of becoming a net energy importer.

This possibility also threatens Mexico with an unprecedented budget crisis, given that approximately 25% of national income comes from petroleum revenues. The current decline in proven petroleum reserves could be the precursor to a state financial crisis that could quickly turn into a national economic and social crisis, given the macroeconomic weight of petroleum revenues.

Given this scenario, it is imperative for Mexico to develop an energy portfolio that fosters and drives sustainable development in the country. Under this lens, renewable energies represent the most promising alternative for Mexico, given the country's abundant renewable resources and human capital at the national level. However, it will require international assistance, both in financing projects as well as in capacity-building at the community level.

**Potential for Renewables** According to the Secretary of Energy (SENER), certain areas of the states of Oaxaca, Baja California, Zacatecas, Hidalgo, Veracruz, Sinaloa, and the Yucatán peninsula could supply up to 10,000 MW of capacity in wind energy to the national electric grid. With regards to solar potential, as a country, Mexico has the third largest potential solar energy supply, with generation capacity for approximately 5kWh/m<sup>2</sup> daily in gross supply, equal to 50 times current nation-wide energy generation.

**Electricity Coverage** Approximately 97% of the population in Mexico is connected to the electric grid; however there remain 2.8 million people without electricity, 60% of whom are indigenous. Furthermore, it is expected that the number of persons without electricity will grow by 20% due to projected population growth over the next decade. Electrifying households without service will be a significant challenge given that the majority of these households are located in small, isolated communities without access to the national grid.

## Case Studies

***Servicios de Agua y Drenaje de Monterrey*** This project consists of two water treatment plants (Northern Plant and Dulces Nombres Plant) in the municipality of Monterrey, Nuevo León that capture biogas from a nearby landfill in order to generate electricity. The installed capacity of the two plants is 10.8 MW. The solids derived from the landfill are sent to a digester where methane gas is produced during decomposition. The gas is then used to generate a portion of the electricity needed to power the two plants. Natural gas supplies the remaining energy needed to operate the plant, however the municipality has plans to increase the capacity of the biogas from the landfill to replace the natural gas. Ninety-five percent of the water treated at the Dulces Nombres plant is discharged into the Pesquería River to be used in agricultural irrigation and the remaining 5% is re-used for electrical generation as part of the Federal Energy Commission's (CFE) Environmental Responsibility Program.

***Bio energy in Nuevo León*** This was the first renewable energy project in both Mexico and Latin America that used biogas formed in a landfill as a combustible. This plant, located in the municipality of Salinas Victoria, Nuevo León currently has an installed capacity of 7 MW with which it generates approximately 50,000 GWh per year and is expanding to 12.72 MW. The technology used is based on internal combustion motors which burn the methane gas extracted from the landfill, which is then conducted through a system of pipes. The energy is generated during the night and is used primarily for public lighting. During the day, the energy is used primarily to satisfy energy needs of the Monterrey Collective Transport System (metro rail).

***Municipio de Aguascalientes*** In 2007, the municipality of Aguascalientes inaugurated the *Capamita Los Negritos* water treatment plant. This plant is not connected to the electric grid; rather it generates its own energy through use of solar panels. The plant serves a community of approximately 150-200 people on the outskirts of the city of Aguascalientes using the same process as a conventional plant. The physical infrastructure was developed using the design and technology of the municipality itself. The solar panels are located in the roof of the facility and generate enough energy to operate the plant 365 days per year. The water pumps as well as the outdoor lighting and security camera at the facility are powered entirely by the solar panels.

## Best Practices

Among the three case studies, several factors in common were found to determine the success of the municipal renewable energy projects. They include:

- Existence of socio-environmental problems, local awareness of them and public pressure to address them.
- Commitment to environmental protection on the part of local government.
- Technical and negotiation capacity in the municipal government.
- Generation of direct benefits for the municipality and the community.
- Access to capital and financing.

## Conceptual Model

The following conditions have been identified as essential for the replicability of the Best Practices Model in other municipalities in Mexico:

***Existence of socio-environmental problems, awareness of them among the local community and public pressure to address them.*** In order to strengthen awareness among the local community of environmental problems present in their locality, their social and economic implications, and the role that renewable energies can play in their solution, we suggest that social environmental awareness programs be conducted, including practical workshops on the use of renewable energy and education on natural resource management and the environment.

***Commitment to environmental protection on the part of the local government.*** In order to achieve a greater commitment to environmental conservation among local governments, we recommend training courses for officials at all levels of local authority on environmental issues and the use of renewable natural resources to generate energy, allowing them to understand how environmental and social problems are interrelated as well as the alternatives that renewable energy can offer.

***Technical and negotiation capacity in the municipality.*** For those municipalities that do not have strong local technical capacity, we suggest that they solicit assistance from local universities and state institutions to conduct an analysis of the proposed technologies, strategies and projects. We also suggest that technical staff at the local government be trained in workshops that introduce them to the alternatives that renewable energies represent to address the local government's obligation to provide public social services.

***Generation of direct benefits for the municipality and community.*** A renewable energy project- in addition to solving a socio-environmental problem- should generate the maximum benefit to the local government and population. In particular, it should aim to generate benefits such as savings in the municipal electric bills, creation of local jobs, development of local technical capacity, solution of public health problems and social ills, and a more dignified life for marginalized populations.

***Access to capital and financing.*** In order to ensure access to capital and financing for renewable energy project development, we recommend that special multilateral funds be created that are earmarked exclusively for environmental issues and renewable energies for municipalities. These funds should have a social and environmental bottom line above a financial bottom line and should have low or zero transaction costs for marginalized municipalities.

## Identified Barriers

***Institutional Barriers:*** Under Mexican law, municipal presidents serve a single three-year term, making it unlikely that he or she would have a long-term development vision for their constituency. Consequently an energy project could lose continuity once a president leaves office.

***Capacity Barriers:*** There is very little capacity among municipal officials to identify the needs of marginalized communities and to plan for feasible solutions. Especially in rural municipalities, officials frequently have a low level of formal education. Nevertheless, at the national level there is a great resource of experts in the energy sector with decades of experience and expertise.

**Social Barriers:** If there is no environmental consciousness among the local community or awareness of efficient use of resources, there is a greater likelihood of opposition to development of projects that are perceived as diverting municipal money from attention to issues such as poverty, health or education.

**Political Barriers:** Under current legislation, the private sector can legally invest in electrical infrastructure; however private companies are prohibited from selling the energy generated to other private parties. All energy generated must be sold directly to the Federal Electric Commission, CFE, which is the only body legally permitted to sell energy to private parties in Mexico. However, private parties and municipalities are legally permitted to generate their own electricity, as long as the excess energy generated is sold only to CFE.

**Financing Barriers:** The high cost of the technologies used in renewable energy projects, coupled with the limited budgets of municipalities and their inability to access commercial loans impedes in large measure the installation of non-conventional technologies for electric energy generation.

## Implications for Local/National Sustainable Development

**Reduced dependency on fossil fuels and reduction of GHG emissions.** Given that the energy sector is responsible for 61% of emissions in Mexico, an increase in investment in renewable energies will contribute substantially to the GHG reduction goal in the National Climate Change Program (PECC).

**Co-benefits for the local population.** Renewable energy projects carry important additional benefits, among them job creation, increase in local productivity, reduction of local pollution, improvements in the water supply, treatment of waste, public lighting in marginalized areas, access to a higher standard of living, and poverty reduction.

**Rural electrification.** Renewable energy projects have the potential to substantially improve the lives of poor rural communities through provision of important services, such as public lighting, water and sewage services, storage of food and medications, communication health and education services, productive activities such as grain mills, small artisanal workshops, greenhouses, etc.

**Mitigation of negative externalities.** A renewable energy project will contribute to the reduction of externalities such as health risks, acidification of soil, rivers and lakes due to burning of fossil fuels, etc.

**Contribution to national technological development.** The technologies selected for implementation will foster national technological development and/or international cooperation to develop technologies in Mexico.

**Development of human capital and strengthening of capacity of local institutions** through the training of local government employees directly involved in the project (in its operation, management, maintenance, etc.).

**Greater participation of civil society in the development and strengthening of environmental standards.** Few people in Mexico are aware of their right to access to information and documentation regarding energy infrastructure projects. This model represents an opportunity for the WBG, which has stricter ESIA and consultation norms, to foster greater participation and transparency in the development process in Mexico.

## Potential Risks

**Financing.** Municipal finances and budgets are fragile and the risk default on payment of a project could be great if a municipality takes on a debt that it cannot sustain. Especially in the case of rural communities, the project financing mechanism must consider the incapacity to take on debt and lack of legal mechanisms or representation for acquiring debt. With this in mind, we suggest that they be supported through non-recoverable financing.

**Lack of technical support.** In the past, rural electrification projects using renewable energies in Mexico have failed because, once installed, the communities did not have the knowledge or training to maintain the equipment. Therefore, it is necessary that local technical capacity be built in order to permit the design and implementation of renewable energy projects, as well as their replicability and maintenance over time.

## Conclusions/ Recommendations

Within a framework of a commitment to raising the standard of living of the poorest in Mexico and a decentralized system for public service provision throughout the country, the World Bank has a responsibility to pay special attention to municipalities, especially the smallest municipalities with the fewest resources. While the Bank has approved two loans for \$15 million each for rural electrification in Mexico, these loans are relatively insignificant compared to the total Bank portfolio in Mexico, which recently surpassed \$10 billion (\$5 billion was disbursed in 2009 alone).

The WBG should create a special fund specifically earmarked for municipalities and states to support renewable energy projects for sustainable development at the local and regional level with a mechanism for direct, simple and fast access both in terms of time and procedure. For the most marginalized municipalities without the capacity to assume debt, we recommend the creation of a grant fund specifically for rural electrification using renewable energies to support already existing initiatives of the Mexican government directed toward the poorest municipalities of the country. These funds should respond to projects that demonstrate the maximization of environmental and social benefits and local development that have at the same time a process of proven social acceptance. Also, these funds should in parallel contribute to the development of technical and institutional capacity of municipal/state governments, educational institutions and NGOs.