

LATIN AMERICA AND CARIBBEAN REGIONAL WORKSHOP

TRANSFER OF TECHNOLOGY IN HONDURAS

I. INTRODUCTION

Honduras is the second largest country in Central America and has a population of about 6 million inhabitants, of which about 65% live in rural areas. Two main cities concentrate most of the urban population and the economic activity of the country, Tegucigalpa the capital, and San Pedro Sula in the Atlantic Plains which is an important pole of industrial activity in Central America.

In October of 1998 Hurricane Mitch affected most of the country, provoking a devastating impact on thousands of human lives, in the natural resource base, and on infrastructure by an estimated amount of about U.S. \$1,500 million. This disaster, whose effects were worse in the rural areas, has aggravated the levels of poverty of the Honduran population.

The country has a large resource base for the production of electricity such as hydropower (estimated between 3,600 and 5,000 MW), solar energy, wind power (60 MW), geothermal (120 MW), and bio-fuels (140 MW). At present, 56% of the total installed power capacity of 600 MW is based on hydro plants and 44% on fossil-fuel thermal plants. However, at a annual rate of 13% in electricity growth and only 20% of the rural population having access to the grid, in the near future the thermal based capacity is expected to surpass the hydro capacity. This is due to various reasons, including the short building times of fossil-fuel plants compared to hydropower plants, i.e. the energy produced by the fossil fuel plants has increased from 485 GWh in 1994 to 1,205 GWh in 1999, and the vulnerability of the hydro plants due to climatic conditions such as draughts and floods.

Power generation is mainly accomplished by ENEE (*Empresa Nacional de Energía Eléctrica*), the national utility (350 MW), and five private thermal generators (250 MW). ENEE is also in charge of transmission and distribution systems. It is estimated by ECLAC that about 70% of the distribution grid was in regular condition and that most of this system had reached its useful life even before Hurricane Mitch.

In Honduras, there are more than 7,000 communities off the grid where rural electrification by conventional grid extension may not be cost-effective as these rural centers are small, dispersed, and low-intensive power consumers. Small and mini (less than 10 MW) and micro hydro (less than 100 kW) sites have been identified and some of them have been developed up to the investment stage. These type of investments “match” the needs of particular end users, like the significant existing market for productive uses of electricity made up by 5,000 small coffee processing facilities.

In addition to ENEE as a public institution, the Energy Cabinet (*Gabinete Energetico*), integrated by several ministries, is the main authority in the energy sector responsible for the formulation of the overall energy policy. The Secretary of Natural Resources and Environment (SERNA), created in 1996, is responsible for the implementation of policies and regulations of the energy sector through the “*Dirección de Energía*”. The other public body is the National Energy Commission –CNE- made up of official representatives who are appointed by the Secretary of SERNA. The CNE has the main responsibility to regulate the electricity sector, as well as to revise changes to the tariff structure, especially in the calculation of the marginal cost of the kWh.

The overall reforms to the electricity sector approved by the National Congress in 1994 were aimed at the privatization of the distribution system, while leaving generation and transmission to ENEE. The process to introduce and implement these reforms has been very slow with no particular attention paid to rural electrification.

Since 1994, there have been other political and legal attempts to promote the

development of renewable sources of energy, especially Law 267-98 and 85-98 enacted by the Congress in 1998 that promotes the development of small scale renewable energy projects (Hydro up to 50 MW) by offering a set of incentives including energy pricing, duty free on imports of equipment and machinery, and “zero” income tax during the first five years after the project’s commissioning.

Private power producers created in 1997 the National Association of Renewable Energy to move forward several bio-fuel power and small-hydro projects. This represents a potential of at least 100 MW of installed capacity that has been prepared for further development if the appropriate regulatory and institutional conditions were in place. However, the lack of a clear implementation policy at the government and utility levels, and continuous changes in the existing legal framework, have prevented these projects from moving into the final investment and development stages.

At the rural level, there are a few commercial entities and NGO groups that have acted as catalysts in creating rural consumer awareness, providing technical assistance and training, and helping to establish micro-entities that sell and finance, in commercial terms, solar home systems.

The main existing barriers for the dissemination of renewable energy sources are: institutional, financial, technical, informational and geographical in nature.

As Honduras progresses towards sustainable development, in conjunction with its efforts for reconstruction after the Hurricane Mitch disaster in 1998, we will have to consider ways to control greenhouse gas (GHG) emissions due to energy consumption for electricity generation, including how to develop their indigenous resources in ways that are economically and socially beneficial.

The global objective is to mitigate the present and future growth of CO₂ emissions from the electricity sector in Honduras within the framework of Article 4.5 of the Convention,

by removing institutional, financial, technical, informational and geographic barriers to market penetration of renewable sources of energy in a manner that serves both commercial and broader national developmental objectives.

II. Technology Needs Assessment.

One of the main barriers for commercial renewable energy projects is the high capital cost associated with many renewable energy technologies, combined with the lack of access to suitable financial instruments and lack of trained personnel.

SOLAR ENERGY

Recently, the Dirección General de Energía of SERNA has completed a sunshine hour map of Honduras which involved 33 weather stations. In the areas where there were no weather stations such as border regions, information was obtained through the collaboration of the government of Guatemala (6 stations) and El Salvador (9). Honduras is privileged to have an annual average of 6.8 sunshine hours which is more than enough to operate isolated photovoltaic rural electrification projects, such as the ones now in operation, located in the village of San Ramón Centro, Choluteca and San Francisco, Lempira, which were funded by the UNESCO. UNESCO is considering to the solar electrification of 1000 villages. The Ministry of Health has installed 60 lighting and refrigeration systems for equal number of health centers in remote areas.

There are 30 qualified technicians for the installation of solar systems, 4 private distributors and 2 NGO's involved in the dissemination of these systems, however, high initial capital costs as well as high bank interests has hampered the dissemination process.

WIND ENERGY

The Dirección General de Energía is focused in trying to gather an inventory of places with wind energy potential. Initial studies of ENEE with AEE (Germany) in

1995 did a feasibility study registering speeds of 7.6 m/s in the Bay Islands, La Mosquitia, Amapá y Cerro de Hule. Actually, a project of 25 MW and another of 60 MW are being delayed mainly by legislative motives.

The main problem that hampers the exploitation of this resource is the lack of information regarding the wind potential because most of the data is associated to airport stations or agricultural weather stations. Also, the Short Term Marginal Costs as well as the high initial investment are constraints for the development of this resource.

BIOMASS

In Honduras there is a great residue potential (forestry, bagasse, coffee husk, rice husk, etc.) which can be use to develop generation and cogeneration projects.

Recent forest biomass studies in a 100 km radius, which includes the states of Francisco Morazán and Olancho, show that 49 sawmills operate and that they generated 86,010 metric tons of residues just in 1997 of which 14,800 metric tons were of sawdust and 71,210 tons of other industrial wood residues. Operations from the forests of Talanga y Guaimaca habe been estimated at 80,000 metric tons. More important is the biomass resulting from the thinning (raleo) of forests, approximately 640,000 tons.

Feasibility studies in the negotiating stage for electric generation from biomass are: Rancho Las Acacias, in San Manuel, Cortés (15-30 MW); between El Progreso and Tela a bamboo project (50 MW); Guaimaca, Francisco Morazán (15 MW); Sabá, Colón (80 MW). Again, high costs of initial investment and the short term marginal cost are hampering efforts to exploit this resource.

HYDROPOWER

The raw potential has been estimated between 3,600 and 5,000 MW. There are approximately 30 projects in the Dirección General de Energía for the development of small scale hydropower projects of which 20 have not had any significant movement in the last two years, therefore the Dirección is proceeding to annul their files. The main constraint for their development is that small hydropower projects of less than five million dollars do not qualify for banking financial support. The low short term marginal cost is another constraint making investment in this sector unattractive.

III. CAPACITY BUILDINGS NEEDS

As mentioned before, power generation in Honduras at the current tendency could incur in the risk of increase thermal power generation and thus increasing dependency on imported fossil fuels generation while having a negative growing impact on the balance of payments while not benefiting from the generation from our own renewable energy resources.

IV. BARRIERS TO TECHNOLOGY TRANSFER

The main problem from the **institutional** point of view is the lack of clarity by government agencies in the application of the existing legal reforms to the electricity sector. The uncertainty around the privatization process of ENEE and the operation of a wholesale market for electricity, has created a lack of confidence among international investors and project developers of several renewable energy projects ready for investment. For instance, the lack of clarification on timing for application and method of calculation of the marginal cost of the kWh has delayed for several years the negotiation of power purchase agreements with ENEE of at least 50 MW based on renewables. On the other hand, there is a lack of public

policy for off-grid renewable energy projects, especially those actions to cope with the lack of electricity services in most of the rural areas of the country.

In the **financial** front, the up-front costs of renewable energy products and projects, the high financial spread charged by the commercial banking system, and the lack of available long-term financial structures are the main barriers to renewable energy development, especially for the end-user who exists in a high level of poverty. Besides, no dedicated financing for renewable energy activities still exists with commercial and development lending institutions, public agencies, and financial intermediaries. The five million dollars minimum investment level for requesting loans to banks is a major limitation for the development of small scale projects.

From the **technical** point of view, the bulk procurement of renewable energy technologies and services is limited due to the current small market for renewable energy services. Specifically there is little knowledge, appropriate skills, and lack of minimum norms and standards for off-grid rural electrification based on renewables.

Regarding **information dissemination**, there is limited availability and access to existing information. A central information point does not exist, instead, information is scattered among various sectors; e.g. private sector, ENEE, SERNA, development assistance agencies, and a few NGOs.

Also, there is an important **geographic** barrier. Accessibility of many renewable energy resource sites are far away from the main demand centers, resulting for example in high transmission and distribution costs, because the availability of renewable energy resources is very site specific, away from the transversal corridor made up by the cities of Choluteca-Tegucigalpa-San Pedro Sula-La Ceiba, a fringe that concentrates most of the economic activity in Honduras.

V. POSSIBLE ACTIONS AND INITIATIVES TO REMOVE BARRIERS

INSTITUTIONAL

Governmental decision in the development of renewable energies described in the Plan Maestro de Reconstrucción y Transformación Nacional (Master Plan for National Reconstruction and Transformation)

Actually, It is been discussed the new version of framework law for the electrical sub sector. All private and governmental actors are participating in that discussion, adding transparency and global consensus to it.

This law is going to accelerate the privatizing process for the utility ENEE, with the adequate transparence.

Clarity in the transference of the obligations of ENEE in PPA's contracts subscribed with the private generators.

FINANCIAL AND TECHNICAL

The development of the wholesale energy market will provide additional transparency to the process, a requirement of every investor. However, the Honduran market remains rather small, therefore as the Central American grid interconnection becomes a reality, it should provide a better incentive for private investors to finance renewable energy projects and obtain better financial terms. The advent of new investors will facilitate the transfer of technology and know-how.

INFORMATION DISSEMINATION

Institutional strengthening of SERNA/DGE, CNE will facilitate the gathering, administration and dissemination of the information.

GEOGRAPHIC BARRIER

The Honduran Government shall be responsible for the expansion of the grid so that demand will increase and the market will expand becoming more attractive for investors. The development of isolated systems shall be done through alternative renewable sources.

VI. OPPORTUNITIES FOR INVESTMENT AND PRIVATE SECTOR PARTICIPATION

The Honduran legal system and the Electrical Subsector is ongoing through a major transformation process. General aim of this process is to incentive private investment in renewable energy projects. The country has a large resource base mainly as hydropower. Nevertheless, in 1999, more than 50% of the energy demand was supplied by fossil fuel thermal plants (457.1 MW). Statistics show that thermal generation is increasingly having an impact on the country's economy and environment.

Studies show that Honduras has an important renewable energy potential. Those studies have estimated a 5000 MW potential for hydropower, 6.8 sunshine hours of solar energy, 40 MW of wind power, 120 MW of geothermal power and 140 MW based on biofuels. The Master Plan of National Reconstruction and Transformation (1999) developed by the Honduran Government in an effort to overcome the Hurricane Mitch disaster, occurred in October 1998, encourages the development of energy generation projects focused on renewable energy. General aim is to develop small scale hydropower projects to take advantage of the favorable country's geographic and environmental conditions that enhances its hydrological potential. Loans and funds will be granted by international aiding agencies to Non-Governmental Organizations and entities involved in the renewable energy subsector's development.

Law Decree 267- 98 and the General Law of the Environment exonerate tax payments for the introduction of clean-environmentally friendly and energy efficient technologies. Furthermore, companies generating energy from renewable resources, obtain a 10% incentive over the marginal cost and receive dispatch priority over non renewable based generators.

The above mentioned benefits are readily granted to those investors that promote technology transfer and implement research programs aiming to energy generation based on alternative sources. Same benefits are given to companies that promote economic growth through imported raw material's substitution, and new jobs creation.

VII. ONGOING AND PLANNED TECHNOLOGY TRANSFER ACTIVITIES

- ◆ Renewable Energies Technological Fair at international level.
- ◆ Agreements with the association of national coffee growers (APROHCAFE) for the development of demonstrative projects for the utilization of renewable resources.
- ◆ Development of 50 solar villages at the financial procurement stage (UNESCO, COHCIT).
- ◆ Training of SERNA/DGE technical staff in different areas.
- ◆ Development of workshops of renewable energy in Central America, with support of SYNERGY from the European Commission

VIII. ELEMENTS OF SUCCESSFUL TRANSFER OF TECHNOLOGY ACTIVITIES

- ◆ The purpose of the International Fair shall be the transfer of technology to all type of audiences, not only investors.
- ◆ Technology transfer shall be adaptable to local level of trained technicians.
- ◆ End users should be self sufficient in the operation and maintenance of technology and should develop the capacity of self gestation.

IX POSSIBLE ELEMENTS OF A FRAMEWOK FOR MEANINGFUL AND EFFECTIVE IMPLEMENTATION OF ARTICLE 4.5 OF THE CONVENTION.

Financial organizations that are located in the members of Annex I should make an investment program in the countries that integrate Annex III through concessionary loans and/or donations for sustainable projects.

X CONCLUSIONS

Honduras is making its best effort in order to comply its obligations as a country under Annex III fostering the appropriate framework for investment and rational use of natural resources.