# Power Sector
# Update and Revision Study

**March 2010**

**Japan International Cooperation Agency – JICA –**
**Honduras Office**

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**Japan International Cooperation Agency**
**(JICA)**

# HONDURAS

# Power Sector Update and Revision Study

## Final Report

**March 22, 2010**

**Prepared for JICA by Manuel I. Dussan**

# Table of Contents

## ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| AMR: | automatic meter reading |
| bbl: | barrel |
| BNDES: | National Development Bank of Brazil |
| BOT: | build, operate and transfer |
| CABEI: | Central American Bank for Economic Integration |
| CFL: | compact fluorescent lamp |
| CMCP: | short-run marginal cost |
| CNE: | Comisión Nacional de Energía |
| COHCIT: | Consejo Hondureño de Ciencia y Tecnología |
| CPME: | Comisión Presidencial de Modernización del Estado |
| CRIE: | Comisión Regional de Interconexión Eléctrica |
| DIRPLAN: | Dirección de Planificación y Desarrollo – Planning and development office |
| EBITDA: | earnings before interest, taxes, depreciation and amortization |
| ENEE: | Empresa Nacional de Energía Eléctrica |
| EOR: | Ente Operador Regional |
| ERP: | poverty reduction strategy |
| FHIS: | Fondo Hondureño de Inversión Social |
| FOSODE: | Fondo Social de Desarrollo Eléctrico – Social fund for electricity development |
| GAUREE: | Generación Autónoma y Uso Racional de Energia (Off-grid generation and rational energy use) |
| GE: | Energy Cabinet |
| GEF: | Global Environment Facility |
| GOH: | Government of Honduras |
| GWh: | thousand million de watt-hour |
| IAEA: | International Atomic Energy Agency |

| | |
|---|---|
| IDA: | International Development Association |
| IDB: | Interamerican Development Bank |
| IFC: | International Finance Corporation |
| JICA: | Japan International Cooperation Agency |
| lbs: | pounds |
| Lps | Lempiras |
| lts: | liters |
| MER: | regional electricity market |
| mts: | meters |
| MW: | million watt |
| MWh: | million watt-hour |
| OES: | Oficina de Electrificación Social |
| p.a.: | per annum |
| PIR: | Rural Infrastructure Project |
| PPA: | power purchase agreement |
| PROMEF: | Power Sector Efficiency Improvement Project |
| sec: | second |
| SERNA: | Secretaría de Recursos Naturales y Ambiente |
| SIAFI: | Integrated financial management system |
| SIEPAC: | Sistema de Interconexión Eléctrica de los Países de América Central |
| Taipower: | Taiwan Power Company |
| UG: | management units |
| UIN: | independent business units |
| VAD: | distribution value added |
| WB Report: | Honduras- Power Sector Issues and Options |
| WB: | The World Bank |

# I. Introduction

The report "Honduras- Power Sector Issues and Options" prepared by the World Bank (WB) in July 2007 (referred to as WB Report) presents a complete diagnostic of Honduras´ power sector, analyzes the main short and long-term challenges for the development of the sector, identifies the main policy options and proposes strategies to meet these challenges. Important domestic and international events have taken place during the past three years, which had an impact on the sector: ENEE´s financial rescue operation implemented by the Government of Honduras (GOH) in 2008, the international financial and economic crisis of 2008 and the domestic political crisis of 2009.

Japan International Cooperation Agency (JICA) and the Interamerican Development Bank (IDB) decided that it was convenient to update the WB Report´s main conclusions to identify the sector´s challenges, especially those related to the development of renewable energy and energy efficiency to reduce its dependency on imported oil, propose short and medium-term corrective actions, identify priority areas that may require JICA and IDB´s assistance, and facilitate the policy dialogue with the new GOH.

JICA retained the services of a consultant, Manuel Dussan, to prepare the Power Sector Update and Revision Study, in a short period of about two and half months. The consultant submitted an Initial Report in January 4, 2010, which reviews recent documents about Honduras´ power sector[1] and proposes a work program to meet the basic objectives of the study. The consultant visited Tegucigalpa in February 1-5, 2010 to meet key staff of ENEE, the Financial Ministry, SERNA, CPME and some private investors, update information on the sector and discuss plans, programs, policies and corrective actions that have been taken or would be taken in the near future. The consultant submitted in February 27, 2010 a draft Preliminary Report that summarizes the findings, conclusions and recommendations of the study. The consultant made a second visit to Tegucigalpa in March 9-11, 2010 to gather missing information, verify some findings and conclusions and meet the new power sector´s authorities.

This final report presents an update of the WB Report in the following topics: evolution of the sector in 2007-2009 and update of main challenges, mainly related to generation expansion, diversification of energy sources based on renewable energy, integration with the regional energy market, financial performance, electricity prices and subsidies, energy efficiency programs and improvements of ENEE´s performance. This report proposes short and medium-term actions to address these challenges and identifies priority areas for IDB and JICA´s assistance.

[1] Honduras, Power Sector Issues and Options, July 2007; Plan indicativo regional de expansión de generación periodo 2009-2023, CEAC, May, 2009; Análisis del mercado Hondureño de energía renovable, Proyecto ARECA, BCIE, 2009; Cálculo de las tarifas del servicio eléctrico de Honduras, Angel Baide, April 2008

This report takes the main conclusions and results of the WB Report as a starting point, examines the evolution of the sector as of 2007 and analyzes changes in the power sector´s outlook, based on recent energy plans and studies prepared by SERNA and ENEE. An independent analysis of the generation expansion plan or ENEE´s financial projections was not included in the scope of this study.

The final report is organized in 4 sections: **executive summary**; **current situation of the power sector**, which reviews the recent evolution of the sector and the action plan implemented by GOH to rehabilitate the sector; **power sector outlook**, which reviews the generation and transmission expansion plans and ENEE´s financial projections and discusses the main challenges; and **options and recommendations**, which discusses options to address the main challenges and identifies priority areas for JICA and IDB´s support.

# II. Executive Summary

The diagnostic of the power sector included in the WB Report of 2007 identifies some important issues about the sustainability of the sector: (i) **A poor performance of ENEE**, with high and increasing black electricity losses, lack of modern information and management systems and weak corporate governance; (ii) **a critical and unsustainable financial situation** of ENEE, related to its poor performance, the vulnerability of generation costs to the volatility of oil prices and the application of broad electricity subsidies; (iii) **the dependency on oil-fired thermal generation**; (iv) **the risk of a short-term energy supply crisis** due to a lack of adequate capacity reserve and delays in contracting new generation capacity. The WB Report concludes that a business as usual scenario – no actions taken to reduce electricity losses, increase tariffs and limit subsidies- is not sustainable in the short-term because the financial deficit would increase and could not be financed with fiscal resources.

***Actions taken to recover the power sector***

GOH implemented an action plan to address the critical situation faced by the power sector in 2007. **To improve the performance of ENEE, the GOH**: (i) supported the implementation of a large program to install automatic meter readers (AMR) and wholesale meters and field visits to detect and correct electricity fraud and theft, which reduced electricity losses from 25.4% to 21.2% in 2007, but the improvements were not sustained and by late 2009 losses increased to 22.5%; (ii) prepared and obtained a US$30 million IDA loan for the implementation of the Power Sector Efficiency Improvement Project (PROMEF), which will restructure the distribution business of ENEE and modernize its information and management systems; and (iii) completed studies, with the assistance of international consultants, to restructure ENEE in four business units, with separate accounts, including a detailed design of the new organization, and procedures for cost-accounting and selecting a new management team.

GOH implemented in 2007-2008 the **ENEE´s financial recovery program,** which included the capitalization of ENEE in about US$220 million, average tariff increases of about 31% in 2008 and 6% in 2009 and short-term financing to settle about US$90 million in arrears for energy purchases to private generators. Due to this program, ENEE´s financial losses decreased from about Lps 2,500 million in 2007 and 2008 to Lps 500 million in 2009, when the bunker C prices dropped to the same average price of 2007, 55 US$/bbl, after having reached an average price of 74 US$/bbl in 2008.

GOH is implementing an **energy sources diversification program based on the development of renewable energy.** ENEE made substantial progress in the preparation of hydroelectric projects using BOT or public/private partnership (PPP) schemes. In 2008 ENEE signed a BOT contract with Taipower for the development of the 100 MW Piedras Amarillas hydroelectric project and completed a feasibility study for this project. It reached an agreement in 2009 to develop a 270 MW hydroelectric capacity (Llanitos and Jicatuyo projects) by a new company formed by a construction company, BCIE and ENEE, with a US$271 million loan from BNDES of Brazil. However the development of these projects experienced a setback in 2009 when The National Assembly of Taiwan did not authorize

Taipower´s investment plan and the BNDES´s loan was frozen due to the diplomatic crisis with Brazil.

Furthermore, the National Congress approved in 2007 a comprehensive renewable energy promotion law, which stirred the preparation of renewable energy generation projects by private investors. In late 2009, ENEE requested bids for the supply of 250 MW in renewable energy generation and received valid proposals to supply about 600 MW of 39 renewable projects (mainly small and medium hydroelectric plants) to be commissioned in 2012-2017. Furthermore, in 2008 ENEE signed a power purchase agreement (PPA) for the supply of 100 MW in wind power (Cerro de Hula project). If all these renewable energy generation projects are implemented and commissioned, the participation of renewable energy in the generation mix would increase from 30% in 2009 to 80% in 2017.

Although ENEE took actions **to reduce the risk of a short-term energy supply crisis,** it appears that external factors, not under control of ENEE, were a major factor in averting energy rationing in 2009. On the one hand, ENEE implemented an Efficient Lighting Project, which distributed free of charge about 6 million compact fluorescent lamps (CFL) to replace most of the incandescent bulbs in the country. On the other hand, the international financial crisis of 2008, which produced a large drop in international trade, had a substantial impact on industrial production in Honduras and electricity sales in the industrial sector decreased by about 10% in 2009. Although firm generation capacity did not increase from 2007 and 2009 and the capacity reserve was not adequate, a supply crisis in 2009 was avoided due to the combination of the international financial crisis and the massive CFL program.

***Short-term challenges***

**As three years ago, the main short-term challenge faced by the power sector is to improve ENEE´s critical financial situation and reduce the risk of an energy supply deficit.** The financial recovery program implemented by GOH in 2008 was instrumental in avoiding a financial debacle in 2008 but was not sufficient to overcome ENEE´s financial problems. In late 2009 average tariffs did not cover electricity supply costs and residential customers, with monthly energy consumption of up to 500 kWh (88% of all customers), received a direct subsidy which amounted to about US$53 million per year and could not be financed with fiscal resources. ENEE´s financial projections show a financial loss of about US$131million in 2010 if tariffs are not increased in about 11%, as required by the tariff adjustment formula approved by the regulator to account for fuel oil price variations (currently at 72 US$/bbl). On the other hand, about 120 MW in costly PPAs with diesel plants will expire in 2010, but these contracts would have to be extended to meet projected demand in 2011. Additionally, ENEE would have to ensure the supply of about 50 MW from the regional market in 2011.

The following action plan is proposed to reduce the risk of financial and energy supply crisis in the short-term:

- Approve immediately an average tariff increase of about 11%, which has been postponed since the second semester of 2009.

- Eliminate the direct subsidies that benefit residential customers with monthly consumptions up to 500 kWh, but taking additional measures to protect residential consumers in the range of 0-150 kWh/month.

- A gradual elimination of cross-subsidies that benefits monthly residential consumptions of up to 1,450 kWh, focusing these subsidies on low-income consumers.

- Revise ENEE´s electricity loss reduction program to make an effective use of AMRs and implement a short-term program to reduce receivables.

- Assess the feasibility of using financial instruments to hedge fuel oil price risks (call options) and smooth out any large tariff adjustment related to increases in fuel prices.

- Negotiate an extension of the PPAs with Lufussa I y Elcosa, which would end in 2010.

- Identify and negotiate energy supply contracts in the regional market to meet short-term generation reserve needs and improve ENEE´s negotiation position to extend the PPAs.

***Medium-term challenges***

**The report identifies four major challenges in the medium and long-term:** (i) a sustainable recovery of ENEE´s financial position, (b) mobilize the financial resources needed to develop the renewable energy generation projects and reduce investment lags in power transmission and distribution, (c) take advantage of the regional energy market, and (d) increase electricity access to the poor.

*Sustainable financial recovery*

The report concludes that to ensure **a long-term sustainable financial recovery** it is necessary to achieve substantial and sustainable improvements in the performance of the sector, establish cost-recovery tariffs and improve energy supply bidding procedures. The **strategy to improve sector performance** will focus, in a first stage, on the improvement of the ENEE´s distribution business with the implementation of PROMEF and ENEE´s restructuring in four business units with separate accounts. However, this is not enough to achieve substantial and sustainable performance improvements. ENEE, as a state-owned enterprise, has poor governance and cannot operate as a commercial enterprise due to several budgetary, financial and procurement controls and political interference. It is necessary to transform it in a commercial enterprise. Additionally, it is necessary to strengthen energy policy making and regulation and establish all rules and regulations necessary to develop a competitive wholesale market, so that ENEE faces the market discipline and improves efficiency.

The **establishment of cost-recovery tariffs and focalized subsidies** is a necessary condition for financial recovery but difficult to achieve if the generation prices are

vulnerable to the volatility of fuel prices. The development of renewable energy generation by private investors would help to diversify generation sources and stabilize electricity prices. However, ENEE´s financial projections for 2010-2015 indicate that the cross subsidies are not sustainable in the long-term even though the share of renewable energy generation increases substantially, because the energy prices of PPAs with new renewable projects are relatively high (10 to 12 US¢/kWh) and average residential tariffs do not cover supply costs.

**The single-buyer model has not been effective in ensuring a sufficient and reliable power supply.** The bidding processes for contracting energy supply have experienced many difficulties and delays in the past and, as a result, ENEE had to implement in many cases costly and inefficient emergency solutions. Recently, ENEE used ad-hoc bidding procedures for the procurement of renewable energy that established very attractive conditions for the participation of private generators but do not respond to a strategy to ensure sufficient and efficient long-term energy supply.

The report proposes to implement the following actions to ensure a **sustainable financial recovery:**

- **In the short-term: (i)** give priority to the implementation of the PROMEF project and to restructuring ENEE in business units with separate accounts; (ii) initiate a gradual process of eliminating any subsidies to residential consumption above 150 kWh/month (or the subsistence consumption) so that cost-covering tariffs are implemented in the medium-term, using as a reference the recommendations of a recent electricity subsidies study prepared by a WB consultant; (iii) award the renewable energy generation bid, selecting the most attractive proposals of bankable generation projects that are ready for execution, and reducing the risk of contracting a large capacity in very long-term PPAs with indexed energy prices.
- **In the medium-term:** (i) prepare a plan for the corporatization of ENEE; (ii) separate the policy making and energy planning role by transferring this functions from SERNA to an Executive Secretariat of the Energy Cabinet; (iii) complete the program to focalize electricity subsidies; (iv) establish procedures and regulations for competitive procurement of energy supply by ENEE; (v) provide technical and political support to CNE, so that it can implement the energy market model establish by law and develop the norms and procedures required to operate within the regional energy market, to regulate long-term energy supply contracts and to allow the development of transmission projects by third parties.

*Mobilization of financial resources*

**Funding of the power sector investment needs is far from being arranged and is a major challenge**. Financing of an estimated US$2 billion investment in renewable energy generation in 2010-2017 would be problematic in the current scenario of tight financial markets after the international financial crisis, ENEE´s and GOH's weak financial positions, and recent reversals in the implementation of hydroelectric projects that had government-to-government support. Besides, as a result of ENEE´s weak financial

situation in recent years, needed investments in transmission and distribution were delayed and now there is an investment backlog of about US$380 million, 72% without financing.

The report proposes the following actions to mitigate project risks and **facilitate funding of investment needs**: (i) GOH to provide a clear signal of its political commitment to improve ENEE´s financial position (cost-recovery tariffs, focalize subsidies and restructure ENEE); (ii) provide partial risk guarantees by multilateral banks to GOH to ensure timely payment to new PPAs with private renewable energy projects; (iii) non-recourse financing by multilaterals of attractive private renewable energy generation projects with large consumers as electricity off-takers; (iv) development by private investors of selected transmission projects under BOT schemes, based on norms and regulations established by CNE.

*Development of the regional energy market*

The regional energy market offers many potential benefits to Honduras, but many barriers need to be overcome. Law 70-2007 eliminated ENEE´s monopoly in regional electricity trade and now allows private generators and large consumers to participate in the regional energy market. But there are still barriers for the development of the regional market mostly related to a lack of harmonization of domestic market regulations with the regional market regulations: (i) the domestic regulations are not adequate to operate a wholesale energy market with the participation of third parties- the Operation Code is missing, as well as the information systems and software needed to manage a wholesale energy market; (ii) ENEE does not have the commercial energy metering systems required by MER and a project to modernize its Control Center has been delayed and has not been contracted as yet; (iii) the development of firm energy export contracts may not be feasible if a legal condition in Honduras to give priority to the supply of the domestic energy demand is not removed; (iv) the regional market Framework Treaty establish the obligation to establish business units with separate accounts in the case of the participation of vertically integrated companies. ENEE has not complied with this requirement.

The report proposes the following **actions to facilitate the development of a regional energy market**:

- **In the short-term: (i)** GOH commitment to implement an action plan to harmonize market regulations and facilitate the development of the regional energy market; (ii) implement required tasks to harmonize the domestic market regulations, as a complement to the design of the regulatory interface being implemented by CRIE; (iii) strengthen CNE to develop its technical capability and credibility needed to prepare and apply the Operation Code.
- **In the medium-term:** (i) install the energy metering system to meet the requirements of MER; (ii) implement the information systems and software required to manage the wholesale energy market with the participation of independent generators and large consumers; and (iii) strengthen ENEE´s Control Center so that it can manage the energy market and coordinate economic dispatch.

*Electricity coverage*

GOH made substantial progress in increasing electricity coverage during the past three years. The national coverage index increased in 10 percentage points in 2006-2009, from 69.1% to 79.3 %, almost reaching the target for 2015 in the Poverty Reduction Strategy (ERP). However additional coordination and financing efforts are needed to meet a target of 90% in 2020, agreed recently by the presidents of the Central American countries. Increasing electricity coverage in isolated areas using renewable energy and improving the efficiency of grid extension programs is a major challenge. The report suggest to prepare an assessment of the rural electrification programs that have been implemented and of the investment needs to make a better use of financing resources and meet the coverage targets.

***Priority areas for international cooperation***

A group of international donors agreed on a coordinated program to support the implementation of GOH´s strategy for the recovery of the power sector, based on the WB PROMEF project to improve the performance of ENEE´s distribution business and on IDB´s project to finance transmission and substation projects. IFC is supporting project finance for private renewable energy generation projects.

This report confirms that the recovery strategy is still valid to address current challenges and that the support program still has a high priority. However, neither the support program is sufficient to meet the assistance needs of the sector nor the actions taken by GOH are sufficient to ensure a sustainable development of the sector.

The formulation and approval by GOH of a comprehensive action plan for a sustainable recovery of the sector and the implementation of the most urgent corrective measures would provide a clear signal of GOH´s commitment and justify the support of the group of donors in other priority areas:

a) **Institutional strengthening**. The lack of separation of roles of policy making, regulation and service provider is a barrier for a sustainable development of the sector. Due to SERNA and CNE´s lack of leadership and technical capability to meet their roles of policy maker and regulator of the energy sector, ENEE has filled the gap and has a major influence in policy making and regulation. Support is needed to strengthening policy making and regulation.
b) **Financing support to renewable energy generation projects**. Development by the private sector of renewable energy generation is difficult due to credit risks of selling energy to ENEE and the project risks associated with projects that are capital intensive and require long preparation periods. The report proposes to provide non-recourse financing to the most attractive private projects and partial risks guarantees to GOH to facilitate financing of small generation projects by the local banks.
c) **Financing priority transmission and distribution projects.** The investment backlog in transmission and distribution projects due to lack of financing is an obstacle for the development of renewable energy generation projects that need additional transmission capacity, compromises the reliability of supply and

sometimes forces the implementation of costly and inefficient emergency solutions. The report suggests supporting the implementation of priority projects with additional loans to ENEE and technical assistance to design the norms and regulations for the development of transmission project by private investors under BOT arrangements.

d) **Technical assistance for basic studies.** Information on the generation potential in renewable energy is incomplete, especially for wind, geothermal and biomass. Technical assistance is needed to finance basic studies on renewable resources that would facilitate development of renewable projects by the private sector.

e) **Assistance for maintenance and expansion of ENEE´s hydroelectric generation plants.** The operation experience of the Francisco Morazán hydroelectric station, the largest investment by ENEE, indicate that ENEE has taken timely actions to address serious operation problems during the past 25 years, related to reservoir leakage in the karstic formations around the dam. ENEE has to implement a new grouting program this year at an estimated cost of US$11 million. On the other hand, it proposes to prepare a prefeasibility study of the expansion, repowering and efficiency improvements of the Francisco Morazán, Cañaveral y Rio Lindo hydroelectric plants.

Specific needs for the support of the donor group in these priority areas are identified at the end of this report.

# III. Current Situation of the Power Sector

Honduras, with Nicaragua and Guatemala, has a lower position on economic development and human development and poverty indexes as compared to other countries in Central America. In 2008, Honduras had a per capita income below US$4,000 (purchase power parity), a medium low income in the WB ranking, had a medium human development index, an indication of progress made in health, education and standard of living, and had a middle position in terms of the poverty index in developing countries as about 50% of its population are poor. Besides, the electricity coverage index in Honduras (77%) was one of the lowest in the region (see Table 1).

**Table 1**

**Central America**
**Basic Statistics**
2008

| | | Costa Rica | El Salvador | Guatemala | Honduras | Nicaragua | Panama | CA |
|---|---|---|---|---|---|---|---|---|
| **Area** | km2 | 51,100 | 21,040 | 108,890 | 112,090 | 130,000 | 75,520 | 498,640 |
| **Population** | million | 4.53 | 6.13 | 13.68 | 7.24 | 5.68 | 3.39 | 40.65 |
| **Density** | pop/km2 | 89 | 292 | 126 | 65 | 44 | 45 | 82 |
| **GNI per cápita (PPP)** | US$ | 10,950 | 6,670 | 4,690 | 3,870 | 2,620 | 11,650 | 5,832 |
| **Human development index** | Ranking 2008 | 50/179 (high) | 101/179 (medium) | 121/179 (medium) | 117/179 (medium) | 120/179 (medium) | 58/179 (high) | |
| **Population below poverty line** | % | 22% | 37% | 56% | 51% | 48% | 37% | 46% |
| **Human poverty index HPI-1** | Ranking 2008 | 5/108 (high) | 35/108 (medium) | 54/108 (medium) | 41/108 (medium) | 46/108 (medium) | 15/108 (high) | |
| **Electricity coverage** | -2007% | 98.8% | 85.8% | 83.8% | 77.0% | 64.5% | 88.9% | |
| **Urban population** | % total | 62% | 60% | 47% | 47% | 59% | 71% | 54% |

Source: World Bank, WDI; and UNDP, development indicators, CEPAL

## A. Energy matrix

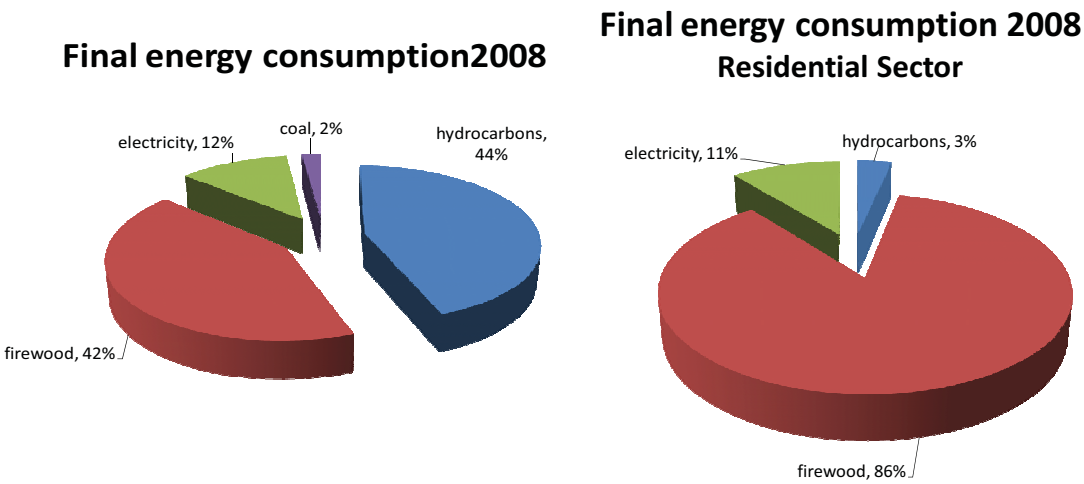
In Honduras, as in other countries in Central America, the participation of oil products in primary energy supply is about 50%, natural gas is not used and coal has a marginal use. Honduras does not produce or refine crude oil and has to import all oil products to meet domestic demand. Hydroelectricity has a relatively low participation as energy source for electricity generation (21%), an indication of a country than depends on oil as an energy source for electricity generation (56%) and on the inefficient use of bagasse in sugar mills (see Figure 1). On the other hand, Honduras and Panama were the only countries in the region that have not developed geothermal generation (see Table 2).

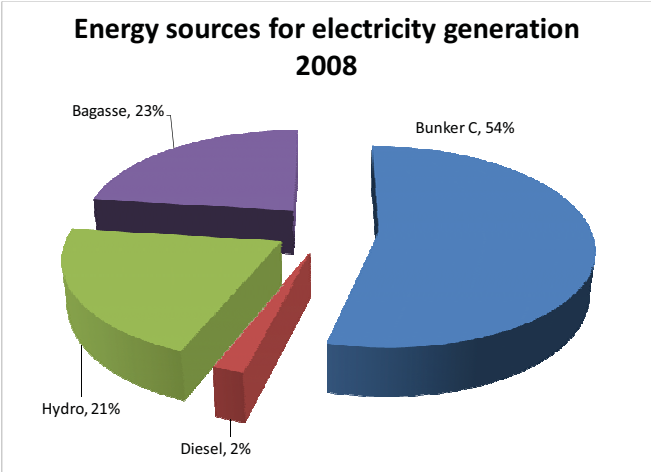
**Table 2**

| Central America | | | | | | |
|---|---|---|---|---|---|---|
| **Primary energy supply** | | | | | | |
| % of total | | | | | | |
| | **Costa Rica** | **El Salvador** | **Guatema-la** | **Hondu-ras** | **Nicara-gua** | **Panama** |
| Crude oil and oil products | 51% | 60% | 42% | 51% | 51% | 73% |
| Coal | 0% | 0% | 4% | 2% | 0% | 0% |
| Hydro | 13% | 5% | 4% | 6% | 1% | 10% |
| Geothermal | 17% | 13% | 3% | 0% | 3% | 0% |
| Firewood | 10% | 14% | 41% | 33% | 37% | 14% |
| Bagasse | 5% | 7% | 8% | 7% | 7% | 3% |
| Others | 4% | 0% | 0% | 1% | 1% | 0% |
| Total | 100% | 100% | 100% | 100% | 100% | 100% |
| Imported (net) | 51% | 60% | 37% | 56% | 51% | 73% |
| Renewables | 49% | 40% | 55% | 47% | 49% | 27% |
| Year | 2007 | 2006 | 2007 | 2008 | 2006 | 2007 |
| Source : Ministry of Energy or equivalent | | | | | | |

Firewood has a high participation, over 30%, in primary energy supply in Honduras, Nicaragua and Guatemala, countries with relatively low electricity coverage and a high percentage of their population living in rural areas. The participation of firewood on final energy consumption is even greater, an indication of an inefficient use of this energy source, mainly in households. Firewood has a 42% on final energy consumption, similar to hydrocarbons, which dominate energy consumption in industry and transportation. Firewood represents 8% of energy consumption in the residential sector, concentrated on the extensive and inefficient use of firewood for cooking in rural areas where LPG has a low penetration (see Figure 1).

**Figure 1**






Source: SERNA, energy balance 2008

Reliance on imported oil as energy source for power generation and the high participation of firewood in final energy use are a matter of concern. First, the oil bill increase to about US$2 billion in 2008, when oil prices peaked, equivalent to 75% of exports (excluding *maquila*). Besides, it is difficult to pass-through to tariffs the generation costs when they are exposed to the volatility of oil prices. Second, the inefficient use of firewood for cooking in rural homes contributes to deforestation and represents a major health risk and a major expense for households. The diversification of energy sources and increases in electricity coverage would help to address these problems and are a major challenge for a sustainable development of the power sector.

## B. Institutional structure

The Electricity Law of 1994 defined a institutional structure and an organization of the power industry which support the development of a competitive energy market and private participation: separation of roles of policy making, under the responsibility of the Energy Cabinet (GE) and the Ministry of Natural Resources and Environment (SERNA), regulation, assigned to The National Energy Commission (CNE), and service provision by unbundled generation, transmission and distribution companies.

However, the new market model was partially implemented and the Empresa Nacional de Energía Eléctrica (ENEE) continues operating as a vertically integrated state-owned company- by and large the only distribution and transmission company and responsible for system operation and economic dispatch- that controls the generation activity as owner and operator of power generation plants and single-buyer of energy to private generators. In the case of rural electrification, municipalities and other institutions that manage funds from the ERP and from international cooperation, share with ENEE the responsibility for new investments. The institutional structure in summarized in Table 3.

**Table 3**

| Role | Institution | Organization | Functions (electricity sector) |
|---|---|---|---|
| **Policy making** | Energy Cabinet (GE) | Formed by President office, SERNA, SEFIN, SEIC. | Definition of energy policies. Approval expansion plans |
| | SERNA | Ministry | Secretary of GE. ENEE´s board president. Formulation and coordination of policies for the use of renewable energy. Establish short-run marginal cost |
| **Regulation** | CNE | Decentralized entity of SERNA. Formed by 5 professionals appointed by SERNA from short list proposed by associations | Approve electricity tariffs, regulation and general supervision. |
| **Service provider** | ENEE | Vertically integrated state-owned company | Generation, transmission and distribution, dispatch center, preparation of expansion plans, single-buyer |
| | Private generators | Private companies | PPAs with ENEE. Possibility of sales to large consumers and energy exports |
| **Rural electrification** | ENEE, municipa-lities, FHIS, COHCIT | | Grid extension and off-grid rural electrification |

SEFIN: Secretaría de Finanzas; SEIC: Secretaría de Industria y Comercio; JD: Junta Directiva; FHIS: Fondo Hondureño de Inversión Social; COHCIT: Consejo Hondureño de Ciencia y Tecnología

The institutional structure has not worked well. GE has met infrequently and SERNA, as technical secretariat, has not provided adequate technical support needed for decision making. SERNA has a conflict of interest in its dual role of environmental protection and development of renewable energy, and does not have the financial and technical resources needed to discharge its broad responsibilities. The separation of roles has not been effective as ENEE filled the gap and has a major influence in policy making and regulation. The indicative generation expansion plans prepared by ENEE have not been formally approved by GE and the contracting of new energy supply by ENEE has experienced delays and difficulties. The regulator has played a marginal role due to a lack of political support to implement the market model, political meddling and the dominant position of ENEE.

However, the single-buyer model has been effective in attracting private participation to generation expansion. Beginning in 1994, generation expansion has been based on long-term PPAs with private generators, resulting from competitive bidding or direct energy purchases at regulated prices to small renewable energy generation projects that take advantage of special incentives.

By the end of 2008, there were 33 private generators, with PPAs with ENEE and an installed capacity of 1,005 MW, equivalent to 63% of total capacity, of which 104 MW in 23 small generators using renewable energy (mostly small hydroelectric plants and bagasse-fired cogenerators). ENEE kept about 560 MW in generation plants, mostly hydro, that it owned before the reform in 1994 and was responsible for transmission and distribution in the national interconnected system (see Table 4).

**Table 4**

| **Honduras** | | | | | |
|---|---|---|---|---|---|
| **Private participation (Dec/08)** | | | | | |
| National Interconnected System | | | | | |
| | **State-owned** | | **Private companies** | | |
| | ENEE | Other * | # | Capacity | % |
| **Generation (MW)** | 559 | 30 | 33 | 1,005 | 63% |
| Hydro | 434 | 30 | 12 | 58 | 11% |
| Thermal | 125 | | 21 | 947 | 88% |
| TG | 33 | | 1 | 40 | 55% |
| MDAV | | | 2 | 34 | 100% |
| MDMV | 92 | | 7 | 791 | 90% |
| Bagasse | | | 11 | 82 | 100% |
| **Transmission** | x | | | | 0% |
| **Distribución (miles clientes)** | 1,131 | | | | 0% |
| Note. TG:gas turbine, MDAV: high speed diesel enfine, MDMV: medium speed diesel engine | | | | | |
| * Nacaome multipurpose hydro projects taht sells electricity to ENEE | | | | | |

In the National Energy Plan 2030, updated recently by SERNA, it was proposed[2] to keep in SERNA only the environmental protection functions and create a Ministry of Energy, responsible for functions related to "the protection and exploitation of renewable energy sources, generation and transmission, storage and commercialization of hydrocarbons y rational use of atomic energy sources". The basic objective is to strengthen and centralize energy policy, which is necessary.

During the past years GOH took control of the management of ENEE as an emergency measure to improve its performance and avoid a financial crisis and a high risk of a supply crisis. ENEE´s top management, its general manager and the board of directors, were replaced in 2006 by an Intervention Board formed by 6 members representing the government, professional associations and trade unions, which was replaced later on by another Intervention Board formed by the Ministers of Defense and Finance. In mid 2009 the intervention was raised and the general manager and the board of directors resumed their functions as established in ENNE´s bylaws.

ENEE´s weak corporate governance and lack of modern information and management systems and commercial practices have been a matter of concern because contribute to its poor performance. Since 2006 it has been proposed to restructure ENEE in independent business units responsible for generation, transmission and distribution and modernize its information systems and commercial practices in the distribution area.

A negligible energy market with large consumers and co-generators are currently in operation, but it can be expanded based on new regulations adopted in 2007. The Electricity Law of 1994 allowed direct energy sales from generators to large consumers (peak demand > 1,000 kW and >= 34.5 kV). This market did not develop due to a lack of clear and adequate rules for the access and use of the power grids, the application of

[2] Alvarez, Elizabeth. Nueva Estructura Institucional del Sector Energético. Informe Final. December 2009.

subsidized tariffs, the dominant position of ENEE and lack of an Operation Code. Later on, a law for the promotion of renewable energy (Law 70-2007) eliminated obstacles for this market allowing electricity exports by renewable generators and establishing a postage stamp of 10 US$/MWh for the access and use of the power grids. CNE reduced the threshold for large consumers to 750 kW and 13.8 kV (resolution 018-2009). On the other hand, some independent generators have installed about 60 MW in thermoelectric plants to supply heat and power to industrial customers in industrial parks located in free trade zones, and sell generation surplus to ENEE at marginal energy cost.

## C. Supply and demand

### 1. Generation

Honduras is highly dependent on imported oil for power generation. In late 2009, conventional thermal generation, mainly medium speed diesel engines using bunker C, represented about 62% of the installed capacity (see Table 5). Thermal generation represented about 54% of total energy generation and while the high-efficiency diesel engines operated with a 45% plant factor, the low-efficiency gas turbines and high speed diesel engines had a plant factor of 7% and were used only for peak loads or during dry periods when hydro generation is low.

Renewable energy generation, mostly hydroelectric plants and bagasse-fired cogeneration plants, had maintained a 38% share in the installed capacity during the last 3 years. The medium and large hydroelectric plants, state-owned, represent about 29% of installed capacity but have decreased its share since 1994 when GOH decided to rely on PPAs with private generators to meet demand growth. The small renewable private generation plants, that took advantage of fiscal and market benefits established by law, with a installed capacity of 150 MW, contributed almost all the increase in total installed capacity in 2006-2009 (50 MW) (see Table 5)

The generation reserve margin in 2007-2008, when the demand growth was about 7% p.a. and generation capacity was stagnant, was not adequate to ensure a reliable supply. Although the installed capacity of 1,593 MW in 2008 was apparently sufficient to meet a peak demand of 1,205 MW in April, only 1,154 MW were available due to the drop in firm capacity of hydroelectric plants, many run-of-the-river, at the end of the summer season and the low availability of bagasse-fired plants at the end of the sugar harvest. Although the reserve margin was almost nil, ENEE did not report energy deficits.

The share of renewable energy generation varies from year to year as the generation mix changes, but also by the behavior of water flows during dry and wet years and the use of the reservoir of the El Cajón hydroelectric project. For example, in 2009 the annual generation of ENEE´s hydroelectric plants increased in 500 GWH or 25% over the generation in previous years, which explains an increase from 37% to 45.7% in the share of renewable energy (see Table 5). The increase in renewable energy generation has a significant financial impact because it reduces costly energy purchases to thermal generators.

**Table 5**

**HONDURAS**
Electricity Supply 2006-2009

| | Energy (GWh) | | | | | Installed capacity (MW) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **2006** | **2007** | **2008** | **2009** | **%** | **2006** | **2007** | **2008** | **2009** | **%** |
| **Supply to national market** | 5,959 | 6,273 | 6,533 | 6,540 | **100.0%** | 1,548 | 1,568 | 1,593 | 1,606 | **100.0%** |
| Hydro state-owned | 1,938 | 2,022 | 2,006 | 2,534 | **38.7%** | 464 | 464 | 464 | 464 | **28.9%** |
| Hydro- small | 132 | 192 | 285 | 247 | **3.8%** | 38 | 55 | 58 | 58 | **3.6%** |
| MDMV- bunker | 3,730 | 3,919 | 3,939 | 3,443 | **52.7%** | 869 | 865 | 865 | 882 | **54.9%** |
| MDAV and TG- diesel | 41 | 14 | 69 | 62 | **0.9%** | 116 | 116 | 116 | 103 | **6.4%** |
| Steam turbine- coal | 0 | 0 | 7 | 44 | **0.7%** | 0 | 0 | 8 | 8 | **0.5%** |
| Térmica- bagazo | 100 | 114 | 185 | 209 | **3.2%** | 60 | 68 | 82 | 92 | **5.7%** |
| Net imports | 19 | 12 | 43 | 0 | **0.0%** | | | | | |
| **Generation** | | | | | | | | | | |
| Public | 2,003 | 2,074 | 2,009 | 2,566 | **39.2%** | 589 | 589 | 589 | 589 | **36.7%** |
| Private | 3,956 | 4,200 | 4,524 | 3,974 | **60.8%** | 959 | 979 | 1,004 | 1,017 | **63.3%** |
| **Generation** | | | | | | | | | | |
| Renewable | 2,170 | 2,328 | 2,476 | 2,990 | **45.7%** | 563 | 587 | 604 | 613 | **38.2%** |
| Thermal-conventional | 3,770 | 3,933 | 4,014 | 3,550 | **54.3%** | 985 | 981 | 989 | 993 | **61.8%** |
| **Total supply** | 5,959 | 6,273 | 6,533 | 6,540 | | 1,548 | 1,568 | 1,593 | 1,606 | 100% |
| Annual rate of growth | 7.4% | 5.3% | 4.1% | 0.1% | | 1.4% | 1.3% | 1.5% | 0.8% | |
| **Available capacity** | | | | | | | 1,276 | 1,154 | 1,231 | 77% |
| **Peak demand** | | | | | | 1,088 | 1,126 | 1,205 | 1,203 | |
| Annual rate of growth | | | | | | 7.3% | 3.5% | 7.0% | -0.2% | |

Source: Dirección de Planificación y Desarrollo- ENEE

## 2. Wholesale energy prices

ENNE´s energy purchases and fuel costs increased in about 40% in 2008 due to substantial increases in oil prices and the reliance on oil-fired generation. The average price of energy of PPAs with private thermal generators increased from 115 US$/MWh in 2007 to 188 US$/MWh in the third quarter of 2008 when bunker C prices reached a peak of 95 US$/bbl. After this quarter, when bunker C prices dropped below 60 US$/bbl, the average purchase price from thermal generators kept in the range of 95 to 130 US$/MWh (see Table 6).

The average energy purchase prices from small renewable energy generation projects in 2007-2009 have been much lower and stable than prices from conventional thermal generators, in the range of 65 to 78 US$/MWh. Most of PPAs with small renewable energy generation plants were contracted in 1999-2003 when expected marginal generation costs, used as a cap for the energy price in these contracts, were low. However, these low prices have a marginal impact on ENEE´s average energy purchase prices, as purchases from small renewable energy generation represented only 10% of total purchases (see Table 6 and Figure 2)

Average generation costs, calculated as total energy purchase costs plus fuel cost over total generation (excluding operation and maintenance and depreciation costs of ENEE´s generation plants), is much lower than the average purchase price from thermal generation, thanks to the contribution of ENEE´s hydroelectric plants at no cost and the low prices of small renewable energy generation. During the last year, beginning in the fourth quarter of

2008, when oil prices dropped, the average generation cost was 68 US$/MWh, while the purchase price from thermal generators was 117 US$/MWh (see Table 6 y Figure 2).

**Table 6**

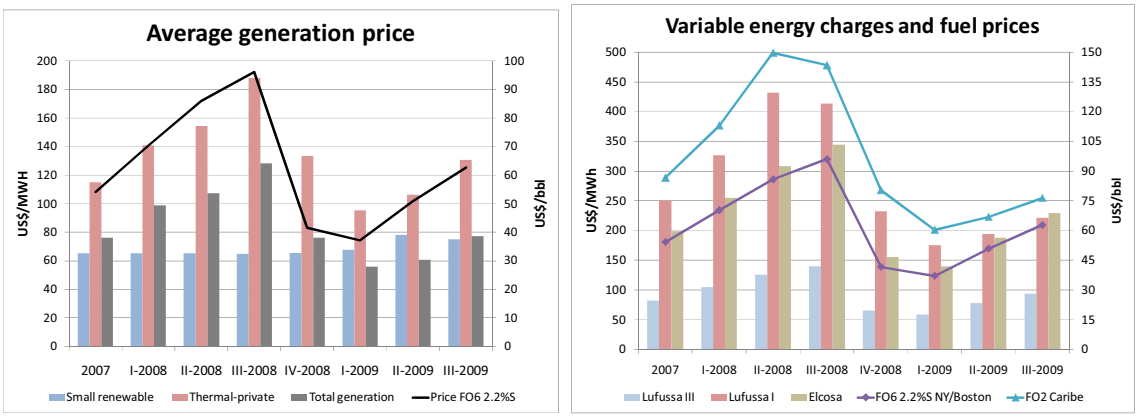
**Honduras**
**Energy purchase cost 2007-2009**

| | Units | 2007 | 2008 | | | | 2009 | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | I | II | III | IV | I | II | III |
| **Small renewables** | | | | | | | | | |
| Energy | GWh | 243.6 | 96.2 | 72.1 | 65.2 | 74.2 | 119.5 | 108.2 | 98.7 |
| Cost | US$ M | 15.9 | 6.3 | 4.7 | 4.2 | 4.9 | 8.1 | 8.5 | 7.4 |
| Average price | US$/MWh | 65.3 | 65.1 | 65.1 | 64.9 | 65.4 | 67.6 | 78.2 | 75.3 |
| **Thermal- private** | | | | | | | | | |
| Energy | GWh | 3,923.0 | 1,003.7 | 1,126.3 | 1,082.3 | 787.3 | 775.2 | 864.8 | 941.9 |
| Cost | US$ M | 450.4 | 141.5 | 173.8 | 203.2 | 105.0 | 73.9 | 92.0 | 123.0 |
| Average price | US$/MWh | 114.8 | 140.9 | 154.3 | 187.8 | 133.3 | 95.3 | 106.3 | 130.5 |
| **Total generation** | | | | | | | | | |
| Energy | GWh | 6,222.7 | 1,519.2 | 1,695.0 | 1,677.4 | 1,484.7 | 1,484.0 | 1,687.4 | 1,712.3 |
| Cost | US$ M | 474.4 | 150.1 | 182.0 | 215.0 | 113.3 | 82.9 | 102.2 | 132.2 |
| Average price | US$/MWh | 76.2 | 98.8 | 107.4 | 128.2 | 76.3 | 55.9 | 60.6 | 77.2 |

Fuente: Dirección de Planificación ENEE

There are substantial differences in the variable charge in PPAs with thermal generators, used to recover fuel and other variable costs, which are explained by differences in fuels, thermal efficiencies and contractual conditions. This point is illustrated by Figure 2, which compares the variable charges in PPAs contracted as emergency generation in the mid 1990´s (and that would expire in 2010) and a recent PPA with an efficient diesel plant. Variable charges for the Elcosa (80 MW) y Lufussa I (40 MW) diesel plants is more than 2.5 times the variable charge of the Lufussa III (210 MW) diesel plant. During the third quarter of 2009, when bunker C prices reached the lowest levels of the past three years, the variable charge in Elcosa y Lufussa I contracts was higher than 140 US$/MWh, while for Lufussa III it was 60 US$/MWh.

**Figure 2**




Source: Own calculations based on ENEE´s information

## 3. Demand

The international financial crisis and the domestic political crisis had a substantial impact on economic growth in 2009 and electricity demand stagnated or dropped in this year. GDP contracted by 3%, electricity sales dropped by 2.6% and peak demand did not increase in 2009. The impact on industrial production and the *maquila*, which depend on exports to USA, was more severe: electricity sales to the industrial sector and to large consumers dropped by 8% and 13%, respectively (see Table 7).

The stagnation of peak demand growth and the drop in energy sales in 2009 had a positive impact on ENEE. On the one hand, a high risk of energy shortages in 2009, related to insufficient generation reserve, was minimized, and on the other, ENEE´s financial deficit was reduced as the average electricity tariff does not cover the incremental cost of energy purchases (variable charge of most expensive contracts). Under the current conditions, it is a good business for ENEE to reduce electricity demand growth.

Electricity losses had a negative development in 2009. The loss reduction action plan implemented by ENEE as of 2007 (installation of automatic meter readers - AMR, and field visits to detect and correct electricity fraud and theft) was effective in reducing losses in 4 percentage points in 2007, from 25.4% a 21.2%, and in 0.6 percentage points in 2008. However, electricity losses increased by about 2 percentage points in 2009, to 22.4%.

Electricity coverage increased 10 percentage points in 2006-2009 to reach 79.3% by the end of 2009, close to the 80% target established in the ERP for 2015.

**Table 7**

**HONDURAS**
Electricity demand 2006-2009

| | Energy (GWh) | | | | |
|---|---|---|---|---|---|
| | **2006** | **2007** | **2008** | **2009** | **%** |
| **Energy sales** | | | | | |
| Residential | 1,805 | 2,063 | 2,129 | 2,147 | **42.6%** |
| Commercial | 1,053 | 1,183 | 1,269 | 1,262 | **25.1%** |
| Industrial | 606 | 626 | 613 | 565 | **11.2%** |
| Large consumers | 607 | 660 | 775 | 672 | **13.3%** |
| Public ligthing | 124 | 125 | 125 | 125 | **2.5%** |
| Official | 236 | 249 | 258 | 266 | **5.3%** |
| Total | 4,431 | 4,906 | 5,168 | 5,036 | **100.0%** |
| Annual rate of growth | 6.2% | 10.7% | 5.3% | -2.6% | |
| Electricity losses | 25.2% | 21.2% | 20.6% | 22.4% | |
| Elec. coverage (%) | 69.1% | 72.6% | 76.4% | 79.3% | |
| Clients (thousand) | 951.9 | 1043.3 | 1131.1 | 1209.8 | |
| Annual rate of growth | 7.1% | 9.6% | 8.4% | 7.0% | |

Source: Dirección de Planificación y Desarrollo- ENEE

## 4. Benchmarking with regional countries

In 2008 the supply and demand indicators of Honduras showed an intermediate position as compared to other Central American countries, except for some indicators that were below the average. As other countries in the region, except Costa Rica where most of generation

comes from renewable energy, Honduras was highly dependent on oil-fired thermal generation. Honduras and Nicaragua lagged behind the region in electricity coverage and electricity losses. Both countries had high electricity losses as compared to Costa Rica, Panamá y El Salvador, which have achieved relatively efficient loss levels. Electricity coverage was low as compared to other countries that have exceeded 85%. On the other hand, Honduras and Costa Rica were the only countries in the region that maintained a power market dominated by a state-owned and vertically integrated monopoly (see Table 8).

**Table 8**

**Central America- Supply and demand indicators**
**2008**

| | Costa Rica | El Salvador | Guatemala | Honduras | Nicaragua | Panama |
|---|---|---|---|---|---|---|
| **Installed capacity** | | | | | | |
| Hydroelectric | 62.3% | 33.7% | 34.5% | 32.5% | 12.0% | 53.6% |
| Geotherma | 6.8% | 14.2% | 2.0% | 0.0% | 9.9% | 0.0% |
| Thermal | 28.1% | 52.1% | 63.6% | 67.5% | 78.1% | 46.4% |
| Wind | 2.9% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Energy generation** | | | | | | |
| Hydroelectric | 78.4% | 35.4% | 45.4% | 42.5% | 17.1% | 63.0% |
| Geotherma | 12.0% | 24.0% | 3.4% | 0.0% | 9.3% | 0.0% |
| Thermal | 7.4% | 40.6% | 51.2% | 57.5% | 73.6% | 37.0% |
| Wind | 2.1% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Electricity sales** | | | | | | |
| Residential | 40.0% | 32.5% | | 42.6% | 31.6% | 30.2% |
| Commercial | 31.1% | | | 25.1% | 26.8% | 45.0% |
| Industrial | 26.4% | | | 24.5% | 22.7% | 8.6% |
| Large consumers | 0.0% | 10.4% | 35.0% | 1.1% | 5.5% | 1.0% |
| **Electricity losses** | 10.6% | 12.8% | 17.1% | 20.6% | 27.3% | 11.8% |
| **Electricity coverage** | 98.8% | 85.8% | 83.8% | 76.4% | 64.5% | 88.9% |

Source: CEPAL- Istmo Centroamericano- Estadísticas del subsector eléctrico-2008, excepto Honduras, tomada de ENEE

## D. Regulatory framework

The regulatory framework for the power sector in Honduras was established by the electricity law of 1994 and has been complemented by other laws, mainly related to the promotion of renewable energy. The following section discusses recent developments on tariff, subsidies and renewable energy.

### 1. Prices and subsidies

Electricity tariffs are based on the principle that tariff should cover efficient supply costs, which includes generation and transmission costs and the distribution value added (VAD). The generation cost, or busbar tariff, is revised annually to reflect the expected value of the short-term marginal generation cost for a 5-year period in the future; the transmission cost should cover efficient investment, operation and maintenance costs; the VAD should be revised every 5 years to reflect the costs of an efficient distribution company. An automatic tariff adjustment formula is applied to take into account changes in external factors, which

are not under control of the power company, that have an impact on costs (inflation, exchange rate, and fuel prices).

Since 2000 until recently ENEE applied a tariff schedule prepared in 2000 and an adjustment formula that presumably reflected variations in supply costs. However, after so many years electricity tariffs lagged real costs. The original tariff schedule did not reflect the real cost structure and in many cases GOH did not authorize the application of the adjustment formula if significant tariff increases were necessary to reflect fuel prices. Tariffs lags and distortions explain in part ENEE´s financial difficulties.

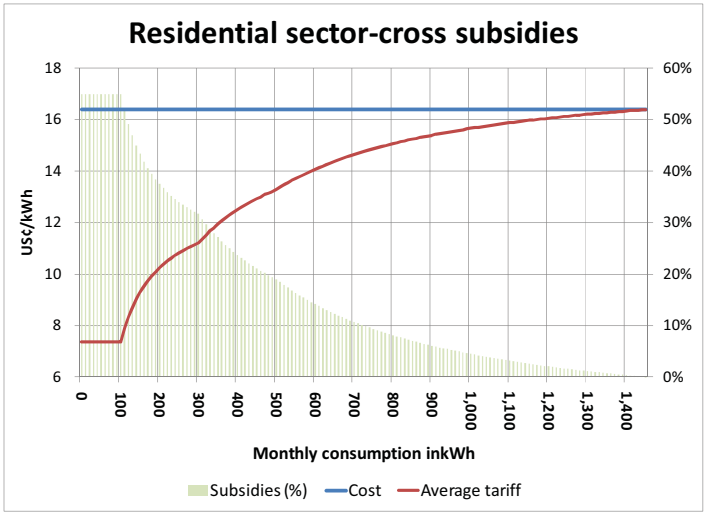
Furthermore, the tariff regime established by law did not guarantee that ENEE, as a single-buyer, could recover the cost of energy purchases under long-term contracts because marginal generation costs frequently are not coupled and are lower than energy prices in PPAs.

CNE approved in February, 2009 a new tariff schedule and adjustment formula that, in principle, covered the energy supply costs estimated at that time, based on a marginal generation cost of 86.9 US$/MWh. The new tariff schedule, as well as the previous one, applies a scheme of cross-subsidies, established by law, whereby the initial 300 kWh/month of consumption in the residential sector is subsidized[3]. However, the schedule applies the maximum subsidy allowed by law and the cross subsidy benefits residential customers with monthly consumption of up to 1,450 kWh[4], about 90% of all customers, with subsidies of 55% of supply costs for a residential customer with 100 kWh/month consumption, 32% for 300 kWh/month, 19% for 500 kWh/ month and 5% for 1,000 kWh/month (see Table 9 and Figure 3). The average subsidy of 30% for the residential sector presumably should be compensated with contributions of up to 20% of cost by other sectors (industrial, commercial, government and some residential customers with high consumption). However the cross subsidies are not neutral and the average tariff only covers 95% of supply costs (see Table 9).

[3] The electricity law establishes subsidies for residential customers: 55% for consumption below 100 kWh/month, and 20% for the step 100-300 kWh/month. These subsidies should be compensated with contributions up to 10% for residential consumption above 500 kWh/month and 20% for other customers (commercial, industrial, etc.

[4] Residential customers with consumption in the range of 300 to 1,450 kWh/month also benefit from the large subsidies for first 300 kWh/month of consumption.

**Figure 3**




Source: Own elaboration based on ENEE´s information

As in previous years, the tariff adjustment formula was partially applied and GOH approved direct subsidies for residential customers, on top of the cross subsidies. The average tariff was reduced from March to June 2009, when fuel prices dropped below the reference price used to calculate the tariff schedule, recovered in June, 2009 when fuel prices increased, but was frozen by GOH when fuel prices were higher than the reference price. ENEE complies with the regulations because the electricity prices established by the adjustment formula are considered to be maximum prices, but impairs its financial position because it cannot recover supply costs. On the other hand, GOH decided that residential customers with monthly consumption below 150 kWh are exempted of the obligation to pay the electricity bill (electricity free of charge)[5], and established additional direct subsidies between 10% and 17% for residential customers with monthly consumption up to 500 kWh. The monthly cost of the direct subsidy is estimated at US$4.5 million (see Table 10).

[5] This subsidy includes the Bonoochenta, which is not longer paid.

**Table 9**

| ENEE | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Tariff schedule Jan/09** | | | | | | | |
| **CATEGORY** | **Clients** | | **Aver. Cost** | **Tariff step** | | **Average Tariff** | |
| | Number | % accum. | US¢/KWh | US¢/KWh | % cost | US¢/KWh | % cost |
| **Tar A - Residential** | | | | | | | |
| 0-100 kWh | 419,800 | 38% | 16.4 | 7.4 | 45% | 7.4 | 45% |
| 101-150 | 171,823 | 53% | 16.4 | 13.1 | 80% | 8.2 | 50% |
| 151-300 | 290,694 | 79% | 16.4 | 13.1 | 80% | 10.4 | 64% |
| 301-500 | 98,440 | 88% | 16.4 | 16.4 | 100% | 12.3 | 75% |
| >500 | 46,458 | 92% | 16.4 | 18.0 | 110% | 15.4 | 94% |
| Subtotal | 1,027,214 | | 16.4 | | | 11.4 | 70% |
| **Tar B - Low voltage** | | | | | | | |
| 0-500 | 51,457 | | 16.4 | 18.9 | 115% | 18.9 | 115% |
| 501-1,000 | 10,964 | | 16.4 | 19.7 | 120% | 19.1 | 116% |
| >1,000 | 13,089 | | 16.4 | 19.7 | 120% | 19.6 | 120% |
| Subtotal | 75,510 | | 16.4 | | | 19.5 | 119% |
| **Tar C - Medium voltage** | | | | | | | |
| Power (Lps/kWh equiv) | | | 1.6 | 1.9 | 120% | 1.9 | 120% |
| Energy (Lps/MWh) | 160 | | 10.3 | 12.4 | 120% | 12.4 | 120% |
| Subtotal | 160 | | 11.9 | | | 14.3 | 120% |
| **Tar D - Large industry** | | | | | | | |
| Power (Lps/kWh equiv) | | | 1.3 | 1.5 | 120% | 1.5 | 120% |
| Energy (Lps/MWh) | 22 | | 9.6 | 11.5 | 120% | 11.5 | 120% |
| Subtotal | 22 | | 10.9 | | | 13.1 | 120% |
| **TOTAL a/** | 1,112,491 | 100% | 15.5 | | | 14.6 | 95% |
| a/ Includes Tariffs E y F (Municipalities and government) and public ligthing | | | | | | | |
| Source: Based on ENEE- Estudio Pliego Tarifario 2009 | | | | | | | |

**Table 10**

| **Honduras** | | | | | |
|---|---|---|---|---|---|
| **Direct electricity subsidies** | | | | | |
| **Category** | **Average tariff** | **Direct subsidy** | **Net tariff** | | **Monthly direct subsidy** |
| | US¢/KWh | US¢/KWh | US¢/KWh | % costo | US$ millones |
| **Residential** | | | | | |
| 0-100 kWh | 7.4 | -7.4 | 0.0 | 0% | 1.21 |
| 101-150 | 8.2 | -8.2 | 0.0 | 0% | 1.66 |
| 151-300 | 10.4 | -1.8 | 8.6 | 52% | 1.14 |
| 301-500 | 12.3 | -1.3 | 11.1 | 67% | 0.47 |
| | | | | | 4.48 |

Source: Own calculations based on ENEE´s information

## 2. Promotion of renewable energy generation

Since 1998 the development of generation based on renewable energy was promoted by fiscal incentives and ENEE´s obligation to purchase energy from small renewable projects under a long-term PPA at a price equal to the marginal generation cost approved by SERNA for the year in which the contract was signed plus a 10% price incentive. Most of

the small renewable energy generation projects now in operation were developed taking advantage of these incentives.

The decree 70-2007 "Law for the promotion of electricity generation using renewable energy" consolidated existing norms on this matter, clarified the legal framework to award licenses and operation contracts for these projects, and introduced some changes in the rules for the operation of the wholesale power market which make it easier for renewable project to have access to the transmission grid and the energy market. This decree confirms or establishes the following main norms (new norms are underlined):

1. Fiscal incentives for renewable energy generation projects: exemption of sales tax applied to purchases of equipment, materials and services; exemption of import taxes and duties for equipment, materials and services; income tax holidays for the initial 10 years of operation (up to 50 MW) and benefits of temporary import of equipments.
2. Renewable projects have the following options for energy sales:
    a. Direct sales to large consumers or distribution companies with prior approval of ENEE.
    b. Direct sales to ENEE, under contract, at the marginal generation cost plus 10% (during the first 15 years for projects with an installed capacity of up to 50 MW). Energy price indexation using the CPI of USA for the first 10 years of the contract.
    c. Sales to ENEE under contract following competitive bidding procedures.
    d. Energy sales to customers in other countries in the regional energy market
3. Broad definition of renewable energy generation to include energy efficiency projects.
4. Reform of the Electricity Law to eliminate ENEE´s monopoly on electricity trade in the regional energy market.
5. These generation projects are responsible for all transmission works necessary to connect to the closest substation of the national interconnection system. ENEE is responsible for strengthening the national grid.
6. These projects will have access to the transmission and distribution grids for energy sales to third parties subject to a maximum toll of 10 US$/MWH and 1% transportation losses
7. Renewable energy generation will have priority in the economic dispatch
8. Licenses and contracts:
    a. SERNA should create a one stop service for processing project studies permits, environmental licenses, water rights and operation contracts.
    b. Time limits for SERNA to decide on requests for environmental licenses
    c. Exemption of the requirement of environmental license and operation contract for renewable projects with a capacity of up to 3 MW.

The decree 70-2007 established comprehensive and advantageous rules for the development of renewable energy generation and was very effective in promoting investments by the private sector in studies to develop renewable resources. However, private investors considered that it was necessary to correct some flaws, especially the restriction of price indexation for only 10 years and the exclusion of the 10% incentives for

projects larger than 50 MW. The National Congress approved amendments to decree 70-2007 (decree 55-2008), but this new law was not sanctioned by the president of Honduras.

## E. Actions taken to improve power sector performance

The diagnostic of the power sector included in the WB Report of 2007 identifies some important issues about the sustainability of the sector: (i) **A poor performance of ENEE**, with high and increasing black electricity losses, lack of modern information and management systems and weak corporate governance; (ii) **a critical and unsustainable financial situation** of ENEE, with financial losses and negative internal cash generation, related to its poor performance, the vulnerability of generation costs to the volatility of oil prices and the application of large and generalized electricity subsidies; (iii) **the dependency on oil-fired thermal generation**; (iv) **the risk of a short-term energy supply crisis** due to a lack of adequate capacity reserve and delays in contracting new generation capacity.

The WB Report concludes that a business as usual scenario – no actions taken to reduce electricity losses, increase tariffs and limit subsidies- is not sustainable in the short-term because the financial deficit would increase and could not be financed with fiscal resources. The main short-term challenge was to avoid a financial crisis and keep the lights on. The WB Report suggested implementing an aggressive loss reduction program, gradual tariff adjustments to reflect supply costs and the implementation of emergency generation and energy savings programs.

The following section describes the action plan implemented by GOH to address the main problems faced by the power sector in early 2007, and the main results of the plan.

### 1. ENEE´s poor performance

GOH took actions from 2006 to 2009 to reduce electricity losses and improve ENEE´s performance. In the short-term ENEE implemented an extensive program to install AMR and wholesale meters, and field campaigns. It also prepared and ensured financing for the Power Sector Efficiency Improvement Project (PROMEF) and completed studies for restructuring ENEE.

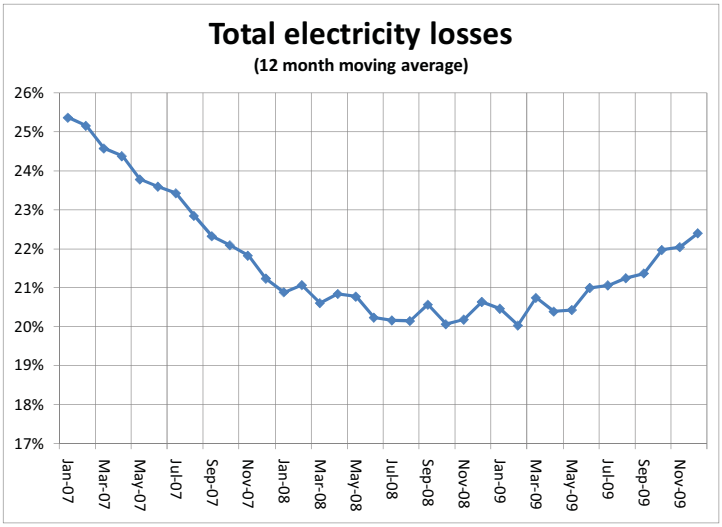
#### *a) Reduction of electricity losses*

ENEE implemented as of 2006 a short-term program to reduce black losses which comprised the installation of AMR for the largest industrial, commercial and residential customers, installation of wholesale meters to prepare energy balances by distribution areas and identify areas with large losses, installation of meters for small customers that did not have meters and implementation of a field campaign to detect and correct fraud, theft, and faulty metering.

The loss reduction program initially made substantial progress but the gains were not sustained in the following years. In 2007, the first year of the program, the electricity losses annual moving average was reduced from 25.4% to 21.2%. In 2008 the reduction

was small and it was not stable and at the end of this year losses were at 20.7%. In 2009, a difficult year due to the political crisis with an uncertain evolution, electricity losses increased and reached 22.5% by the end of this year (see Figure 4). Although losses were reduced in 3 percentage points in 2006-2009, the reversal in 2009 has raised concerns about the sustainability of this program. ENEE has installed adequate metering to prevent, detect and eliminate electricity fraud and theft by a group of consumers that concentrate most of electricity sales, but apparently has not implemented the organization, procedures and systems required for an effective use of this equipment. An assessment of the loss reduction program seems to be justified to detect and correct any flaws.

**Figure 4**




Source: Own elaboration based on ENEE´s information

### *b) The Power Sector Efficiency Improvement Project*

ENEE´s performance improvement plan, prepared in 2006 and 2007, recognized that the problem of high black losses and the difficulties in achieving improvements that can be sustained in the long-term are related to deficiencies in the management of the distribution business, mainly a lack of a corporate strategy and an organization focused on improving the service to the clients and the management of commercial activities, and the lack of modern information and management systems.

The Power Sector Efficiency Improvement Project (PROMEF), prepared to address these problems, comprises the restructuring of the distribution business of ENEE and modernizing ENEE´s information systems.

GOH obtained a US$30 million IDA loan to finance PROMEF, which is now waiting to meet the conditions for effectiveness, with three main components: (i) the improvement of ENEE´s distribution business, (ii) rehabilitation of distribution feeders and (iii) technical assistance to strengthen ENEE´s corporate governance and institutional capabilities.

The first component includes the design, acquisition and installation of a new automated commercial management system (service connections, meter reading, billing, collection, client service, a call center, service cut-off and reconnection); an incidence recording and management system (detection of distribution faults, attention of customer´s claims, creation of distribution operation centers); and a corporate resources management information system (accounting and finance, integrated human resources management, purchases and contracts, logistics, asset management and corporate planning). This component also includes the installation of additional AMR equipment.

The second component comprises the rehabilitation of distribution feeders and procurement of equipment, spare parts and materials for maintenance of the distribution system.

The technical assistance component supports: ENEE to comply with the Transparency Law, and carrying out external audits; the definition of roles and responsibilities for the Board of Directors and the General Manager; putting in place a new distribution and commercial management unit; outsourcing of selected ENEE´s commercial functions; examining the long-term financial sustainability of ENEE, including improvements of the tariff and subsidy structure.

Summarizing, the project PROMEF focus on the strengthening and modernization of the ENEE´s distribution and commercial areas, essential to achieve a sustainable reduction of electricity losses, improve collections and client service. Restructuring ENEE in business units and the creation of independent units are left for a second phase of the transformation of ENEE.

### *c) Restructuring ENEE*

GOH retained consulting services in 2008 to define a strategic plan for restructuring ENEE in business units with separate accounts, propose a new organization, and implement the reorganization of ENEE. PA Consulting completed the restructuring study in mid 2009[6].

The consultant concluded that there is lack of political support to create independent business units. Instead GOH wants to keep ENEE as an integrated state-owned enterprise organized in distinct management units responsible for the main activities and with measurable performance indicators. The consultant replaced the concept of independent business units (UIN) by Management Units (UG).

The consultant also concluded that the design and operation of UG are constrained by existing regulations, as the obligation to use the Integrated Financial Management System (SIAFI), and to comply with the government´s procurement procedures. Therefore, it would be necessary to adapt the new organization so that ENEE can operate as a commercial public service company but subject to norms that were designed for government entities.

[6] PA Consulting. Reorganización de la Empresa Nacional de Energía Eléctrica (ENEE), Fase II-Informe final. June, 2009

The consultant proposes to reorganize ENEE in 4 UG (generation, transmission, dispatch center and distribution) supported by 2 corporate services units, working under a chief operations officer (see Figure 5). The consultant proposes to keep the existing organization of the transmission unit in two regional offices and the distribution unit in three regional offices. The consultant designed the new organizational structure, the required adjustments in the accounting and financial information systems, the procedures and criteria to separate accounts, the allocation of personnel and the methodology to select the new management team. Other consulting firm (HQ Solutions) prepared a detailed design of the methodology and procedures for a competitive, transparent and technical selection and recruitment of the management team based on experience, qualifications and talent. The new organization is consistent with the creation of a distribution and commercial unit as proposed by PROMEF.

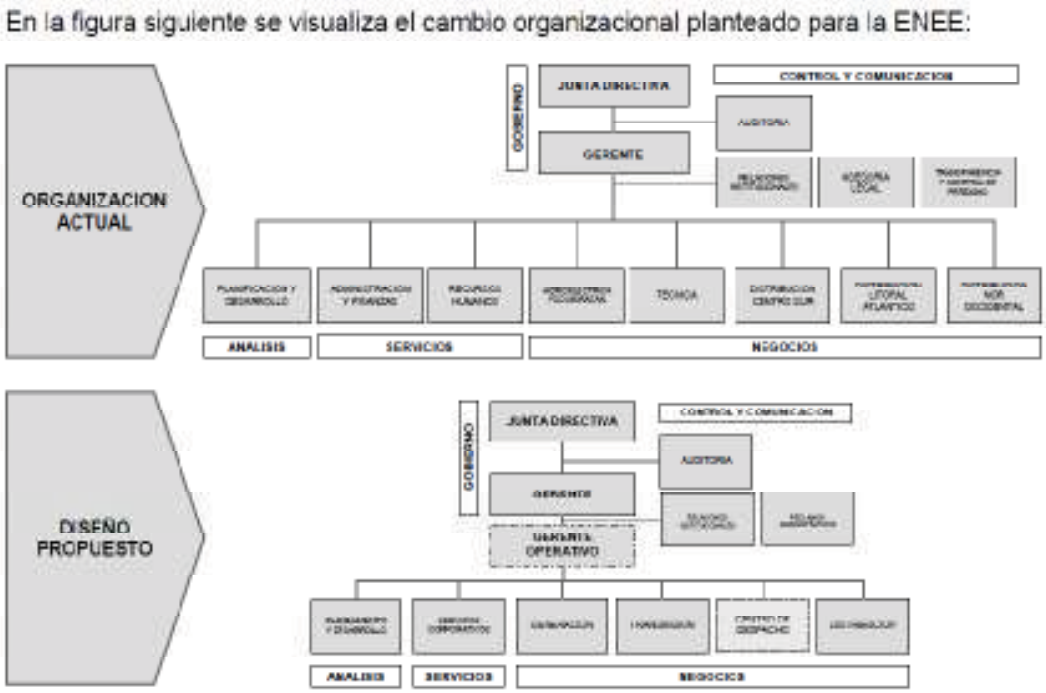
The consultant discussed the main conclusions and recommendations of the report and there is agreement, in principle, about the restructuring in 4 management units, except that ENEE´s technical manager questioned the need to have the dispatch center as a separate unit from the transmission business. Others disputed if it was justified to create a new position of a chief operations officer.

ENEE´s restructuring in management units and the implementation of PROMEF are a step in the right direction and necessary to improve ENEE's corporate governance and performance. ENEE´s reorganization is a major means to improve its performance. The creation of UG with separate accounts make it easier to introduce necessary incentives to improve performance (performance of UG can be measured and rewarded), to regulate transmission and distribution (separate regulatory accounts, transparent pricing), and to introduce competition (reduce entry barriers to the market and increase the autonomy of the dispatch center). Recruitment of the top management of the distribution unit using competitive procedures would help to reduce political meddling in the appointment of ENEE´s management team.

The creation of an autonomous dispatch center unit is convenient in light of its important role as independent administrator of the energy market and system operator in the context of a regional energy market, but is not essential in the short-term as long as ENEE´s dispatch center is strengthen to perform these functions and has a transparent management.

ENEE´s restructuring and the implementation of PROMEF improves the current situation but do not guarantee a substantial and sustainable improvement of ENEE´s performance. As indicated by PA Consulting, ENEE has to comply with norms of public entities that hinder its operation as a commercial enterprise. It is convenient to study the feasibility of completing the transformation of ENEE in a commercial enterprise: first, converting the UG in independent business units and, later on, their corporatization in independent companies with separate board of directors, professional management and participation of small shareholders.

**Figure 5**




Source: PA Consulting. Informe reorganización de la ENEE

## 2. The financial crisis

The analysis of ENEE´s financial results prepared in early 2007 for the WB Report concluded that the financial situation was critical and unsustainable if electricity losses were not reduced and electricity tariffs increased to cover supply costs. With annual financial losses of about Lps. 2,500 million (equivalent to 2% of GDP) and a negative internal cash flow generation during 2001-2006, ENEE had to postpone needed investments in transmission and distribution and finance the deficit with expensive revolving credits with the local banks and increasing accounts payable (arrears with the thermal generators).

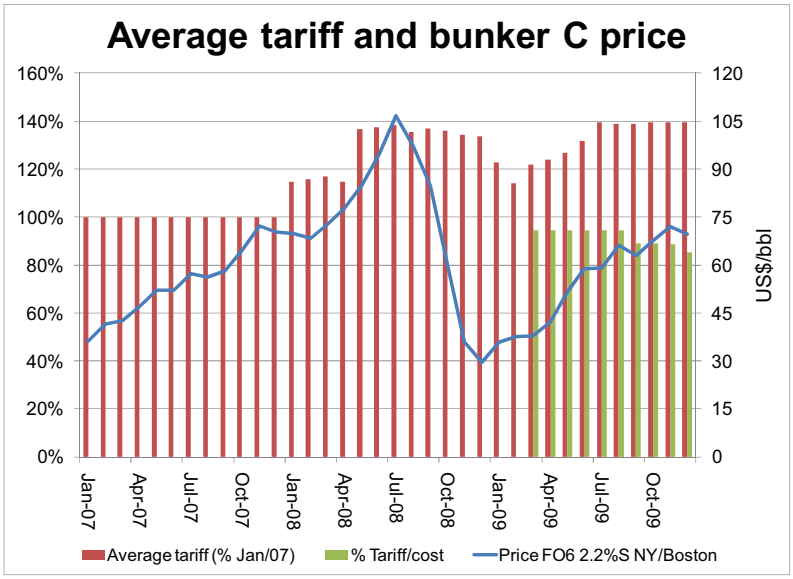
GOH started to implement ENEE´s financial recovery plan since late 2006, consisting of the loss reduction program already commented, budget transfers to capitalize ENEE, compensation of subsidies, and tariff increases. In 2007, when bunker C prices increased from 35 to 60 US$/bbl, it was clear that ENEE´s financial situation was unsustainable, and GOH took the following actions:

a) GOH contributions to ENEE of about US$220 million, US$150 million for capitalization and US$70 million in compensation for direct subsidies. This operation was completed in early 2008.
b) Issuing promissory notes to pay the arrears to private generators for about US$90 million
c) Average tariff increases of about 15% in January and 19% in May, 2008.

Due to this program, ENEE´s financial losses decreased from about Lps 2,500 million in 2007 and 2008 to Lps 500 million in 2009, when the bunker C prices dropped to the same average price of 2007, 55 US$/bbl, after having reached an average price of 74 US$/bbl in 2008 (see Figure 6 and Table 11). ENEE´s financial results for 2007-2009 show that:

a) The average electricity tariff increased by 31% in 2008 and 6% in 2009. However, in late 2009 the average tariff could not cover supply cost (85% of cost), after the large increase of Bunker C prices in 2009 (from 30 to 70 US$/bbl) and ENEE did not apply the tariff adjustment formula to reflect the increase in fuel prices (see Figure 6).
b) As a result of the tariff lag in late 2009, ENEE increased the arrears for energy purchase to private generators. Although by mid 2009 ENEE was paying on time, by late 2009 accounts payable to generators have increased to Lps 1,367 million, equivalent to 2 months of billing, including one month in arrears.
c) The average energy purchase price increased by 32% in 2008 and dropped 26% in 2009 due to the fluctuations in average bunker C prices in these years (36% and -25%). Generation prices are very sensitive to the volatility of fuel prices. The vulnerability to fuel prices is a financial risk for ENEE because the experience shows that for political reasons the tariff adjustment formula is not applied when fuel prices increase too fast.

**Figure 6**




Source: Own elaboration based on ENEE´s information

d) After the substantial progress made in reducing electricity losses in 2007 and 2008, losses increased and reached 22.4% by the end of 2009, well above efficient levels (below 15%)
e) The average tariffs in 2007 and 2008 were not sufficient to cover average energy purchase prices (let alone the purchase price including electricity losses). In 2008

the average tariff was 13.6 US¢/kWh and the average purchase prices, including losses, was 18.8 US¢/kWh, resulting in a marginal financial loss of 5.2 US¢/kWh. The situation improved in the first semester of 2009 but in late 2009 the margin was negative.

f) ENEE financial loss was US$140 million in 2007 and increased to US$162 million in 2008.

g) IN 2009, ENEE´s financial loss was US$79 million when ENEE´s revenues are cut down by Lps 1,021 million (US$54 million), corresponding to the direct subsidies that were not compensated by GOH (about the same value of US$4.48/month estimated in Table 10). Notwithstanding the decline in ENEE´s performance in 2009 (increase in electricity losses and US$59 million write-off in accounts receivable) ENEE´s financial loss was reduced to US$24 million (without the impact of direct subsidies) thanks to the drop in fuel prices in 2009 and the tariff increases in 2008.

**Table 11**

| **ENEE** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Profit and loss statement 2007-2009 | | | | | | | | |
| (in million Lps) | | | | | | | | |
| | | | | | | | | |
| | **2007** | **2008** | **2009** | | | **2007** | **2008** | **2009** |
| **Total revenues** | 10,033 | 13,725 | 12,608 | | **Indicators** | | | |
| Services | 9,486 | 13,701 | 13,611 | | **EBITDA (million Lps)** | (417) | (451) | 872 |
| Subsidies (not compensated) | 313 | - | (1,021) | | **Average tariff (US¢/kWh)** | 10.4 | 13.6 | 14.4 |
| Other revenues | 234 | 24 | 18 | | % change | | 31% | 6% |
| **Operation costs and expenses** | 11,978 | 15,459 | 13,611 | | **Energy purchase price (US¢/kWh)** | 11.3 | 15.0 | 11.0 |
| Energy purchases and fuels | 9,003 | 12,588 | 8,803 | | % change | | 32% | -26% |
| Other operation expenses and costs | 2,975 | 2,871 | 4,808 | | **Purchase price + losses** | 14.3 | 18.8 | 14.2 |
| Personnel | 776 | 830 | 996 | | **Price FO6 2.2%S NY (US$/bbl)** | 54.2 | 73.5 | 55.1 |
| Depreciation | 1,528 | 1,283 | 1,876 | | **Collections (%)** | 94% | 95% | 96% |
| Other operation expenes | 671 | 758 | 1,937 | | **Electricity losses (%)** | 21.2% | 20.6% | 22.4% |
| **Net operation revenues** | (1,945) | (1,734) | (1,003) | | **CRI (%)** | 74.1% | 75.4% | 74.1% |
| **Total financial expenses** | (724) | (1,345) | (507) | | | | | |
| **Profits before taxes** | (2,669) | (3,078) | (1,511) | | **CRI: cash recovery index** | | | |
| Taxes | - | - | - | | | | | |
| **Profit (loss)** | **(2,669)** | **(3,078)** | **(1,511)** | | | | | |
| **Profit (loss) (US$million)** | **(140)** | **(162)** | **(79)** | | | | | |

Source: Own calculations based on ENEE´s information

## 3. The reliance on oil-fired thermal generation

In 2003, when ENEE signed long-term PPAs for about 400 MW from two medium-speed diesel plants, this technology was the best option to expand generation capacity because renewable energy generation could not compete with prevailing low oil prices. However, in the following years the fuel prices increased and the average energy purchase price for the new PPAs exceeded 100 US$/MWh. The purchase price for PPA´s signed in the 1990´s, sometimes for emergency generation, was higher than 200 US$/MWh.

The development of renewable energy generation became a priority for GOH in order to diversify energy sources, stabilize generation prices and eventually, reduce the energy purchase prices when the high-cost PPAs expired and could be replaced by lower-cost contracts with energy prices that are not indexed to volatile oil prices. The fiscal and

market incentives policy established on the late 1990´s to promote the development of small renewable energy generation projects was successful, as currently about 10% of ENEE´s total energy purchases are from small hydroelectric and bagasse projects at prices below 80 US$/MWh.

However, GOH recognized that it was necessary to promote the development of medium and large hydroelectric projects and eventually, gas and coal-fired thermal generation, to make substantial progress in transforming the energy matrix and reducing the reliance on oil-fired generation

ENEE made substantial progress in preparing hydroelectric projects based on BOT schemes or public/private partnerships (PPP). Under a cooperation agreement with the government of Taiwan (China), in 2008 and 2009 ENEE updated the feasibility studies for the 100 MW Piedras Amarillas hydroelectric project, completed the project design and signed a BOT contract with Taiwan Power Co. (Taipower), based on an energy purchase price of 96 US$/MWh (marginal generation cost) and ENEE´s obligation to purchase the land needed for the project, implement the environmental impact mitigation program and strengthen the transmission grid. However, the project experienced a setback in April, 2009 when the National Assembly of Taiwan did not approve Taipower´s investment budget for this project. Currently GOH is considering the option to develop this project under a BOT contract with a new investor, once Taipower releases all the information and reports of the feasibility study and project design.

ENEE also made substantial progress in the development of the Jicatuyo and Llanitos hydroelectric projects (combined capacity of 270 MW) under a complex PPP scheme with the participation of Odebrecht, as main contractor and temporal shareholder with a capital investment of US$30 million, ENEE as off-taker and shareholder with a contribution of US$100 million (using funds available in the Petrocaribe account), BCIE responsible for financial structuring and shareholder with a contribution of US$100 million and FURNAS from Brazil, responsible for construction supervision and project operation for the initial 5 years. The National Development Bank of Brazil (BNDES) approved a loan of US$271 million but it was frozen in mid 2009 after the diplomatic crisis with Brazil. A fiduciary trust will be established to manage all contract and financial resources. The contract for developing these projects was approved by the national congress in May, 2009.

The scheme for developing the Jicatuyo and Llanitos projects, apparently was questioned by the new government because the price of the construction contract has not been defined yet and GOH may assume an open contingent obligation to finance the projects. Although the energy purchase price has been defined at about 98 US$/MWh (the generation marginal cost plus 10%), and an investment budget for the generation, transmission and distribution components has also been defined[7], the construction cost, which is used to determine the cost of the construction contract with Odebrecht, cannot be defined because feasibility studies and project designs have not been completed as yet.

[7] The Project includes a transmission component of up to US$150 million and a distribution component for up to US$40 million. However, these amounts will be adjusted to compensate for any increase in the investment cost of the generation projects.

In 2008 ENEE signed a 20-year PPA with the Cerro de Hula wind power project, 100 MW capacity and 40% plant factor, at a price of about 111 US$/MWh (marginal generation cost plus 10%). The PPA was already approved by Congress and the project would be commissioned in 2012.

In 2008 ENEE called for bids for the development of 250 MW in coal fired plants (100 and 150 MW lots), with the obligation to install in advance 80 MW in diesel engines to meet any short-term energy shortfall, The idea was to address transmission constraints in the Atlantic coast and help diversify generation sources. The bid experienced several difficulties and finally, a PPA for 150 MW was awarded and approved in 2009 by Congress. However, the contractor has not met the effectiveness conditions, does not have environmental and operation licenses, and probably the project would not be implemented.

The decree 70-2007 stirred the interest of private investors in the development of renewable energy generation but, in general, investors were not willing to sign PPA under the terms and conditions established in this law. In September, 2009 ENEE initiated a bidding process to contract the supply of up to 250 MW in renewable energy generation, which complied with the objections of investors to decree 70-2007.

This bid established very attractive conditions for the development of renewable energy generation:

a) A cap of 102.5 US$/MWh for the energy charge and 7.52 US$/kW-month for the capacity charge, to be paid based on the average capacity that the project can deliver during peak hours. The caps meet the price limits established in decree 70-2007 for direct purchases to renewable energy generation projects[8].

b) The levelized energy price would be in the range of 102.5 to 122.5 US$/MWh, depending of the project´s contribution to peak power.

c) Bidders are allowed to index about 30% of the energy and capacity charges based on the consumer price index (CPI) of USA.

d) 30-year PPA.

e) Bidders can propose to sell a portion of the generation capacity to third-parties (large consumers, exports and other distribution companies), but ENEE has a contingent obligation to purchase all the generation capacity at the price awarded in the bid if sales to third parties do not materialize.

The response to the bid exceeded all expectations. The bid established two lots: 150 MW for small projects (<15 MW) and 100 MW for larger projects. The bid results, summarized in Table 12, show that:

[8] Marginal generation cost + 10% as an incentive. For 2010, SERNA established a marginal cost of 97.96 US$/MWH for energy and 7.38 US$/kW-month for capacity.

a) ENEE received bids from 50 projects for the supply of 740 MW of generation projects using hydro, biomass, wind and geothermal energy and energy savings by energy efficiency projects, but about 88% of the capacity was in hydroelectric projects.
b) The capacity of individual projects is in a wide range from 1 MW to the 160 MW Tornillitos hydroelectric project.
c) A capacity of only 225 MW was offered to ENEE, less than the 250 MW that was requested, but with a contingent obligation of purchasing 740 MW. Energy prices met the price cap and are in the range of 98.6 to 112.8 US$/MWh. Many bidders but little competition.
d) The bid did not establish time-limits to commission the generation projects. About 50% of the proposed capacity would be commissioned before 2014 and the balance in 2015-2017.
e) After bid evaluation, only 39 projects, with an installed capacity of about 600 MW, met the bidding conditions and requirements (180 MW to ENEE and 420 MW to third parties)

**Table 12**

**ENEE**
**Renewable energy generation bid**
**Proposals**

| | No. | Capacity (MW) | | Proposed (MW) | | Levelized price | |
|---|---|---|---|---|---|---|---|
| | | max | min | ENEE | third part. | max | min |
| **Lot I <15 MW** | | | | | | | |
| Biomass | 3 | 6 | 2 | 2 | 11 | 112.8 | 99.8 |
| Energy efficiency | 1 | 19 | 19 | 15 | 5 | 112.8 | 112.8 |
| Wind | 1 | 5 | 5 | 1 | 5 | 104.5 | 104.5 |
| Hydro | 36 | 18 | 1 | 98 | 148 | 112.8 | 98.6 |
| Total | | | | 115 | 167 | | |
| **Lot II >15 MW** | | | | | | | |
| Energy efficiency | 1 | 16 | 16 | 1 | 15 | 107.8 | 107.8 |
| Geothermal | 1 | 35 | 35 | 5 | 30 | 109.9 | 109.9 |
| Hydro | 7 | 160 | 19 | 104 | 306 | 111.8 | 99.2 |
| | | | | 110 | 351 | | |

| | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|
| Capacity commissioned (MW) | 4 | 19 | 196 | 303 | 461 | 461 | 676 |

Source: Own elaboration based on ENEE´s information

Although the response to this bid by private investors was very positive, there are matters of concern:

a) **Dealing with the contingent obligation**. If ENEE awards a capacity of 180 MW, it would have a contingent obligation of up to 600 MW. Although some generation projects have supply contracts with large consumers and the potential demand of large consumers (>750 kW) could reach about 300 MW, it is unlikely that the

market for sales to third parties could reach 420 MW. Therefore, there is a substantial risk that the contingent obligation becomes a firm obligation.

b) **The paper projects**. The bidding documents required that prospective bidders demonstrated their technical and financial capabilities and that they had submitted to SERNA all documents to obtain an operation license and the water rights (if necessary) for the projects. Besides, SERNA records show that there are some projects in an advanced stage of preparation (with feasibility studies, operation and environmental licenses and water rights ready). However, it is unlikely that the bidders, mostly local investors, would be able to mobilize the financial resources needed to fund an investment of about US $1.2 billion (assuming an investment cost of 2,000 US$/kW) when access to domestic and international capital markets is difficult due to the impact of the international financial crisis of 2008.
c) **The transmission investments**. ENEE´s power transmission grid does not have spare capacity to transport all the energy generated by the projects that submitted bids. The investors have to build the lines to connect the projects to the transmission grid but ENEE would have to invest about US$100 million in the expansion and strengthening of the transmission grid and does not have the resources to finance this investment.
d) **The length of PPAs**. Contracting a substantial generation capacity in 30-year PPAs, with energy and capacity charges that are partially indexed to the CPI, is not recommended because it reduces the flexibility in the future to take advantage of lower energy prices related with technology changes and the development of regional generation projects.

### 4. The risk of a short-term energy crisis

The WB Report warned about the risk of an energy crisis in 2007-2010 due to a tight supply/demand balance and that the planned generation capacity was to sufficient to meet the projected demand. The projected generation reserve was not adequate (compared to a target of 10%) and an energy deficit in 2009 was projected (see Table 13).

ENEE took preventive measures to address the high risk of an energy crisis but, in fact, external factors that were not under the control of ENEE played an important role in avoiding energy shortfalls in 2009. ENEE asked for bids in 2007 for the supply of 250 MW in thermal generation with the obligation to supply 80 MW in the short term but, as it was indicated above, the PPAs run into difficulties and this capacity would not be available. Furthermore, it asked for bids to supply 60 MW in off-season, using installed generation capacity in the sugar mills, but prices were too high and the bid was declared void. It also contracted in 2008 about 30 MW of surplus capacity of self-generators and co-generators.

**Table 13**

**Supply/demand balance 2007-2009**
(in MW)

| | 2007 | 2008 | 2009 |
|---|---|---|---|
| **Projected** | | | |
| Firm capacity | 1242 | 1322 | 1329 |
| Peak demand | 1180 | 1267 | 1351 |
| Reserve | 5.3% | 4.3% | -1.6% |
| **Real** | | | |
| Installed capacity | 1,568 | 1,593 | 1,606 |
| Available capacity */ | 1,276 | 1,154 | 1,231 |
| Peak demand | 1,126 | 1,205 | 1,203 |
| Reserve | 13.3% | -4.2% | 2.3% |

*/ Average available capacity in the month of maximum peak demand

Source: Own calculations based on ENEE´s information

On the other hand, ENEE implemented in 2008-2009 the Efficient Lighting Project, which distributed free of charge about 6 million compact fluorescent lamps (CFL) to replace most of the incandescent bulbs in the country. The project was supported by the Government of Venezuela (it supplied 4 million CFL) and was implemented with technical assistance from the Cuban government. In late 2009 about 93% of CFLs had been distributed. Although it is difficult to distinguish the impact of this program on demand growth in 2009 from the impact of the international financial crisis, an evaluation prepared by GAUREE indicates that the drop in the evening peak demand exceeded in 55 MW the drop of peak demand at noon, an indication of the impact of CFLs in energy consumption at night. However, the program may not be sustainable because residential customers may not have adequate price incentives to buy new CFL if they are paying a fraction of the electricity supply cost.

The international financial crisis of 2008, which produced a large drop in international trade, had a substantial impact on industrial production in Honduras and electricity sales in the industrial sector decreased by about 10% in 2009. Although firm generation capacity did not increase from 2007 and 2009 and the capacity reserve was not adequate (see Table 13), a supply crisis in 2009 was avoided due to the impact on peak demand of the combination of the international financial crisis and the massive CFL program (the peak demand in 2009 was 150 MW short of projected demand).

## F. International cooperation and lessons learned

A group of international donors (WB, IDB, IMF, CABEI and the European Union) agreed in 2007 on a coordinated program to support the implementation of GOH´s strategy for the recovery of the power sector. IMF approved in 2008 an operation to support the economic stabilization program submitted by GOH, which included commitments to increase electricity tariffs and implement ENEE´s financial recovery plan; the WB approved in 2009 a US$30 million loan to implement PROMEF; IDB approved a US$28.6 million loan to finance the Power Sector Support Program, which focused on transmission expansion projects, and a second US$20 million loan to finance this program, which depends on the availability of resources from the Special Operations Funds; CABEI, IFC and IDB´s private

window would support the development of renewable energy generation by the private sector.

The support program by the group of donors is complemented with bilateral cooperation agreements with the Government of Taiwan to develop the Piedras Amarillas hydroelectric generation project, and with Brazil to develop the Los Llanitos and Jicatuyo hydroelectric generation projects. Furthermore, the Fondo Hondureño de Inversión Social (FHIS) is implementing the Rural Infrastructure Project (PIR) financed by WB, and ENEE was implementing a project to strengthen its operations (IDB-1584/SF-HO), the GAUREE project with the support of the European Commission and a technical cooperation of the International Atomic Energy Agency (IAEA) to prepare a water balance of the Yojoa lake.

Recent evaluations and audits performed by the multilateral banks on the implementation of power projects in Honduras pointed out that ENEE has deficiencies in the procurement and financial management areas and in its institutional capability for implementing projects, mostly related to lack of control, inadequate recording of accounts, cumbersome procedures for decision making, and gaps in administrative rules and procedures. The new loans of WB and IDB take into account the lessons learned and have created special project units responsible for procurement and managing the loan resources[9].

On the other hand, the operation experience of the Francisco Morazán hydroelectric station (El Cajón hydroelectric project), the largest investment made by ENEE, indicates that ENEE has taken timely actions to address serious operational problems during the past 25 years, related to reservoir leakage, a common risk of projects with dams placed on a limestone formation with karstic zones. ENEE had to implement 15 years ago a costly grouting program to seal the rock and reduce water seepage, potentially dangerous to the structural integrity of the dam (see Annex A). Water seepage increased recently when the reservoir reached its maximum historic level and later on, an earthquake hit Honduras in 2009. ENEE has to implement this year a new grouting program and concrete lining of a drainage gallery at an estimated cost of US$11 million.

[9] BID. Informe Propuesta de Préstamo HO-L1019, 2008; Banco Mundial, Informe de evaluación del proyecto PROMEF (45791-HN), December 2008

# IV. Power sector outlook

## A. Demand and efficiency

ENEE updated in 2009 the electricity demand projections taking into account, by and large, the impact of the international financial crisis on the 2009 demand and on the prospects for economic growth in the medium-term - GDP growth was adjusted to 2% in 2010, gradually increasing to 5% in 2014. Other key factor for projecting electricity demand is the level of electricity losses. The demand projections start with 21.9% losses in 2009 (lower than the real value of 22.4% at the end of 2009) and assume an annual reduction of 0.6 percentage points until it reaches 16.9% in 2018. This assumption is reasonable, as long as ENEE reactivates the loss reduction program. The demand projection does not consider the impact of energy savings programs as the efficient lighting program of 2009, a reasonable assumption taking into account the lack of incentives for investing in energy efficiency due to extensive electricity subsidies in the residential sector.

**Table 14**

**Honduras**
**Electricity demand projections**
**(exclude demad served by cogenerators)**

| | | Peak demand | Energy demand | Energy sales | Losses |
|---|---|---|---|---|---|
| | | MW | GWh | GWH | % |
| | **2009** | 1,203 | 6,536 | 5,106 | 21.9% |
| | **2010** | 1,258 | 6,850 | 5,392 | 21.3% |
| | **2011** | 1,308 | 7,131 | 5,656 | 20.7% |
| | **2012** | 1,369 | 7,475 | 5,973 | 20.1% |
| | **2013** | 1,434 | 7,846 | 6,317 | 19.5% |
| | **2014** | 1,505 | 8,247 | 6,689 | 18.9% |
| | **2015** | 1,578 | 8,660 | 7,076 | 18.3% |
| | **2016** | 1,653 | 9,084 | 7,477 | 17.7% |
| | **2017** | 1,729 | 9,518 | 7,892 | 17.1% |
| | **2018** | 1,809 | 9,970 | 8,283 | 16.9% |
| | **2019** | 1,899 | 10,483 | 8,709 | 16.9% |
| | **2020** | 1,996 | 11,030 | 9,163 | 16.9% |
| | **2021** | 2,095 | 11,593 | 9,631 | 16.9% |
| | **2022** | 2,198 | 12,178 | 10,116 | 16.9% |
| | **2023** | 2,305 | 12,783 | 10,619 | 16.9% |
| | **2024** | 2,414 | 13,402 | 11,134 | 16.9% |
| | **2025** | 2,526 | 14,041 | 11,664 | 16.9% |
| **TC** | **09-12** | 4.4% | 4.6% | 5.4% | |
| | **12-20** | 4.8% | 5.0% | 5.5% | |
| | **20-25** | 4.8% | 4.9% | 4.9% | |

TC: annual rate of growth
Source: ENEE

ENEE projects an annual energy demand growth of 4.6% in the short-term, in 2009-2012, which increases to 5.0% in the long run. Electricity sales grow at a higher rate of 5.5% due to the impact on sales of the reduction in black losses (see Table 14). The demand

projection excludes the demand of large consumers, currently served by cogeneration and self-generation, and assumes that ENEE will continue serving the remainder of the consumers.

## B. Generation potential with renewable energy

Honduras has a substantial renewable energy generation potential, but the information on this potential is not complete and is not updated. The hydroelectric generation potential is estimated at 5,000 MW, based on old studies on the inventory of hydroelectric resources, and the potential for wind power is estimated at 10,000 MW, based on regional wind maps using satellite information. In the case of geothermal and biomass (bagasse) energy, the generation potential of sites that have been identified is much smaller, in the range of 100 MW for each resource (see Table 15)

SERNA´s registry of renewable energy generation projects that have or are requesting licenses or permits (studies, operation and environmental) and the information on hydroelectric projects being prepared by ENEE provide a better indication of the generation potential that could be developed in the medium-term. In late 2009 SERNA had in the registry of renewable energy generation projects with operation license approved and feasibility studies completed, 59 hydroelectric projects with an installed capacity of 1,033 MW, 3 geothermal projects with 75 MW, and 2 wind projects with 107 MW. Additionally, it had registered with permits for studies (preliminary, pre-feasibility or feasibility studies) 137 projects with an installed capacity of about 1,700 MW. On the other hand, ENEE was preparing 6 medium and large hydroelectric projects with an installed capacity of 800 MW (see Table 15).

The information on the potential for mini and micro hydroelectric generation and solar panels as a solution for off-grid energy supply is scarce and is not consolidated. ENEE is implementing a program to install 3 micro-hydro plants, of about 100 kW each, financed by the European Commission. FHIS is implementing the projects PIR and the Rural Electrification Project financed by GEF/WB, which include the construction of 9 micro-hydro plants to supply small isolated communities. The Honduran Science, Technology and Innovation Council (COHCIT) is implementing the Eurosolar project to provide 68 small communities with solar panels and communication and education equipment to be used in schools and health-care centers. ENEE has implemented, under GAUREE, projects to supply energy with solar panels to small isolated communities, as the Guajiniquil project that serves 40 households and one school.

**Table 15**

**Renewable energy generation potential**
(MW)

| Resource | Potencial | | | SERNA registry | | | | Source |
|---|---|---|---|---|---|---|---|---|
| | Theoretical | Identified | Operat. 2009 | Operation license a/ | | Study permit | | |
| | | | | MW | No. | MW | No. | |
| **Hydro** | 5,000 | | 522 | 1,033 | 59 | 1,167 | 114 | Olade, 2006, DGE SERNA |
| **Geothermal** | | 125 | 0 | 75 | 3 | | | DGE, SERNA |
| **Wind** | 10,000 | | | 107 | 2 | 479 | 12 | DGE, SERNA |
| **Biomass** | | 100 | 92 | 8 | 3 | 45 | 11 | DGE, SERNA |

a/ With feasibility studies

**Medium and large hydroelectric projects**

| Project | Capacity | Study level |
|---|---|---|
| Tablón | 20 | |
| Piedras Amarillas | 100 | Feasibility |
| Llanitos | 98 | Feasibility / in process |
| Jicatuyo | 173 | |
| La Tarrosa | 150 | Basic studies |
| Valencia | 270 | |

Source: own elaboration based on SERNA and ENEE´s information

## C. Generation expansion plan

ENEE´s Planning and Development Office (DIRPLAN) periodically updates the indicative generation expansion plan, using the most recent information on demand projections, new PPAs, progress made in the implementation of small private renewable energy generation projects, and on the generation projects that are candidates to meet demand growth.

There are many uncertainties about the development of the generation projects that are included in the expansion plan for the following 7 years, related to: the difficulties and setbacks in the preparation of the Piedras Amarillas, Jicatuyo y Los Llanitos hydroelectric projects and the lack of definition about the scheme that would be used to develop these projects; the delays and problems in developing the 150 MW coal-fired plant; and the lack of clarity on the strategy to be used to award the renewable energy generation bid.

Therefore, instead of preparing a new generation expansion plan, DIRPLAN has used the previous plan and updated the commissioning dates for the projects that are being prepared based on the following assumptions:

a) Include only PPAs that are confirmed and do not face major difficulties:
    a. The rehabilitation of ENEE´s Alsthom y Sulzer diesel plants and the installation of a 60 MW coal-fired unit.
    b. The 100 MW Cerro de Hula wind power project
    c. 22 MW in small renewable energy generation projects that are being developed (mini-hydros and biomass).

b) The medium hydroelectric projects currently under preparation are included (Piedras Amarillas, Llanitos y Jicatuyo, La Tarrosa and Valencia) adjusting the commissioning dates.
c) ENEE will award a capacity of 180 MW in the renewable energy bid, but a contingent obligation for 600 MW will be included in the expansion plan according to the commissioning dates proposed in the bid.
d) The private thermoelectric plants will be retired when their PPAs expire.

The assumptions made on the award of the renewable energy generation bid are overly optimistic, taking into account the difficulties in financing all the generation projects and the required transmission expansion. Once this bid is awarded, DIRPLAN will be able to adjust the expansion plan and propose alternatives to meet demand growth in the medium term.

The generation projects defined in the plan can meet demand growth until 2017, with minor exemptions. After 2017, besides developing the large hydroelectric projects left in the list of candidates (La Tarrosa and Valencia), the plan selects coal and gas-fired thermoelectric plants. The generation expansion plan (see Table 16) identifies additional actions that should be taken to meet demand in the short-term:

- To meet demand in 2011, it is necessary to negotiate an extension of the PPAs with the Lufussa I and Elcosa thermal plants (total of 120 MW), which expire in 2010. Therefore, the plan assumes that these plants will be replaced by a diesel plant with the same capacity but with lower generation prices.

- There is a capacity deficit of 50 MW in 2011. The plan assumes that this deficit will be met with an import contract from the regional electricity market, but the supplier has not been defined as yet.

ENEE has not justified that the expansion plan shown in Table 16 is the least-cost solution to meet the projected demand. A complete economic analysis would be needed, which is beyond the scope of this report. Instead, a simple comparison of the purchase energy prices from the new renewable energy generation projects with the prices under existing contracts with the most efficient diesel plants can illustrate this issue.

Figure 7 compares the levelized energy price and the variable energy charge of the PPAs with Lufussa III y Enersa diesel plants, with the levelized energy price of the renewable energy generation bid and the marginal generation costs approved for 2010, used to determine the energy prices for direct purchases to renewable projects[10]. We observe that:

a) The CMCP plus 10%, used as a price cap for direct energy purchases, is slightly higher than the levelized energy purchase price from Lufussa III and Enersa, based on a bunker C price of 70 US$/bbl, similar to its current price.

[10] The levelized energy price is calculated applying the energy and capacity charges and using a 65% plant factor, which is equal to the annual load factor of total demand.

**Table 16**

**SUMMARY**

**GENERATION EXPANSION PLAN**

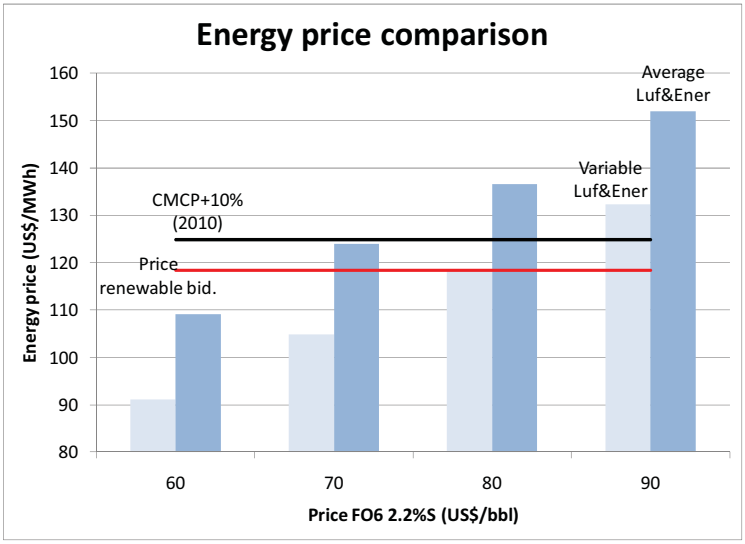
**2010 - 2024**

| GENERATION CAPACITY ADDED (MW) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PLANTA | Fuel | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
| Alsthom y Sulzer (VETASA) | Bunker | 60.0 | | | | | | | | | | | | | | |
| Coal (VETASA) | Coal | | | | 60.0 | | | | | | | | | | | |
| Eecopalsa Biogás (II etapa) | Biogas | 0.9 | | | | | | | | | | | | | | |
| Quilio II | Hydro | | 0.9 | | | | | | | | | | | | | |
| Mangungo I | Hydro | | 1.2 | | | | | | | | | | | | | |
| Matarrás I | Hydro | | 1.0 | | | | | | | | | | | | | |
| Masca I | Hydro | | 1.7 | | | | | | | | | | | | | |
| Eólico | Wind | | | 100 | | | | | | | | | | | | |
| Mangungo II | Hydro | | | | 1.3 | | | | | | | | | | | |
| Matarrás II | Hydro | | | | 2.3 | | | | | | | | | | | |
| Masca II | Hydro | | | | 1.0 | | | | | | | | | | | |
| La Ruidosa | Hydro | | | | | 6.2 | | | | | | | | | | |
| Río Frío (Ocotepeque) | Hydro | | | | | 3.4 | | | | | | | | | | |
| Gualcarque ENEE | Hydro | | | | | | 8.3 | | | | | | | | | |
| renewable bid 250 MW* | Hydro | | 4 | 15 | 177 | 107 | 158 | | 55 | | | | | | | |
| Imported energy La Geo | Geothermal | | 50 | | | | | | | | | | | | | |
| Motores diesel media vel.** | bunker C | | 120 | | | | | | | | | | | | | |
| Coal plant | coal | | | | | | | | | 200 | | | 100 | | | 50 |
| Gas turbines | Diesel | | | | | | | | | | 200 | | | | | |
| Tablón | Hydro | | | | | | | | 20 | | | | | | | |
| Piedras Amarillas | Hydro | | | | | | | 100 | | | | | | | | |
| Tornillito (renewable bid) | Hydro | | | | | | | | 160 | | | | | | | |
| Llanitos | Hydro | | | | | | 98 | | | | | | | | | |
| Jicatuyo | Hydro | | | | | | | 173 | | | | | | | | |
| La Tarrosa | Hydro | | | | | | | | | | 150 | | | | | |
| Valencia | Hydro | | | | | | | | | | | | | 270 | | |
| TOTAL | | 60.9 | 179.1 | 114.5 | 241.8 | 116.6 | 264.3 | 273.0 | 235.0 | 200.0 | 350.0 | 0.0 | 100.0 | 270.0 | 0.0 | 50.0 |
| Retired | | -120 | 0 | -47 | -60 | 0 | -38 | 0 | 0 | -440 | -140 | 0 | 0 | 0 | 0 | 0 |
| Net addition | | -59 | 179 | 68 | 182 | 117 | 226 | 273 | 235 | -240 | 210 | 0 | 100 | 270 | 0 | 50 |
| Accumulated | | -59 | 120 | 188 | 370 | 486 | 713 | 986 | 1,221 | 981 | 1,191 | 1,191 | 1,291 | 1,561 | 1,561 | 1,611 |

Source: ENEE

b) The levelized energy purchase price, established as a price cap in the renewable energy generation bid is smaller than the levelized purchase price from the thermal plants, based on a bunker C price of 70 US$/bbl
c) The levelized purchase price from renewable energy generation is substantially smaller that the purchase price from thermal plants for bunker C prices higher than 80 US$/bbl. On the other hand, it is substantially higher for fuel prices below 60 US$/bbl.
d) If bunker C prices are below 80 US$/bbl, the variable energy charge of thermal plants is smaller than the levelized purchase price from renewable energy generation, an indication that it may not be justifiable to displace this thermal generation with energy purchases from new renewable energy generation plants.

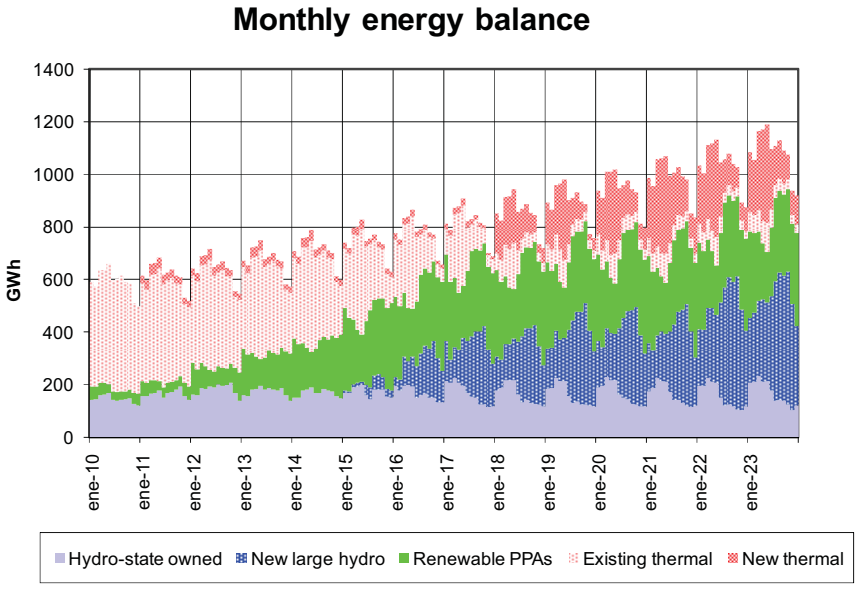
**Figure 7**




Source: Own elaboration based on ENEE´s information

The share of renewable energy generation in the generation mix would increase substantially from 2010 to 2017 (see Figure 8). Renewable energy generation displaces thermal generation especially during the rainy season of June to November. The share of renewable energy would increase up to 80% by 2017. After 2017, when the contracts with the efficient diesel generators Lufussa III y Enersa expire, it would be necessary to replace these contracts with new thermoelectric plants (or negotiate an extension of these contracts) to firm-up renewable energy generation during dry seasons.

**Figure 8**




Source: Own elaboration based on ENEE´s information

## D. Financial projections

The three most important factors that determine ENEE´s Profit and Loss Statement are the average tariff, the average energy purchase price and electricity losses. The combination of tariff lags, high losses and energy purchase prices that are high and dependent on volatile fuel prices explain most of ENEE´s financial crisis. The main assumptions made for preparing ENEE´s financial projections for 2010-2015 are explained below.

*Energy purchase prices*

The average energy purchase price depends mainly on the bunker C price and the energy prices in new PPAs with private generators. The new renewable energy generation contracts should help to stabilize the energy purchase prices. The energy purchase prices for 2010-2015 were estimated, based on a simulation of the operation of the generation system, using the generation expansion plan summarized in Table 16 and the proposed energy prices in new PPAs (see Table 17). We observe that:

a) The share of energy purchases to thermoelectric generators is reduced from 68% to 16% of total generation in 2010-2017. A smaller dependence on oil-fired generation should help to stabilize energy purchase prices.
b) The share of purchases to renewable energy projects would increase from 7% to 63% in the same period and, therefore, the energy price in the new PPAs would be a major factor in defining the average energy purchase price.
c) The share of ENEE´s hydroelectric generation will decrease gradually from about 29% at the beginning to about 21% at the end of this period. Therefore, ENEE would have less room to compensate any financial losses in energy purchases with the economic rent of its hydroelectric projects.
d) The average energy purchase price decreases gradually in 9% over this period, from 132 US$/MWH to 119 US$/MWh, assuming that the current bunker C price of 72 US$/bbl keeps constant. Although the generation mix changes radically during this period, the drop in the average purchase price is moderate due to the relatively high price for renewable energy generation (about 110 US$/MWh).
e) The average generation price, including ENEE´s hydroelectric generation at no cost, fluctuates in the range of 92 to 94 US$/MWh. The average generation price has minor changes because the decrease in the energy purchase price is compensated by a drop in the participation of ENEE´s hydroelectric generation in the generation mix.
f) The average generation price increases for higher fuel prices, but the drop in average prices during the period is more significant, about 16%, from 115 US$/MWh to 97 US$/MWh. The elasticity of average prices to fuel prices is higher at the beginning of the period, when thermal generation predominates, than at the end of the period when the participation of thermal generation is minor. For a 25% increase in fuel prices (72 to 90 US$/bbl), the average generation price increases 16% in the initial year and only 3% at the end.

**Table 17**

| Generation prices | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Price FO6 2.2%S NY/Boston | | 72 | US$/bbl | | | | | | |
| | | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
| **Levelized generation price** | | | | | | | | | |
| Thermal PPAs | US$/MWh | 138.2 | 139.1 | 140.7 | 138.7 | 133.2 | 138.5 | 149.0 | 164.6 |
| New hydros | US$/MWh | | | | | | 95.6 | 95.9 | 103.9 |
| Renewable PPAs | US$/MWh | 71.7 | 79.2 | 94.7 | 104.5 | 107.6 | 108.4 | 108.9 | 110.4 |
| Total contracts | US$/MWh | 131.7 | 129.3 | 129.4 | 126.5 | 122.4 | 120.0 | 117.5 | 119.2 |
| Average with ENEE´s gener. | US$/MWh | 99.2 | 94.0 | 92.3 | 93.6 | 93.0 | 91.9 | 92.1 | 94.6 |
| Fuel oil @80 US$/bbl | US$/MWh | 106.2 | 99.7 | 97.5 | 98.0 | 96.8 | 94.6 | 93.9 | 95.8 |
| Fuel oil @90 US$bbl | US$/MWh | 114.8 | 106.9 | 104.0 | 103.4 | 101.7 | 97.9 | 96.1 | 97.2 |
| **Total generation** | GWh | 6,836 | 7,131 | 7,471 | 7,842 | 8,241 | 8,659 | 9,084 | 9,518 |
| Thermal PPAs | GWh | 68% | 61% | 54% | 48% | 44% | 31% | 22% | 16% |
| New hydros | GWh | 0% | 0% | 0% | 0% | 0% | 4% | 17% | 24% |
| Renewable PPAs | GWh | 7% | 12% | 18% | 26% | 32% | 41% | 39% | 39% |
| Total without ENEE´s hydro | GWh | 75% | 73% | 71% | 74% | 76% | 77% | 78% | 79% |
| **Total purchase costs** | MUS$ | 676 | 670 | 689 | 734 | 765 | 796 | 837 | 901 |
| Fuel oil @80 US$/bbl | MUS$ | 724 | 711 | 728 | 768 | 797 | 819 | 853 | 912 |
| Fuel oil @90 US$bbl | MUS$ | 783 | 762 | 776 | 810 | 837 | 847 | 873 | 925 |
| Source: Own calculations with ENEE´s information | | | | | | | | | |

*Electricity tariffs*

Assuming that bunker C prices will remain at current levels of 72 US$/bbl, the average electricity tariff would depend in the short-term on the application of the tariff adjustment formula. For the base case, we assume that the current average tariff of 2.78 Lps/kWh, equivalent to14.6 US¢/kWh, will be kept constant.

*Electricity losses*

The abatement of electricity losses in the short-term would depend on the actions taken by ENEE to restore and improve the detection and control of electricity fraud and theft using the AMR equipment already in place. On the medium-term would depend on a successful implementation of PROMEF. For the financial projections we made a conservative assumption that losses would be reduced in 0.6 percentage points per year.

*Financial results*

Preliminary projections of ENEE´s Profit and Loss Statement for 2010-2015 indicate that ENEE´s financial situation is critical and unsustainable in the short-term with current tariffs if bunker C prices do not decrease (see Table 18):

a) Present average tariff do not cover operation costs and expenses, based on prevailing bunker C prices, let alone for higher fuel prices.

b) Current average tariff do not cover the average energy purchase price, including the cost of electricity losses. Therefore, ENEE´s financial loss would increase for a higher rate of growth of demand.

c) The year´s loss, about Lps 1,500 million in 2009, would increase to Lps 2,600 million in 2010, due to the increase in average fuel prices from 55 to 72 US$/bbl. The financial loss gradually decreases during this period as electricity losses are reduced and energy purchase prices also decrease.

**Table 18**

| **ENEE** | | | | | | | |
|---|---|---|---|---|---|---|---|
| Profit and loss statement 2010-2015 | | | | | | | |
| (in million Lps) | | | | | | | |
| | | | | | | | |
| **Case:** | 0% | increase current tariff | | | | | |
| | 72 | US$/bbl | | | | | |
| | | | | | | | |
| | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** |
| **Total revenues** | 12,608 | 14,899 | 15,633 | 16,514 | 17,469 | 18,504 | 19,579 |
| Services | 13,611 | 14,881 | 15,615 | 16,496 | 17,451 | 18,486 | 19,561 |
| Subsidies (not compensated) | (1,021) | - | - | - | - | - | - |
| Other revenues | 18 | 18 | 18 | 18 | 18 | 18 | 18 |
| **Operation costs and expenses** | 13,611 | 17,180 | 16,792 | 17,358 | 18,394 | 19,186 | 19,872 |
| Energy purchases and fuels | 8,803 | 13,312 | 12,753 | 13,116 | 13,959 | 14,561 | 15,148 |
| Other operation expenses and costs | 4,808 | 3,868 | 4,040 | 4,241 | 4,435 | 4,625 | 4,723 |
| Personnel | 996 | 1,130 | 1,199 | 1,272 | 1,340 | 1,408 | 1,493 |
| Depreciation | 1,876 | 1,834 | 1,888 | 1,962 | 2,030 | 2,093 | 2,039 |
| Other operation expenes | 1,937 | 904 | 953 | 1,008 | 1,065 | 1,124 | 1,191 |
| **Net operation revenues** | (1,003) | (2,281) | (1,160) | (844) | (926) | (683) | (293) |
| **Total financial expenses** | (507) | (298) | (235) | (175) | (168) | (160) | (155) |
| **Profits before taxes** | **(1,510)** | **(2,579)** | **(1,395)** | **(1,019)** | **(1,093)** | **(843)** | **(448)** |
| Taxes | - | - | - | | | | |
| **Profit (loss)** | **(1,510)** | **(2,579)** | **(1,395)** | **(1,019)** | **(1,093)** | **(843)** | **(448)** |
| **Profit (loss) (US$million)** | **(79)** | **(136)** | **(73)** | **(54)** | **(57)** | **(44)** | **(24)** |
| | | | | | | | |
| **Indicators** | | | | | | | |
| | | | | | | | |
| | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** |
| **EBITDA (million Lps)** | 45.9 | (23.5) | 38.3 | 58.7 | 58.0 | 74.1 | 91.8 |
| **Profit (loss) (US$M)** | (79) | (136) | (73) | (54) | (57) | (44) | (24) |
| **Average tariff (US¢/kWh)** | 14.4 | 14.6 | 14.6 | 14.6 | 14.6 | 14.6 | 14.6 |
| % change | 6% | 2% | 0% | 0% | 0% | 0% | 0% |
| **Energy purchase price (US¢/kWh)** | 11.0 | 13.9 | 13.0 | 13.0 | 12.7 | 12.3 | 12.1 |
| % change | -26% | 26% | -7% | 1% | -2% | -3% | -2% |
| **Purchase price + losses** | 14.2 | 17.7 | 16.4 | 16.3 | 15.8 | 15.2 | 14.8 |
| **Price FO6 2.2%S NY (US$/bbl)** | 55.1 | 72.0 | 72.0 | 72.0 | 72.0 | 72.0 | 72.0 |
| **Collections (%)** | 96% | 96% | 97% | 97% | 98% | 98% | 98% |
| **Electricity losses (%)** | 22.4% | 21.3% | 20.7% | 20.1% | 19.5% | 18.9% | 18.3% |
| **CRI (%)** | 74.1% | 75.6% | 76.5% | 77.5% | 78.9% | 79.5% | 80.1% |
| | | | | | | | |
| Source: Own calculations based on ENEE´s information | | | | | | | |

d) ENEE´s financial losses would increase in about Lps 1,000 million if GOH keeps, but does not pay, the existent direct subsidy.

e) Although ENEE´s EBITDA is positive after 2010, the internal cash generation would be negative. A preliminary cash-flow analysis show a deficit of about Lps

2,000 million in 2010-2011, to meet financial obligations and finance priority investments in overhauling generation plants and expanding substations and distribution grids (see Table 19). Financing this deficit with short-term loans with local banks does not seem feasible.

**Table 19**

| **ENEE** | | | |
|---|---|---|---|
| **Sources and applications 2009-2011** | | | |
| **(in million Lps)** | | | |
| | | | |
| **Case:** | **0%** | **incr. existing tariff** | |
| | **72** | **US$/bbl** | |
| | | | |
| | **2009** | **2010** | **2011** |
| Net operation revenues | -1,003 | -2,281 | -1,160 |
| Other revenues (expenses) | -305 | -10 | -10 |
| Depreciation | 1,876 | 1,834 | 1,888 |
| **Total operation revenues** | 567 | -457 | 718 |
| Internal loans | | | |
| External loans | 305 | 129 | 310 |
| Transfers | 468 | 25 | 25 |
| **Total Sources** | 1,340 | -303 | 1,054 |
| Interest and commissions | 234 | 288 | 225 |
| Internal debt | 178 | 170 | 97 |
| external debt | 56 | 117 | 128 |
| Amortization | 1,319 | 376 | 2,253 |
| Internal debt | 1,207 | 91 | 1,982 |
| external debt | 112 | 285 | 271 |
| Investments | 547 | 1,155 | 1,006 |
| Working capital change | 262 | -155 | -110 |
| **Total applications** | 2,361 | 1,664 | 3,374 |
| **Surplus (deficit)** | -1,021 | -1,967 | -2,320 |
| **Surplus (deficit) US$million** | -54 | -103 | -122 |
| | | | |
| Source: Own calculation based on ENEE´s information | | | |

## E. Challenges and opportunities

### 1. In the short-term

As three years ago, the main short-term challenge faced by the power sector is to improve ENEE´s critical financial situation and reduce the risk of an energy supply deficit. However, the situation is different. Demand is growing at slower pace, electricity losses have decreased but now show a negative trend, the fiscal situation is critical and there is no sufficient fiscal space or borrowing capacity to implement a financial recovery plan as it was done in 2008.

ENEE´s financial situation is critical and unsustainable, at present bunker C prices, if electricity tariffs are not increased and direct subsidies are not reduced. About 80% of ENEE´s short-term operating costs are not under ENEE´s control because they are determined by energy prices in existing PPA´s, bunker C prices and hydrological conditions.

On the other hand, the generation expansion plan shows that it is necessary to negotiate an extension of the PPAs with Lufussa I y Enersa generation plants that will expire in 2010 and purchase about 50 MW of firm power in the regional market to keep the generation reserve in the range of 4%-9% in 2010-2012, which does not meet ENEE´s reliability criteria (10%), but may be acceptable taking into account that power demand is growing in 2010 at a slower pace than projected. Prolongation of the PPAs may have a financial impact because the financial projection assumes a price-break in the costly PPAs, but ENEE has a weak negotiating position – the two generation plants are essential to meet demand and apparently ENEE does not have credible alternatives to replace this generation.

## 2. On the medium-term

The major challenges of the power sector in the medium and long-term are: (a) to secure the financial sustainability of the power sector, (b) mobilize the financial resources required to diversify the generation sources and eliminate the investment lags in transmission and distribution; (c) to take advantage of the potential benefits of the regional energy market; and (d) increase the access to electricity service by the poor.

### *a) Financial sustainability*

Sporadic tariff adjustments, ad-hoc electricity loss reduction programs and support from the national budget are emergency options to relieve the periodic financial crisis of the power sector. However, to ensure the financial sustainability of the power sector in the long-term it is necessary to have a substantial and sustained improvement of ENEE´s performance , establish cost-covering electricity tariffs and establish market mechanisms to ensure a sufficient and efficient energy supply.

**ENEE has to improve its performance** because it cannot charge its customers with all its inefficiencies or rely on fiscal support to cover financial losses. The strategy to enhance ENEE´s performance focus, on the short-term, in the improvement of its distribution business by modernizing its information and management systems, creating separate management units with separate accounts and putting in place a distribution management team (project PROMEF).

The first stage of this strategy is not sufficient to achieve substantial and sustainable improvements. ENEE, as a state-owned enterprise, has poor governance and cannot operate as a commercial enterprise due to several budgetary, financial and procurement controls and political interference. It is necessary to transform it in a commercial enterprise. Additionally, it is necessary to strengthen energy policy making and regulation and establish all rules and regulations necessary to develop a competitive wholesale market, so that ENEE faces the market discipline and improves efficiency.

The **establishment of cost-recovery tariffs and focalized subsidies** is a necessary condition for financial recovery but difficult to achieve if the generation prices are vulnerable to the volatility of fuel prices. As a matter of political survival, GOH has been reluctant to apply automatic tariff adjustment formulas that result in sudden and substantial

tariff increases for most of the population, and has preferred to introduce generalized electricity subsidies.

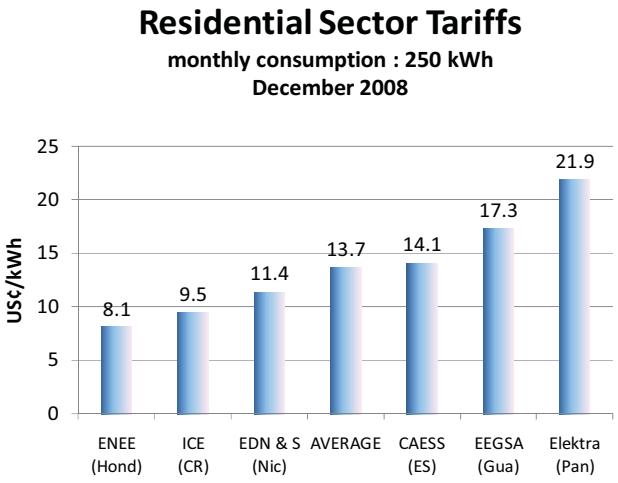
The development of renewable energy generation by private investors would help to diversify generation sources and stabilize electricity prices. It is also possible to use financial instruments to hedge fuel oil price risks and smooth out any large tariff adjustment related to increases in fuel prices. Although the stabilizations of generation prices would help in the application of cost-covering tariffs, it is also necessary to correct the large distortions in the current tariff structure.

Currently, about 88% of electricity customers, residential customers with a monthly consumption up to 500 kWh, pay a net tariff of less than 11 US¢/kWh (taking into account the direct subsidy), which does not cover the projected supply cost taking into account the substitution of renewable energy for thermal generation with high and volatile prices. In order to cover costs, it would be necessary to increase in about 50% the average tariff for these residential customers and concentrate electricity subsidies on the poor. This tariff increase would align residential electricity prices in Honduras with other countries in the region. In late 2008, the average residential tariff for a residential customer with a monthly consumption of 250 kWh was about 75% higher in the region than in Honduras (see Figure 9)

**The single-buyer model has not been effective in ensuring a sufficient and reliable power supply.** The bidding processes for contracting energy supply have experienced many difficulties and delays in the past and, as a result, ENEE had to implement in many cases costly and inefficient emergency solutions. It is not a problem related with the market model but of deficiencies in its implementation. A few Latin American countries (Brazil, Peru, Colombia and Chile) and most Central American countries have established centralized competitive bidding procedures to contract long-term energy supply to meet project demand.

In Honduras, procurement of electricity supply has faced many difficulties and delays. The electricity regulator does not play an active role in establishing norms and procedures for the procurement of energy that promote competition and achieve low energy prices, related to the bidding strategy to obtain an adequate portfolio of contracts that help managing price risks, allowing sufficient time to build and commission generation projects, and an efficient application of price caps. Apparently CNE only reviews the power purchase contracts. On the other hand, the tariff regulations do not guarantee that the cost of the PPAs awarded under competitive bidding procedures are passed-through to tariffs and ENEE takes the risk that the average tariff is not sufficient to cover this cost. The tariff adjustment formula takes into account the impact on the busbar tariff of changes in the energy purchase prices, but sometimes the formula is not applied.

**Figure 9**




Source: Proceso de demanda eléctrica-CENPE-ICE

### *b) Mobilizing financial resources*

The positive response to the renewable energy generation bid and progress made in the financial structuring of medium hydroelectric projects prove that the policy of promoting the development of renewable energy through fiscal and market incentives for small projects and PPP for medium and large projects have been effective in attracting private investors and in diversifying the generation sources.

However, funding of the investments needs in renewable energy generation is not ensured and is a major challenge due to:

a) ENEE is a major credit risk as an off-taker of generation projects due to its weak financial position and the uncertainties about its financial recovery;
b) GOH is experiencing a difficult fiscal situation and its sovereign guarantees are not very effective in mitigating ENEE´s credit risks;
c) Access to domestic and international credit to finance capital intensive projects is difficult and expensive after the international financial crisis;
d) the renewable energy generation projects are capital intensive with investment costs over 2,000 US$/kW. The generation expansion plans calls for the development of about 1,000 MW in renewable energy projects in 2010-2017, which would require an annual investment of US$250 million in this period;
e) the energy contract market with large consumers may be small as compared to 1,000 MW in renewable energy generation capacity that is being developed but it may reduce project risks and help finance a few renewable projects; the possibility of electricity sales by renewable energy projects to large consumers may reduce project risks and help finance a few renewable projects;
f) financial structuring of the Piedras Amarillas, Jicatuyo and los Llanitos hydroelectric projects based on bilateral cooperation agreements is facing difficulties and it may be necessary to attract private investors to develop some of

these projects using traditional project finance schemes, which demand a solid economic justification and the mitigation of the project and market risks.

Moreover, ENEE had to postpone needed transmission and distribution investments due to its weak financial position during the last years and there is a large backlog of projects that are not financed as yet. ENEE´s investment program shows that during the next 4 years it is necessary to invest about US$300 million in priority transmission lines and substations, of which about US$200 million is not financed. Adding up investments in the rehabilitation and expansion of distribution networks, the investment needs would increase to about US$380 million, 72% of which does not have financing. An investment of about US$125 million is necessary to reinforce the transmission grid and connect many generation projects that participated in the renewable energy bid (see Table 20).

### *c) Integration with the regional energy market*

The implementation of SIEPAC and the creation of the regional electricity market (MER) are in the final stages. In 2010, the new interconnection line from Guatemala to Panama (except for a small section in Costa Rica) will be commissioned and the regional regulator and operator (CRIE and EOR) will start applying in full force MER regulations. The market charges to finance the operation of CRIE and EOR have been approved and the studies for harmonizing the local and the regional market regulations are being implemented by consultants in each one of the countries in the region.

Honduras can benefit of the start of operations of MER in 2010 and the possibility of entering into import/export firm energy contracts with agents in other countries in the region because it would facilitate the development of private generation projects in the country (possibility of energy export contracts) and of a competitive wholesale power market that provides new options for a reliable and efficient power supply. For instance, the Hidro Xacbal project, under construction in Guatemala by Honduran investors, submitted a proposal for a long term supply of 45 MW in the renewable energy generation bid. Importing 50 MW from the MER in the short-term could be a good substitute for costly emergency solutions to reduce the risk of energy shortages in 2011. The possibility of energy sales to third-parties facilitates financing of renewable energy in Honduras.

Although decree 70-2007 facilitates the participation of Honduras in the MER by removing ENEE´s monopoly position in regional energy trade and letting private generators and large consumers to register as agents in the regional market and sell/buy energy in the energy market, there are still some obstacles that need to be removed to develop a regional energy market, mostly related to a lack of harmonization of the domestic and regional market regulations:

a) The existing electricity regulations in Honduras are not adequate for the operation of a wholesale energy market with the participation of third parties- the Operation Code is missing, as well as the required information systems and software to apply the code, manage the market and coordinate the operation of the power system.

**Table 20**

**ENEE- Investment program T&D**
**in US$ thousand**

**PROJECTS TO BE DEVELOPED BY ENEE WITH ITS OWN RESOURCES**

| Description | Voltage (kV) | MVA | Investment | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|
| Expansion substation San Pedro Sula Sur | 138/34.5 | 50 | **3,735** | | 1,307 | 2,428 | | | |
| Expansion substation Suyapa (replace transformer T524) | 138/13.8 | 50 | **3,146** | | 3,146 | | | | |
| Construction of substation Catacamas and trasmission line Juticalpa - Catacamas, 40 km | 69/34.5 | 25 | **6,000** | | 2,100 | 3,900 | | | |
| Expansion substation Cañaveral | 138/34.5 | 50 | **1,913** | | 670 | 1,243 | | | |
| Various investments | | | **20,834** | 20,834 | | | | | |
| Expansion substation Siguatepeque | 138/34.5 | 25 | **1,013** | | | 355 | 658 | | |
| | | **TOTAL** | **36,641** | 20,834 | 7,223 | 7,926 | 658 | | |
| **PROJECTS FINANCED BY IDB** | | | | | | | | | |
| Construction of substation Amarateca + 25 MVAR de Compensación Reactiva en 13.8 kV | 230/138/13.8 y 230/34.5 | 150/150/50 y 50 | **20,100** | | | 7,035 | 13,065 | | |
| Expansion Toncontin Etapa I | 230/138 y 230/13.8 | 150 y 50 | **11,800** | | | 4,130 | 7,670 | | |
| Construction substation Centro and trasmission line Bellavista - Centro, 2.5 km | 138/13.8 | 50 | **7,146** | | | 2,501 | 4,645 | | |
| Expansion substation Zamorano | 69/34.5 | 30 | **1,258** | | | 252 | 604 | 403 | |
| | | **TOTAL** | **40,304** | 0 | 0 | 13,918 | 25,984 | 403 | |
| **PROJECTS FINANCED BY WB** | | | | | | | | | |
| Electricity loss resuction program | | | **10,091** | 3,532 | 6,559 | | | | |
| **PROJECTS TO BE DEVELOPED BY PRIVATE RENEWABLE ENERGY GENERATORS** | | | | | | | | | |
| Construction substation Cuyamel and trasmission line Masca-Cuyamel, 138 kV, 40 km. | 138/34.5 | 50 | **11,406** | | 3,992 | 7,414 | | | |
| Construction substation Lean, and related works | 138/69/34.5 | 50 | **7,429** | | 743 | 743 | 5,943 | | |
| | | **TOTAL** | **18,835** | | **4,735** | **8,157** | **5,943** | | |
| **PROJECTS TO BE DEVELOPED BY THIRD PARTIES UNDER BOT ARRANGEMENTS** | | | | | | | | | |
| Construction trasmission line Sanbuenaventura - SPSS, 51 km | 230 | 265 | **10,324** | | | 3,613 | 6,711 | | |
| Expansion substation San Pedro Sula Sur | 230/138 | 150 | **11,042** | | | 3,865 | 7,177 | | |
| trasmission line Amarateca - Juticalpa, 157 km, 230 Kv | 230 | 530 | **40,000** | | | 14,000 | 26,000 | | |
| Expansion substation Juticalpa and trasmission line Juticalpa - Reguleto, 150 km | 230/69/34.5 | 100/100/25 | **40,000** | | | 8,111 | 15,062 | | |
| Construction substation La Entrada and trasmission line Santa Rosa - La Entrada, 35 km, 69 kV | 230/69/34.5 | 100/100/50 | **5,250** | | | 1,838 | 3,413 | | |
| Expansion substation Reguleto and 30 MVAR reactive compensation in S/E Reguleto | 230/138/34.5 | 150/150/50 | **2,173** | | | 761 | 1,412 | | |
| | | **TOTAL** | **108,789** | | | **32,187** | **59,775** | | |
| **PROJECTS WITHOUT FINANCING** | | | | | | | | | |
| Expansion Toncontin Etapa II | 230/138 y 230/34.5 | 150 y 50 | **3,100** | | | | | 1,085 | 2,015 |
| Construction trasmission line San Pedro Sula Sur - Ciudad El Progreso, 45 km | 230 | | **7,603** | | | | | 2,661 | 4,942 |
| Construction trasmission line Toncontin - Danli, 80 km | 138 | 160 | **11,700** | | | 4,095 | 7,605 | | |
| Expansion Miraflores loop arrangement and Construction trasmission line Miraflores - Lainez, 5 km | 138 | 160 | **4,003** | | | 1,401 | 2,602 | | |
| Construction substation El Sitio | 230/34.5 | 50 | **5,677** | | | 1,987 | 3,690 | | |
| Expansion substation Choloma, ectionalize trasmission line L514 and 2nd connection Enersa | 138 | | **3,246** | | | 1,136 | 2,110 | | |
| Expansion of 8 substations | 138/34.5 | 350 | **19,411** | | | 6,794 | 12,617 | | |
| Construction of 6 substations | 230/34.5 y 138/34.5 | 300 | **31,826** | | | 11,139 | 20,687 | | |
| Normal expansion distribution grids 34.5/13.8 kV | | | **83,597** | 0 | 8,694 | 27,678 | 21,416 | 9,033 | 16,776 |
| | | Total | **170,163** | **0** | **8,694** | **54,230** | **70,727** | **12,779** | **23,733** |

Source: ENEE

b) ENEE has not installed the required commercial energy metering systems needed to measure, register and transmit information about energy transactions with the regional market. Furthermore, a project to modernize ENEE´s Control Center, financed by IDB, has been delayed and the main communications and SCADA contracts have not been awarded as yet.
c) It is possible to overcome these obstacles in 2010 with political will and the decision of ENEE´s management to support the development of a regional market. In case that all information requirements established in the regulations of MER cannot be met, it is possible to agree on transitory arrangements.
d) There are more substantial obstacles to the development of MER. Firm energy export contracts may not be feasible if a legal condition that gives priority to the supply of the domestic energy demand, established in article 13 of the electricity law, is not removed. The regional market Framework Treaty establishes the obligation that vertically integrated companies should create business units with separate accounts. ENEE has not complied with this requirement. If GOH does not take concrete actions to remove these barriers, there is a potential problem of lack of reciprocity with countries in the region that have adopted norms that facilitate the development of a regional market.

### *d) Increasing electricity coverage*

GOH made substantial progress in increasing electricity service coverage during the past three years. From 2006 to 2009 the coverage index at national level increased 10 percentage points, from 69.1% a 79.3 %, almost reaching ERP´s 80% coverage target for 2015. This substantial advance was achieved thanks to financial resources for rural electrification provided by ERP to the municipalities, the PIR project implemented by FHIS and the rural electrification projects implemented by OES/ENEE as administrator of the Social Fund for Electricity Development (FOSODE).

Although there is still room for increasing coverage with grid-connected rural electrification projects, a major challenge is to implement off-grid projects using renewable energy and to increase the efficiency of grid-connected programs, now that the Central American presidents agreed on a 90% coverage target for 2020[11], which would require additional coordination and financing efforts in the case of Honduras.

The grid-connected rural electrification projects are executed or coordinated by OES/FOSODE but there are coordination issues. OES/FOSODE uses a geographical information system to identify, budget and prioritize grid-connected projects. This office plays an active role in the preparation and supervision of PIR´s projects and coordinates its activities with FHIS. However, for the projects implemented by the municipalities with ERP´s funds, OES/FOSODE only provides technical assistance as requested and does not have authority to approve the projects or responsibility in the supervision of works. The current implementation arrangements apparently do not guarantee that the resources are

[11] Estrategia Energética Sustentable para Centroamérica 2020.

used efficiently to finance the programs with the highest social rates of return nor the quality of the works.

On the other hand, as indicated in section IV.B, the off-grid rural electrification projects are executed by several agencies other than OES/FOSODE.

With the decentralization in the planning and execution of rural electrification programs, OES/FOSODE has not updated the Social Electrification Plan, which is the basis to estimate investment needs, and has not consolidated past investments. It is necessary to improve the coordination in the planning and implementation of new projects to increase coverage with off-grid electrification programs and improve the efficiency of grid extension programs.

# V. Options and recommendations

## A. Corrective measures

Spite of the effort made and the corrective actions taken by GOH during the past years to recover the power sector, the sector still faces major short and medium-term challenges to achieve a sustainable recovery in difficult circumstances of stagnant economic growth, weak public finances, a credit crunch in the domestic and international capital markets and ENEE´s fragile financial position. This section presents and discusses options to address these challenges and the consultant´s recommendations.

### 1. Options to address short-term challenges

In the short-term it is necessary to prevent the risk of a financial and energy supply crisis if emergency actions are not taken. The analysis presented below shows that to avoid a financial crisis it is necessary to increase the average electricity tariff by 11%, as required by the tariff adjustment formula to cover fuel costs, focalize direct subsidies and eliminate cross subsidies that benefit the non-poor, and reactivate and revamp the program to reduce electricity losses and receivables. A supply crisis can be prevented by negotiating a time extension of PPAs with thermal generators that expire in 2010 and contracting the supply of at least 50 MW from the MER.

#### *a) Financial crisis*

ENEE´s short-term financial projections indicate that it is necessary to increase average electricity tariffs to cover a financial deficit projected for 2010 and 2011 if bunker C prices stay at about 72 US$/bbl. A tariff increase of 11%, a value resulting from the application of the tariff adjustment formula approved by CNE in February 2009, would be sufficient to meet the financial loss as long as GOH compensates ENEE for the direct subsidies or focalize these subsidies on the poor (see Table 21) .

There are few options, under the control of ENEE or GOH, to eliminate the financial deficit other than increasing tariff and reducing subsidies:

- A priority action is to improve ENEE´s bills collection and reduce accounts receivable, which increased by about Lps 400 million in 2009.
- Although ENEE´s EBITDA for 2010 and 2011 exceeds Lps 1,000 million, it is not sufficient to meet debt service and internal cash generation required to finance priority investments (see Table 21). Contributions of the national treasury or short-term loans do not seem to be an alternative under the current tight financial conditions.
- It seems unlikely that electricity losses are reduced in 2010 in more than the 1.1 percentage points assumed in the financial projections. ENEE´s loss reduction program needs to be reactivated and revamped.

**Table 21**

| **Financial results 2010-2011** | | | | | | |
|---|---|---|---|---|---|---|
| **(in million Lps)** | | | | | | |
| | | | | | | |
| **Case:** | 11% | **incr. existing tariff** | | | | |
| | 72 | US$/bbl | | | | |
| | | | | | | |
| **Profit and loss statement** | | | | **Sources and applications** | | |
| | | | | | | |
| | **2010** | **2011** | | | **2010** | **2011** |
| **Total revenues** | 16,536 | 17,350 | | Net operation revenues | -701 | 498 |
| Services | 16,518 | 17,333 | | Other revenues (expenses) | -10 | -10 |
| Subsidies (not compensated) | - | - | | Depreciation | 1,834 | 1,888 |
| Other revenues | 18 | 18 | | **Total operation revenues** | 1,122 | 2,376 |
| **Operation costs and expenses** | 17,237 | 16,853 | | Internal loans | | |
| Energy purchases and fuels | 13,312 | 12,753 | | External loans | 129 | 310 |
| Other operation expenses and costs | 3,925 | 4,100 | | Transfers | 25 | 25 |
| Personnel | 1,130 | 1,199 | | **Total Sources** | 1,276 | 2,711 |
| Depreciation | 1,834 | 1,888 | | Interest and commissions | 288 | 225 |
| Other operation expenes | 961 | 1,013 | | Internal debt | 170 | 97 |
| **Net operation revenues** | (701) | 498 | | external debt | 117 | 128 |
| **Total financial expenses** | (298) | (235) | | Amortization | 376 | 2,253 |
| **Profits before taxes** | **(999)** | **263** | | Internal debt | 91 | 1,982 |
| Taxes | - | - | | external debt | 285 | 271 |
| **Profit (loss)** | **(999)** | **263** | | Investments | 1,155 | 1,006 |
| **Profit (loss) (US$million)** | **(53)** | **14** | | Working capital change | 55 | -131 |
| | | | | **Total applications** | 1,874 | 3,352 |
| | | | | **Surplus (deficit)** | -597 | -641 |
| | | | | **Surplus (deficit) US$million** | -31 | -34 |
| Source: Own calculations based on ENEE´s information | | | | | | |

Additional tariff increases maybe required if bunker C prices exceed 72 US$/bbl. An option to smooth out any large tariff adjustment related to increases in fuel prices is to use financial instruments to hedge the price risk of bunker C in the east coast of USA. This can be done by purchasing a call option contract for bunker C with a strike price in the range of 70-80 US$/bbl, and a volume similar to the annual fuel consumption for power generation (about 5.4 million barrels). When the monthly price of bunker C exceeds the strike price, the financial institution that sold the call option should compensate the buyer (GOH) with an amount equal to the difference between the market and the strike prices multiplied by the monthly volume that was contracted. The price (or premium) of the call option depends, among other things, on the strike price, the duration of the option, and the volatility of the underlying asset (bunker C). Hedging fuel price risks for more than one year is very expensive. Call options have been used in other countries to stabilize electricity tariffs[12], but have to be assessed taking into account current market conditions.

The following action plan is recommended to avoid a financial crisis in the short-term:

[12] To smooth out any large tariff adjustments, Panama contracted in 2009 a call option to hedge the price risk of Bunker C for 3 million barrels and a strike price of 50 US$/bbl , and paid a premium 5.29 US$/bbl and a total cost of US$16 million.

- Approve immediately an average tariff increase of about 11%, which has been postponed since the second semester of 2009.
- Eliminate the direct subsidies that benefit residential customers with monthly consumptions up to 500 kWh, but taking additional measures to protect residential consumers in the range of 0-150 kWh/month.
- A gradual elimination of cross-subsidies that benefits monthly residential consumptions of up to 1,450 kWh, focusing these subsidies on low-income consumers.
- Revise ENEE´s electricity loss reduction program to make an effective use of AMRs and implement a short-term program to reduce receivables.
- Assess the feasibility of using financial instruments to hedge fuel oil price risks and smooth out any large tariff adjustment related to increases in fuel prices.

### *b) Short-term energy supply crisis*

Several actions can be taken to ensure a sufficient energy supply in 2010-2012: negotiate an extension of the PPAs with Lufussa I y Elcosa that would expire in 2010, energy purchases in the regional market, purchasing surplus generation of co-generators and self-generators, improving the availability of generation units currently under operation, leasing emergency plants, early commissioning of generation projects under construction, energy saving programs and, as a last resort, energy rationing.

Negotiating a time extension of the PPAs with Lufussa I y Elcosa is a high-priority action considering that these plants are operating, the owners do not intend to retire or dismantle these plants and it should be possible to negotiate better energy prices than the leasing option.

Contracting energy supply from the MER is an option that should be explored immediately since most countries in the region may have a generation surplus in 2010-2011: electricity demand dropped in 2009 due to the international financial crisis and most countries were implementing emergency generation expansion programs to address energy deficits or inadequate generation reserve margins in 2007 and 2008. Besides, the possibility of energy purchases in MER will improve ENEE´s negotiating position with Lufussa I and Elcosa.

It seems that ENEE has already purchased most of generation surpluses from co-generators that serve large consumers in the free-trade zone industrial parks and that saw a drop in electricity sales due to the contraction in industrial production after the international financial crisis.

Actions to improve the availability of existing generation capacity and to monitor a timely construction of new projects are always necessary measures to increase firm power supply. In the short-term, the potential for additional energy savings probably is small, after the implementation of the efficient lighting program.

Leasing emergency generation plants and energy rationing are expensive and last resort options that should be used only if the other actions are not sufficient to ensure a reliable supply in the short-term.

## 2. Options to address long-term challenges

### *a) How to ensure the financial and institutional sustainability*

Section IV.E.2.a) identified the necessary conditions to ensure the financial sustainability of the power sector in the long-term: substantial and sustainable improvements in the sector´s performance, establish cost-covering tariffs and improve the procedures to contract long-term supply of energy to meet demand. To meet these conditions it is necessary to implement the following action plan, with urgent measures to be taken in the short-term, and important actions to be adopted in the medium-term.

**Substantial and sustainable performance improvements**. PROMEF defines a clear strategy to improve ENEE´s performance and provides the resources to implement the first stage of the strategy. However, the implementation of this project has been delayed by the political crisis of 2009 and the WB loan is not effective as yet. Therefore, it is important that the new top management of ENEE assign a high priority to the implementation of this project. It is also urgent to initiate the restructuring of ENEE in UGs and to create and put in place the new management team of the distribution unit.

As a second phase of this strategy, once the new UGs and information systems are in operation, the transformation of ENEE can be completed, from a public entity to a public corporation managed as a private company. If the first stage of the strategy does not achieve substantial improvements in performance it might be necessary to retain the services of private contractors to manage the distribution business.

As a complement, it is also necessary to separate and strengthen the roles of policy making and regulation and establish the rules for the operation of a wholesale market. The National Energy Plan[13] proposes that SERNA should deal only with environmental protection and transfer the policy making and energy planning functions to a new Ministry of Energy, but keeping GE as an energy cabinet overseeing the energy sector.

Although it is convenient to focus SERNA on environmental matters, we think that it is not justifiable to create a separate Ministry of Energy and keep GE with the same functions as before. We suggest considering a different arrangement: to transfer SERNA´s energy policy functions and staff to a new Executive Secretariat of GE, which will provide technical support for decision making and will be headed by a high-level public official that will replace ENEE´s general manager as ministry of energy without portfolio.

CNE needs political support to implement the market model established in the law, with the limitations imposed by ENEE´s role as a de facto single-buyer, and needs to build up its

[13] SERNA. Elaboración de la Política Energética y Plan Energético Nacional al 2030. February 2010.

credibility and technical capabilities as an independent regulator. CNE should play a major role in the preparation and implementation of: (i) rules and regulations required for the operation of a wholesale power market and in harmonizing these rules with regional regulations, (ii) the norms and principles for contracting long-term energy supply and (iii) the norms and procedures for developing transmission projects by private investors.

**Establish cost-covering tariffs.** The previous analysis on financial sustainability (see section IV.E.2.a) shows that it is difficult to pass-through to tariffs generation costs that are exposed to the volatility of fuel prices and that cross subsidies that benefit 88% of the customers are not sustainable in the long term, even in the case when generation sources are diversified and generation prices stabilized.

The renewable energy generation bid is an opportunity to advance in the diversification of energy sources and stabilize generation prices. However, the generation expansion scenario in which ENEE awards the supply of 600 MW in renewable generation that will be commissioned before 2017 does not seem to be feasible or desirable. The lack of spare capacity in the transmission network, the difficulties in mobilizing the required financial resources, and the concerns about paper projects are sufficient reasons to assume that only a fraction of this generation capacity will be developed. On the other hand, there is a high price risk in contracting the supply of 600 MW based on 30-year PPAs, with an energy price that is relatively high and partially adjusted by the consumer price index of USA. The "fixed" energy purchase prices established in the long-term PPAs may prove to be high as compared to market prices. However, it is possible and advisable to make a partial award, selecting the most attractive proposals of generation projects in advanced stages of preparation.

Therefore, it is urgent to evaluate and award the renewable energy generation bid, taking advantage of the very positive response by private investors, and making a realistic assessment of ENEE´s capability to finance the required transmission investments and the need to reduce ENEE´s contingent obligation for purchasing a generation capacity that may be too large and risky.

The current electricity cross subsidies are neither efficient nor sustainable. The electricity law established a scheme with price caps to the subsidies and contributions that can be applied to each tariff category. Using this scheme, it is possible to design lifeline tariffs that focus the cross subsidies on the poor. However, the regulator approved a tariff schedule that apply the maximum subsidies allowed in the law, benefiting most of the non-poor residential consumers at the expense of the really poor that do not have access to electricity and cannot be served because a lack of financial resources, and affecting the competitiveness of the industrial sector, including the *maquila*. Furthermore, a direct subsidy provides free electricity to residential customers with a monthly consumption below 150 kWh and additional price discounts for monthly consumption up to 500 kWh (see section III.D.1). It is not sustainable or efficient to continue increasing the average tariff to cover supply costs but keeping a subsidy for residential customers with monthly consumption below 1,450 kWh and compensating the shortfall in revenues with higher tariffs for other sectors.

Therefore, it is recommended to initiate immediately a process to eliminate all subsidies (direct and crossed) to residential customers with consumptions above 150 kWh/month (or a subsistence consumption), and apply in the medium term a cost-covering tariff with subsidies focalized on the poor. The results and recommendations of a tariff study prepared recently by a WB consultant can be used to make necessary adjustment in the short-term[14].

**Improving the procedures for contracting long-term energy supply.** An efficient and sufficient energy supply is necessary to ensure the financial sustainability of the sector. Electricity tariffs cannot cover high and volatile generation prices resulting from inefficient long-term procurement of energy supply. The following actions are recommended to amend deficiencies in procedures used by ENEE for energy procurement:

a) Establish adequate competitive bidding procedures for guiding ENEE´s long-term contracting of energy supply. There is ample experience in Latin America, which can be applied in Honduras, in the design of bidding procedures and strategies that promote competition (including energy imports) and stable and efficient energy prices. It is necessary to provide technical support to CNE for the design and application of adequate bidding procedures.
b) Prepare and approve the Operations Code and support ENEE´s Dispatch Center to procure the information systems and software required to apply the Operations Code and manage a wholesale power market with the participation of large consumers and independent generators.
c) Access by prospective generation investors to basic information about renewable energy generation projects can help in promoting competition in long-term energy supply. SERNA should update and complete basic studies about the generation potential using renewable energy (wind and solar, geothermal, biomass and small hydroelectric projects), and prepare basic information about the most attractive sites.
d) Allow ENEE to pass-through to tariffs the energy purchase costs in PPAs that follow competitive bidding procedures approved by CNE or the procedures for direct purchases of renewable energy using the price caps established in the law.

### *b) How to facilitate the mobilization of financial resources*

Funding the investments in renewable energy generation in 2010-2017 would be problematic in the current scenario of tight financial markets after the international financial crisis, ENEE´s and GOH's weak financial positions, and recent reversals in the implementation of hydroelectric projects that had government-to-government support. ENEE is a substantial credit risk even in the case that GOH provides guarantees for a timely payment of ENEE´s obligations under the PPAs. The arrears in the payment of energy purchases and the lack of commitment to apply cost-covering tariffs are a matter of concern for potential investors and lenders.

[14] Angel Baide. Subsidios al Consumo Residencial de Electricidad en Honduras. Análisis y recomendaciones. March 2010.

Credit risk can be reduced by reducing the exposure of a generation project to electricity sales to ENEE. The 38 MW La Vegoña hydroelectric project, which participated in the renewable energy generation bid, is a good example. IFC is currently evaluating the feasibility of funding this project, under a project finance scheme in which the project sells most of its production to large consumers (33 MW) and only 5 MW to ENEE.

Credit risk can also be mitigated if GOH provides a clear signal of its political commitment to improve ENEE´s financial position and implement the most urgent corrective measures (cost-recovery tariffs, focalized subsidies and ENEE restructuring). This would facilitate funding small renewable energy projects by the local banks. Furthermore, the credit risk for the local banks can be minimized by partial risk guarantees issued by multilateral banks to GOH to ensure timely payment to new PPAs with private renewable generators.

Financing medium and large hydroelectric projects using BOT schemes is more difficult in the short-term. The investment needs and the project risks are larger and ENEE would be the main off-taker. Financial structuring of the Piedras Amarillas, Jicatuyo and los Llanitos Hydroelectric projects made progress thanks to cooperation agreements with friendly governments. If these operations fail, other options can be explored:

- Wait for more favorable conditions in the capital markets to fund generation projects using BOT schemes,
- assess the possibility of developing these projects under PPP arrangements with the support of other governments,
- develop these projects as traditional public investments, but in the medium-term, once ENEE´s performance has improved and its financial sustainability is ensured.
- develop the most attractive projects under PPP arrangements using non-recourse project finance, but reducing the credit risk with the leverage of electricity sales to large consumers or energy exports. The 160 MW Tornillitos hydroelectric project submitted a tender in the renewable energy bid for the supply of only 30 MW to ENEE. To reach financial closure it would need to finalize energy supply contracts with third parties for most of its production.

Private investment can be mobilized to develop a portion of the backlog of transmission and distribution projects. Competitive bidding procedures can be used to contract the development of the largest transmission lines by private investors under BOT arrangements (a US$108 million investment according to Table 20). This scheme has been used successfully in Colombia and Peru to implement transmission expansion plans. However, it is necessary to design and put in place a stable and credible regulatory framework for the development of transmission lines by third parties: transmission tariffs that ensure adequate long-term remuneration of transmission projects, norms and procedures to award BOT contracts under competitive bidding procedures, norms and procedures to collect the revenues related to transmission charges and pay individual BOT contracts.

### c) How to develop the regional energy market

Section IV.E.2.c) identified concrete actions to facilitate the development of the regional energy market and help Honduras taking advantage of its potential benefits:

**In the short-term**

a) GOH commitment to implement an action plan to harmonize market regulations and facilitate the development of the regional energy market;
b) implement required tasks to harmonize the domestic market regulations, including the preparation of the Operations Code as a complement to the design of the regulatory interface being implemented by CRIE;
c) strengthen CNE to develop its technical capability and credibility needed to prepare and apply the Operation Code.

**In the medium-term**

a) Install the energy metering system to meet the requirements of MER, implement the information systems and software required to manage the wholesale energy market with the participation of independent generators and large consumers, and strengthen ENEE´s Control Center so that it can manage the energy market and coordinate economic dispatch.
b) Clarify the legal provision about the priority of meeting the demand of the domestic market, invoking the hierarchy of international treaties over local laws.

### d) How to increase electricity coverage

Section IV.E.2.d) concludes that significant financial resources have been available to develop grid-connected and off grid rural electrification projects and programs, but it is necessary to improve the efficiency in the use of financial resources and the coordination between all the institutions that develop these programs.

It is recommended to assess the experience in the development of grid-connected rural electrification projects and revise existing policies and institutional arrangements regarding: project identification and selection, project design criteria, supervising project execution, investment and consumption subsidies, how effective are these projects in promoting economic development in rural areas, need to apply a multi-sectorial approach taking into account transportation, health and education needs, and the need to coordinate rural electrification programs with the strengthening of sub-transmission grids to meet quality of service and reliability standards. Additionally, to assess the investment needs to meet the 90% electricity coverage target

### e) Summary of options and corrective actions

Table 22 summarizes the proposed action plan to address the major challenges, organized in short and medium-term actions:

**Table 22**

| Challenge | Short-term actions | Medium and long-term actions |
|---|---|---|
| ***Avoid short-tern financial and energy supply crisis*** | • Negotiate an extension of Elcosa and Lufussa I PPAs<br>• Tariff increase according to tariff adjustment formula<br>• Reduce receivables and improve bill collection<br>• Revise the electricity loss reduction program<br>• Eliminate the direct subsidies that benefit residential customers with monthly consumptions up to 500 kWh, but taking additional measures to protect residential consumers in the range of 0-150 kWh/month.<br>• A gradual elimination of cross-subsidies that benefits monthly residential consumptions of up to 1,450 kWh, focusing these subsidies on low-income consumers. | |
| **Financial and institutional feasibility** | • Give high priority to the implementation of PROMEF<br>• Create UGs and organize the distribution unit<br>• Award the renewable energy generation bid | • Assess ENEE´s corporatization<br>• Separate the policy making and energy planning roles; assess the option to transfer these functions from SERNA to an Executive Secretariat of GE.<br>• Complete implementation of program to eliminate subsidies for non-poor residential customers and focalize subsidies on the poor<br>• Strengthen CNE to implement an energy market model and play a major role in harmonizing local and regional market regulations, and setting rules for competitive procurement of energy supply and develop transmission projects by third parties.<br>• Pass through to tariffs the energy costs of PPAs contracted following |

| Challenge | Short-term actions | Medium and long-term actions |
|---|---|---|
| | | approved bidding procedures<br>• Update basic studies on the potential of renewable energy generation |
| **Mobilize financial resources** | • Clear signal from GOH to implement a sound sector recovery plan<br>• Reduce credit risks for local banks by issuing partial risk guarantees to GOH<br>• For larger hydroelectric projects, non-recourse financing by private window of multilaterals to generation projects that sell energy to third parties | • Development of by third parties using competitive bidding to award BOT contracts for development of transmission projects by private investors, subject to rules and regulations established by CNE. |
| **Development of a regional energy market** | • Political support to an action plan to harmonize local and regional market regulations<br>• Preparation and application of Operations Code<br>• Support CNE to prepare and apply Operations Code | • Install commercial energy metering system to meet MER regulations<br>• Implement information systems and programs required to manage a wholesale power market with the participation of large consumers and independent generators.<br>• Strengthen ENEE´s Dispatch Center to be able to manage wholesale power market and coordinate the operation of power system |
| **Increase electricity coverage** | • Assess grid-connected rural electrification programs, define an action plan to improve efficiency and coordination in the use of financing resources and assess investment needs to meet 90% electrification target. | |

## B. Priority areas for international cooperation

A group of international donors agreed in 2008 on a coordinated program to support the implementation of GOH´s strategy for the recovery of the power sector, based on the WB operation to improve the performance of ENEE´s distribution business and on IDB´s project to finance transmission and substation projects. IFC is supporting project finance for private renewable energy generation projects.

This report confirms that the recovery strategy is still valid to address current challenges and that the support program still has a high priority. However, neither the support program is sufficient to meet the assistance needs of the sector nor the actions taken by GOH are sufficient to ensure a sustainable development of the sector.

This report recommends an action plan, to be developed by GOH, to address the short and medium-term challenges faced by the power sector and ensure a sustainable development. The plan includes the following main action: (i) an immediate average tariff increase of about 11%, as required by the tariff adjustment formula; the elimination of electricity subsidies to non-poor residential consumers and the focalization of subsidies on the poor; (ii) the revision and restoration of the electricity loss reduction program; (iii) separation and strengthening of energy policy making and regulation roles; (iv) complete ENEE´s restructuring program to improve its performance; (v) implement an action plan to harmonize the local and regional market regulations and develop a wholesale energy market with the participation of large consumers and independent generators; (vi) award the renewable energy generation bid taking into account the need to mitigate the risk of large contingent energy purchase obligations; (vii) design and implementation of an adequate scheme for the financing and development of transmission projects by third parties; and (viii) improvements in competitive bidding procedures to contract long-term energy supply.

The formulation and approval by GOH of a comprehensive action plan for a sustainable recovery of the sector and the implementation of the most urgent corrective measures would provide a clear signal of GOH´s commitment and justify the support of the group of donors in other priority areas:

a) **Institutional strengthening**. The lack of separation of roles of policy making, regulation and service provider is a barrier for a sustainable development of the sector. Due to SERNA and CNE´s lack of leadership and technical capability to meet their roles of policy maker and regulator of the energy sector, ENEE has filled the gaps but at the expense of its main responsibility as service provider. Support is needed for strengthening policy making and regulation.
b) **Financing support to renewable energy generation projects**. Development by the private sector of renewable energy generation is difficult due to credit risks of selling energy to ENEE and the project risks associated with projects that are capital intensive and require long preparation periods. We suggest providing non-recourse financing to the most attractive private projects and partial risks guarantees to GOH to facilitate financing of small generation projects by the local banks.
c) **Financing priority transmission and distribution projects.** The investment backlog in transmission and distribution projects due to lack of financing is an obstacle for the development of renewable energy generation projects that need additional transmission capacity, compromises the reliability of supply and sometimes forces the implementation of costly and inefficient emergency solutions. It is suggested to support the implementation of priority projects with additional loans to ENEE and technical assistance to design the norms and regulations for the development of transmission project by private investors under BOT arrangements.

d) **Technical assistance for basic studies.** Information on the generation potential in renewable energy is incomplete, especially for wind, geothermal and biomass. Technical assistance is needed to finance basic studies on renewable resources that would facilitate development of renewable projects by the private sector.

On these priority areas, there are several projects and studies that can be supported by the international cooperation:

### 1. Institutional strengthening

**National Energy Commission (CNE)**

- Support the organization and training of CNE.
- Technical assistance for the preparation of the Operations Code and other norms required for the operation and management of a wholesale power market with the participation of several agents (generators, large consumers, distribution companies)
- Technical assistance for the preparation of norms, strategies and procedures for competitive procurement of long-term energy supply
- Technical assistance for the preparation of competitive bidding procedures to contract the development of transmission projects by third parties using BOT schemes, and for the preparation of other required norms for the regulation of the transmission business.

**Energy Cabinet (GE)**

- Support for the creation of an Executive Secretariat.

### 2. Financing of renewable energy generation projects

- Non-recourse financing of the most attractive private renewable generation projects.
- Partial risk guarantees to GOH for the payment of PPAs with new small renewable generation projects. These guarantees reduce the credit risk and facilitate financing of small generation projects by local banks
- Financing of a grouting program and lining of a drainage gallery to reduce seepage in the dam of the Francisco Morazán hydroelectric plant (See Annex A). These urgent Works could be financed with resources of the Fiscal Emergency operation that the WB is preparing.
- Financing micro-hydroelectric projects for off-grid rural electrification. GAUREE has identified a few projects.

### 3. Priority transmission and distribution investments

- Support to the structuring of BOT schemes for the development of transmission lines and substations by the private sector. ENEE estimates an investment of about US$100 million in transmission projects that are not financed yet and could be developed using these schemes.

- Financing a program to expand existing substations and build small transmission lines. ENEE estimates a US$85 million investment to be implemented in 2012-2015.
- Financing ENEE´s distribution rehabilitation and expansion plan. An annual investment of about US$20 million would be required.

## 4. Basic studies

- Preparation of a national wind energy map, estimation of the wind power potential and identification of the most attractive sites for the development of wind power projects.
- Preparation of an action plan for the assessment and use of geothermal energy in Honduras, including the definition of priority exploration activities and the identification of sites with geothermal potential.
- Pre-feasibility studies of the Valencia and La Tarrosa hydroelectric projects.
- Pre-feasibility studies for the expansion, repowering and efficiency improvements of the Francisco Morazán, Cañaveral and Rio Lindo hydroelectric plants.
- Technical assistance for the revision and improvement of the electricity loss reduction program based on AMR equipment. This is an urgent activity that should be implemented in the first semester of 2010.
- Assessment of the grid-connected rural electrification programs and the investment needs to meet a 90% electricity coverage target.

**Annex A**

**FRANCISCO MORAZÁN hydroelectric station (El Cajón)**
**Experience in project operation and performance**

The 300 MW Francisco Morazán hydroelectric plant, also known as El Cajón hydroelectric project (referred to as "The Project"), is the largest generation plant currently under operation in Honduras and when the project was commissioned in 1985, it added a large capacity as compared to peak demand.

The Project comprises a 226 mts high concrete arch dam located in a gorge of limestone formation covered by volcanic rock. Due to the complex geology of limestone with karstic zones, the dam foundation was sealed with an extensive grout curtain.

Since its commissioning in 1985, The Project has faced serious operational problems that have been timely addressed by ENEE, some of them related to seepage at the dam site. However, these problems had not significant impact on electricity generation during the 25 years of operation. The Project has produced 29,185 GWh, equivalent to 1167 GWh/year, or a 44.4% average plant factor.

**Performance of civil works and main equipments**

**Leakage- first event.** After two years of the initial filling of the reservoir, hydrostatic pressures at the dam foundation had increased abnormally, indicating breaches in the zone that was made impermeable. Water seepage increased and it was necessary to implement in 1987-1989 a US$5.5 million grouting program to seal the major leaks. However, by late 1989 underground water seepage into the powerhouse increased. The panel for the security of the dam (PSO), made up by international experts that periodically visit the project to supervise the performance of the dam structure, alerted ENEE that it was essential to implement a much larger grouting program to reduce the large reservoir leakage (800 lts/sec) and relieve high hydrostatic pressures at the dam foundation that could cause serious damage to the dam structure and compromise its stability. ENEE implemented in 1993-1995 an extensive grouting program (project TRATI), at a total cost of US$32.9 million, financed by WB, IDB and ENEE´s own resources[15]. The project objectives were successfully achieved and total water seepage was reduced from 1629 lts/sec to 88 lts/sec.

**Changes in water turbine design**. In October, 1991 the Francis turbine of the generation unit No. 1 failed when the lower ring came off and hit the runner. Unit No. 1 was out of service for 7 months. A design problem of the turbine lower ring was corrected in all units in 1994-1997 at a cost of US$4.2 million.

**Fire at the powerhouse**. In February 1999 the power transformer of Unit No. 1 caught fire, and the fire spread and damaged a 100 mts section of the power cables of the other generation units. The generation units were gradually put back in operation between March

[15] See Implementation Completion Report. Morazán Dam Emergency Project. WB, December 1996.

and June of 1999 and all damages were fixed by February 2000 at a direct cost of about US$6 million.

**Overhaul of turbines and generators**. In late 2003, during the annual inspections of major equipments, ENEE detected cavitation pitting in the Francis turbines and loose wedges in the generator´s stator windings. A major overhaul of all units was needed after 20 years in operation. The overhaul of 3 units was executed in 2006-2009 (7 months per unit) and the overhaul for the last unit is being programmed for August, 2010.

**Leakage- second event.** In 2005 PSO recommended to execute a new grouting program to control water seepage that had increased in some areas. ENEE began in 2007 the bidding process to contract the works, but postponed this process because it detected that seepage in the right abutment increased to 225 lts/sec in October, 2008 after the reservoir reached its maximum level (heavy rains caused by tropical depression No. 16). PSO analyzed the problem in its meeting of February 2009 and recommended concrete lining of the right-side drainage gallery and a systematic grouting program to seal some leaks. Water seepage increased later on, after a magnitude 7.1 earthquake hit Honduras in May 2009. ENEE revised the scope of works included in the bid, and increased its budget to US$10.5 million. ENEE expect to award the contract as soon as possible and implement the grouting program in 24 months starting in mid 2010. ENEE may require a loan to finance these works.

**Expansion of The Project´s installed capacity**

Doubling of the installed capacity of The Project with four additional 75 MW units was considered during final design and construction. Necessary intakes and horizontal tunnels were built and the cavern for the new powerhouse was partially excavated.

A feasibility study for expanding the capacity of The Project was completed in 1993, with JICA financing[16]. The study concluded that the least-cost solution was to expand the capacity with two 75 MW units, which would require to construct a 221 mts penstock, a new powerhouse, and a 100 mts discharge tunnel, and a total investment of about US$110 million. The consultant recommended completing the expansion in 2002-2006, when peak demand growth would justify adding peaking generation units. The study confirmed the technical and economic justification of the project, based on a comparison with the alternative of installing gas turbines. ENEE did not pursue the project.

PSO suggested in February 2007 to complete a feasibility study of expanding the capacity of The Project with one unit to optimize generation at low loads, taking into account that the 75 MW Francis turbines have cavitation problems when operating at low loads and impose a constraint on the minimum operational water flow. ENEE received in April, 2007 a proposal for this study[17], but did not award the contract.

[16] Electric Power Development Co. Feasibility Study on Amplification Project of El Cajón Hydroelectric Power Plant. Final Report. Summary. April 1993.

[17] Central eléctrica General Francisco Morazán. Nueva Unidad. Propuesta técnica y económica para un estudio de factibilidad. Lombardi S.A. Abril de 2007.

ENEE decided recently to prepare a pre-feasibility study of the options to improve the efficiency and increase the installed capacity of El Cajón, Cañaveral and Rio Lindo hydroelectric plants, taking into account their operation in the national and regional energy markets. GOH requested in 2010 a US$150,000 technical assistance from IDB to complete this study.

In principle, the idea of expanding the installed capacity of these 3 generation plants is an attractive option to increase firm capacity. By 2017 the generation system will have a substantial installed capacity in small renewable generation projects, run-of-the-river hydroelectric plants and wind power and bagasse generation projects that will make a small contribution to firm power. Increasing the installed capacity at Rio Lindo and Cañaveral maybe an attractive project, because these plants operate at a high annual plant factors, over 60%, and with a larger installed capacity could increase energy generation and firm power. The capacity expansion of El Cajón plant, with a lower plant factor (about 44%) and a firm capacity that depends on the variations of the reservoir level, would be less attractive, except that in this case the expansion cost may be lower because a portion of the required civil works are already completed.

Therefore, the proposed study is justifiable. Moreover, the feasibility study of the capacity expansion of the Francisco Morazán plant, completed in 1993, needs to be updated in many areas: the generation mix has changed a lot since 1993 as well as the potential benefits of installing peaking units; the SIEPAC project will be commissioned in 2010, which would have a substantial impact on the benefits of peaking plants; the scope of the economic analysis was narrow as it did not consider the project in the context of a generation expansion plan, taking into account economic dispatch and the impact of its reservoir level on firm capacity; the study did not consider the problem of low-load operation nor the possibility of changing the turbine runners to improve the efficiency of the generation units.

**Managing the protected forest area around the reservoir**

In October 2008, when El Cajón´s reservoir increased to maximum historic levels, most of the 14,000 people, living in the 27,000 hectares protected forest area, were displaced to the slopes of the forest around the reservoir, increasing the pressure over the forest areas. ENEE´s unit responsible for managing the project´s hydrological basin has promoted a strategy to involve the communities living in the reservoir area in the protection of the forest, by reaching agreements with municipalities, fisherman and ranchers on reducing the pressure on the forest in exchange for having controlled access to the forest for domestic use and to artisanal fishing in the reservoir.