RENEWABLE ENERGY

NICARAGUA

Unlocking Potential, Reducing Risk

Renewable Energy Policies For Nicaragua

Wolfgang Mostert

ESMAP

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Preface

This strategy work was launched in response to a dilemma that was recognized early on by the Comisión Nacional de Energía (CNE) of Nicaragua, and encapsulated in the introduction to this synthesis report. Why was it that Nicaragua, endowed with perhaps the richest collection of renewable energy resources in Central America, ranked last in the subregion in utilization of this resource?

Given Nicaragua's limited financial resources, the study soon focused the challenge of private sector resource mobilization. While country risk and macroeconomic instability loomed as significant factors limiting private sector willingness to invest in renewable resource development, it became apparent that a large fraction of the investment barriers were inherent in the policy and incentive framework of the energy sector itself. Some of these barriers were unwittingly introduced in the course of implementing a wide-ranging electricity sector reform and restructuring in the year 2000.

The study therefore took a case study approach in order to analyze investment impediments from a private sector perspective. Case studies were carried out for small to medium hydropower, geothermal and wind energy as the three major renewable potentials in the country. The case studies were informed through close contact with both the local developer and international investor communities. The case study outputs provided clarity and confirmation of specific sectoral policy and information barriers, and provided a solid basis for the formulation of the measures recommended in the synthesis report.

While this work focuses on conditions in Nicaragua, many of its observations and recommendations can be generalized to the global problem of ensuring that environmental considerations (represented in this case by avenues for renewable energy) are adequately ingrained into the design of power sector reforms. In addition, the lessons learned are equally applicable to the challenge of assuring energy security through supply diversity in an era of high and volatile fossil energy prices.

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CNE's management and staff were extremely helpful in providing information and feedback on presentations of findings and recommendations. The CNE President, Mr. Raúl Solórzano, offered ongoing support at the political level. Ms.Gioconda Guevara and Mr. Ricardo Mendoza were the driving force behind day-to-day work and discussions. Their hospitality and intellectual feedback were a strong stimulus for the work undertaken.

At the World Bank, appreciation is extended to Mr. Charles Feinstein, Sector Manager, Energy Sustainable Development Department, Europe and Central Asia Region (Formerly, Sector Leader for Finance, Private Sector and Infrastructure, Latin American and the Caribbean Country Management Unit) who was responsible for the collaboration between ESMAP and CNE, identifying key issues for analysis, coordinating the work of contracted consultants, and organizing workshops and policy seminars with CNE. Thanks also go to Mr. Douglas F. Barnes, Senior Energy Specialist, Energy, Transport and Water Department who provided constructive criticism of the first draft of the report, and to Ms. Clemencia Torres De Mastle, Senior Regulatory Economist in the Latin America and the Caribbean Region, for her valuable advice and support throughout the study. Ms. Norma Adams, editor, took on the task of transforming a complex manuscript into a readable document. Special thanks to Mr. Daniel Farchy, Ms. Marjorie K. Araya and Ms. Ananda Swaroop for coordinating the editing, production and dissemination of the final report.

Acronyms and Abbreviations

ANAM	National Environment Authority
ARESEP	Regulatory Authority for Public Services
BANOBRAS	National Bank for Infrastructure and Services
BCIE	Central American Bank for Economic Integration
BOO	build, own, operate
BOT	build-own-transfer
BOOT	build, own, operate, transfer
CAPM	capital asset pricing model
CDM	clean development mechanism
CER	certified emission reductions
CIDA	Canadian International Development Agency
CNE	National Electricity Commission
CNFL	Power and Light Company
COPE	Energy Policy Commission
CRIE	Regional Electric Power Interconnection Commission
DECASA	Central America Energy Distributor, SA
DGE	General Energy Administration
DNE	National Electricity Directorate
DTI UK	Department of Trade and Industry
EEGSA	Guatemala Electric Power Company
EEMS	municipal companies
EGAT	Electricity Generating Authority of Thailand
EIAs	environmental impact assessments
ENEE	National Electric Power Company
ESB	Electricity Supply Board
ETESA	Electric Power Transmission Company, SA
FOGES	guarantee and stabilization fund
GAUREE	autonomous generation and rational use of energy power in Honduras
GDP	gross domestic product
GEF	Global Environment Facility
GECSA	Central Power Company
GGG	Guatemala Generating Group
HFO	heavy fuel oil
IAEA	International Atomic Energy Agency
ICE	Costa Rican Electricity Institute

IDB	Inter-American Development Bank
IEP	indicative expansion plan
GPS	Global Power Solution
IFC	International Finance Corporation (of the World Bank Group)
INAA	Nicaraguan Sewerage and Aqueduct Institute
IPPs	independent power producers
INDE	National Electrification Institute
MEM	Ministry of Energy and Mines
MIGA	Multilateral Investment Guarantee Agency
MINAE	Ministry of Environment and Energy
NGO	nongovernmental organization
NPV	net present value
NRECA	National Rural Electric Cooperative Association
OECD	Organisation for Economic Co-operation and Development
OMCA	Central American Market Operator
PCA	Central American Hydropower Plant
PERZA	Rural Electrification Program for Atlantic Region
PGEFR	Renewable Energy Generation Project
PMD	municipal development plan
PND	national development plan
PPA	power purchase agreement
PPP	purchasing power parity
PSB	Santa Barbara Plant
PV	photovoltaic
R&D	research and development
RE	renewable energy
RECs	Rural Electric Cooperatives
REF	rural electrification fund
RPS	renewable portfolio standard
SBS	small business service
SERNA	Natural Resources and Environment Secretariat
SFLG	small firms loan guarantee
SHPs	small hydropower plants
SHS	solar home system
SIEN	Nicaraguan Energy Information System
SIFER	renewable energy system development
SIGET	superintendent of electricity and telecommunications
SNIDE	national energy information and documentation system
SPP	small power producer
SPV	solar photovoltaic
TELCOR	Nicaraguan Institute for Telecommunications and Postal Services
VAT	value added tax

Key Terms

English	Spanish
bulk power market	mercado mayorista
bulk power price	precio mayorista
large consumers	grandes consumidores
monomial price (average price from the spot and contract markets equal to the kilowatt-hour price of the bulk power market)	precio monómico
national heritage	patrimonio nacional
one-stop shop	ventanilla única
power broker	comercializador
PPA contracts market	mercado de contratos PPA
regulating reserve	reserva de regulación
run-of-the-river	filo de agua
short-term capacity market	mercado de corto plazo de capacidad
spinning reserve	reserva rodante
spot market	mercado ocasión
spot price	precio spot

Units of Measure

GWh	giga watt (s) per hour
kV	kilo volt
kW	kilo watt (s)
kWh	kilo watt (s) per hour
MMBTU	million British thermal unit
MW	mega watt (s)
MWh	mega watt (s) per hour
km^2	square kilometer
Toe	ton equivalent of oil

Major Laws and Decrees

Number-Year	English	Spanish
217-1996	Environment and Natural Resources Law	Ley General del Medio Ambiente y los Recursos Naturales
6-1997	1997 Regulatory and Institutional Framework for Public Electricity Service Law	Marco Regulador e Institucional para el Servicio de la Electricidad Pública 1997
42-1998	Electricity Industry Law Regulation (Decree)	Reglamento a la Ley de la Industria Eléctrica
271-1998	Reform of the Founding Law of the Nicaragua Energy Institute	Ley de Reformas a la Ley Orgánica del Instituto Nicaragüense de Energía
272-1998	Electricity Industry Law	Ley de la Industria Eléctrica
14-1999	Nicaragua Protected Areas Regulation (Decree)	Reglamento de Areas Protegidas de Nicaragua
128-1999	Electricity Industry Law Regulation (Decree)	Reglamento a la Ley de la Industria Eléctrica
443-2002	Geothermal Resource Exploration and Development Law	Ley de Exploración y Explotación de Recursos Geotérmicos
462-2003	Forestry Law	Ley Forestal
467-2003	Hydropower Promotion Law	Ley de Promoción al Sub-sector Hidroeléctrico
2003	Water Rights Bill	Anteproyecto Ley del Uso de Agua
52-2003	Incentives for the Development of Renewable Energy Projects Law	Ley de Incentivos para el Desarrollo de Proyectos de Energía Renovable
12-2004	Wind Energy and Run-of-the-river Hydropower Policy Support (Decree)	Decreto de Apoyo al Desarrollo de los Recursos Eólicos e Hidroeléctricos de Filo de Agua
13-2004	National Energy Policy (Decree)	De Establecimiento de la Política Energética Nacional
33-2005	Reform of Electricity Industry Law Regulation (Decree 42-98)	Reforma al Decreto 42-1998 Reglamento de la Industria Eléctrica
531-2005	Amendment to the Promotion Law for Hydropower	Enmienda Ley de Reforma a la Ley 467 de Promoción al Sub-sector Hidroeléctrico
532-2005	Renewable Energy Promotion Law	Ley para la Promoción de Generación Eléctrica con Fuentes Renovables
554-2005	Energy Service Stability Act	Ley de Estabilidad del Servicio de Energía Eléctrica en el País
511-2006	Public Services Superintendency Law	Ley de la Superintendencia de Servicios Públicos

Executive Summary

Nicaragua, Central America's largest country, is endowed with abundant, high-quality renewable energy (RE) resources. In 2004, the economically viable RE potential of 3,000 mega watt (s) (MW) – consisting of hydropower (1,700 MW), geothermal energy (1,000 MW), wind energy (200 MW) and biomass (100 MW) – was five times higher than the national power capacity. Thanks to these rich resources, new geothermal and hydropower plants and wind farms can supply power at a lower risk-adjusted cost per kilo watt (s) per hour (kWh) than conventional thermal plants. They can also provide price stability, save foreign exchange, generate employment, increase national value-added and reduce the country's exposure to the risk of potentially increasing fuel prices. The large capital requirements for RE investment offer an excellent opportunity to accelerate development of a national capital market.

Yet, despite RE's rich potential and price competitiveness, the share of RE supply in Nicaragua's national power production has declined 30 percentage points over the past 25 years (from more than 60 percent in 1980 to 35 percent in 2005), while that of diesel-fired power has continued to increase. The reasons why investments with clear economic and financial advantages have not been preferred involve a variety of factors in the country's business and regulatory environment. At the macroeconomic level, major obstacles have included deep political divisions and confrontations – the legacy of decades of oppression and civil war – and low national income. Some 77 percent of rural residents and 64 percent of urban ones (70 percent of the overall population) live in conditions of poverty. Since the early 90s, investment in productive infrastructure has stagnated. By the end of 2003, the electrification rate had reached only 55 percent nationally and only 30 percent in the rural areas.

Lack of investor confidence in RE has been fueled by the failed power sector reform of 1998-99. Design criteria, which should have included increasing Nicaragua's rate of rural electrification and developing its rich RE potential, took neither into account. Institutional and financial arrangements to accelerate rural electrification were too weakly defined and had to be adjusted in later years, while the power market scheme prevented new RE generators from securing long-term supply contracts on a competitive basis. Unfortunate sequencing of implementation also contributed to the failure. Privatization of the State-owned hydropower company failed because an important new water rights law had not been adopted. In addition, the new private distribution company had difficulty fighting electricity theft because the legal framework was insufficiently equipped to punish it.

The 1998-99 reform process divided the public governance functions for the power sector between the National Energy Commission (CNE) and the National Energy Institute (INE). Since

reform, these policy and regulatory institutions have disagreed on important issues, thereby impeding a coherent approach to rural electrification. Their battle over institutional authority in assigning and regulating water rights, for example, has delayed adoption of the country's new Water Rights Law. Such turf battles have increased investment risk and hurt promoters' ability to plan and implement projects.

Nicaragua's postreform situation is not unlike that of four of its Central American neighbors, who also implemented power sector reforms in the late 90s. El Salvador, Guatemala, Honduras and Panama, like Nicaragua, have witnessed the reality that liberalization favors power sector investments with short payback periods, while such capital-intensive investments as hydropower and geothermal energy are stymied. In their generation portfolios, all five countries have clearly expressed their preference for RE for reasons related to the environment, foreign exchange and long-term price stability. All have lamented that private sector RE investments have been delayed, yet, none has imposed a moratorium on conventional thermal power investment. All have had difficulty obtaining parliamentary approval of their respective water laws. These countries, along with Costa Rica, share an interest in designing rules for a Central American power market that facilitate investment in RE-based generation in their respective countries.

Lessons from international experience suggest that two factors are critical for RE policy success: 1) a comprehensive regulatory framework; and 2) government's adoption of published, quantified targets for RE penetration into the power market by specified years. By the end of 2005, Nicaragua's RE policy and regulatory framework contained many of the relevant building blocks for success but lacked critical fundamentals: quantified targets for RE penetration, adequate natural resource laws and appropriate power rules for tendering new generation.

Breaking the barriers to RE investment in Nicaragua means moving beyond the status quo. To correct fundamental flaws, a set of comprehensive and coherent policy initiatives and strategies is called for. Unlocking the country's RE potential and, at the same time, reducing the political and regulatory risk for investors, requires two major policy initiatives:

- Elimination of the fundamental, legal and regulatory obstacles to investment in medium- and large-scale RE generation. For geothermal energy, this implies making adjustments to the National Park Law; for hydropower, it means adopting the new Water Rights Law; and
- Parliament's adoption of the new RE law. This law sets minimum RE penetration targets in the national power market by 2010, 2015 and 2020; it also provides a coherent set of policy, regulatory and incentive measures to eliminate market distorting barriesrs.

The proposed strategy for promoting RE investment in Nicaragua offers a comprehensive, cost-effective approach to reducing demand- and supply-side barriers to investment, improving access to project finance and integrating RE promotion into the rural electrification policy.

The strategy's four modules highlight two key terms: *comprehensiveness* and *risk management*. RE experience in Nicaragua and around the world has underscored the lesson that comprehensive – not partial – approaches are effective in unlocking a country's RE potential. Above all, the strategy aims to eliminate investor risk of political and regulatory uncertainty. In Nicaragua, reducing risk and uncertainty provides investors a stronger signal and is more cost-effective than investment incentives. Indeed, investment incentives are a minor complementary and, in the end, dispensable part of the RE strategy: under the right regulatory conditions, RE investments in Nicaragua are fully competitive with conventional thermal power projects.

On the demand-side, the strategy aims to increase investor confidence by proposing recommendations that reduce off-take risk for RE generation. Four specific interventions are offered: 1) reducing off-take risk of sales to distributor Union Fenosa (assisting Union Fenosa in reducing distribution losses and using risk- and benefit-adjusted prices in tenders for new generation); 2) introducing power brokers in the bulk market; 3) using appropriate mandated market instruments (a niché market for intermittent power supply from wind energy and run-of-the-river (ROR) hydropower and a 10-year moratorium on the construction of conventional thermal power plants to develop the mass RE market; and 4) promoting the Central American Electric Interconnection System (SIEPAC), Central America's regional power market.

On the supply-side, the strategy works to reduce investor risk by offering measures that can increase the necessary competition in supply and reduce production cost per kWh of output from future RE generation. Six major areas of supply-side interventions are recommended: 1) adopting regulations for resource exploitation; 2) streamlining approval and planning procedures; 3) investing in resource and project cost information; 4) promoting public risk-sharing in geothermal exploitation; 5) installing an appropriate incentive regime; and 6) strengthening the national research and development (R&D) supplier base.

Competition for new projects can be increased and the cost of production and bid prices per kWh reduced if private investors – both national and foreign – gain access to national and regional sources of project finance. Because RE projects differ substantially in size, technology and cost per MW, financing options must be flexible. CNE's strategy comprises initiatives in seven areas: 1) tapping national debt and equity capital (bond issues); 2) introducing partial-risk guarantees and contingent finance; 3) analyzing the feasibility of mini-hydro leasing schemes; 4) using sub-sovereign guarantees for community investment; 5) using environmental finance; 6) using bank credits; and 7) introducing risk guarantees for foreign investments.

Finally, the strategy seeks to integrate RE into rural electrification. Wherever they can reduce the cost of power supply in rural electrification projects – both on- and off-grid – micro and mini hydropower plants; small-scale, biomass-fired power plants; and solar photovoltaic (SPV) systems will be promoted effectively. Specific interventions are to: 1) analyze financing options; 2) support the Rural Electrification Administration (DER) to serve exclusively as secretariat of the National Electricity Development Fund (FODIEN) (thereby eliminating CNE's conflicting roles as both policymaker and project implementer); 3) support FODIEN's subsidy functions; and 4) promote stand-alone power systems in the absence of grid-based electrification.

1. Introduction

Situated along the Central American isthmus between Honduras and Costa Rica, Nicaragua is the region's largest country, with a territory of 129,500 square kilometers (km^2). Nicaragua is also Central America's most sparsely populated country per km^2; 43 percent of its 5.5 million people reside in rural areas. The country boasts of the world's10th largest freshwater body, Lake Nicaragua; nearly 20 percent of the Nicaraguan territory is protected as national parks or biological reserves.

Historically, Nicaragua's economy has been based on the export of cash crops, including banana, beef, coffee, rum and tobacco. Agriculture still employs a significant percentage of the labor force – 31 percent – generating 18 percent of the gross domestic product (GDP). The services sector comprises 55 percent of the labor force and 52 percent of GDP, while the industry accounts for 17 and 27 percent, respectively.[1]

In the early 80s, civil war damaged or destroyed much of the country's infrastructure; for a time, inflation ran at several thousand percent. Over the past two decades, however, many State-owned industries have been privatized, inflation has been brought to manageable levels and economic growth has returned. During the 1996-2002 period, economic growth averaged a modest 2.6 percent per year. In 2002, per capita income was US$710[2] (US$2,500 at purchasing power parity [PPP]);[3] while income distribution was one of the most unequal in the world (Box 1.1).

Today, Nicaragua remains one of the Western Hemisphere's poorest countries. Some 77 percent of rural residents and 64 percent of urban ones – 70 percent of the overall population – live in conditions of poverty.[4] Widespread poverty explains the country's low per capita consumption of electricity (281kilo watt (s) per hour [kWh]). Indeed, at the end of 2003, the national electrification rate had reached only 55 percent. Poor economic conditions and repercussions of civil war have resulted in the exodus of an estimated 2 million people from Nicaragua.

Plenty of Renewable Energy; Scarcity of Investment

Nicaragua's RE potential is both large and varied. In 2004, the economically viable RE potential of 3,000 mega watt (s) (MW) – composed of hydropower (*hidroeléctrico*)

[1] *CIA World Factbook.*
[2] *World Bank data (www.worldbank.org).*
[3] *www.lexmundi.com.*
[4] *In 2002, the national poverty rate (percentage of people living on incomes of US$2 or less per day) was 47 percent; nearly 40 percent of people lived in conditions of absolute poverty (US$1 or less per day).*

Box 1.1: Nicaragua's Legacy: Progress Amid Crisis

Nicaragua's turbulent transformation from authoritarian rule to constitutional democracy has been marked by political crises and natural disasters. The capital city of Managua was never completely rebuilt after a 1972 earthquake that left 500,000 homeless. The repressive Somoza regime, which ruled the country for more than 40 years, was finally overthrown by the Sandinistas in the late 70s. Despite promises of prosperity, Sandinista revolutionary rule of the 80s drove the country to economic ruin.

The 1990 election of President Violeta Chamorro – marking the nation's first peaceful transfer of power from one party to another – was a turning point that, over the next six years, laid the foundation for democratic inclusiveness and economic growth. The Chamorro administration consolidated democratic institutions, stabilized the economy, privatized State-owned enterprises and reduced human rights violations. Although Chamorro's successor, Arnoldo Alemán, continued economic liberalization, his administration lacked transparency and accountability.

In 2003, he himself was sentenced to 20 years in prison on charges of corruption and fraud, even as the country struggled to recover from the 1998 shocks of Hurricane Mitch and a worldwide crash in the price of coffee, the country's major export.

Amid these crises, Nicaragua has managed to rein in hyperinflation, cut military spending and open up its economy. At the same time, 77 percent of the rural population – 45 percent of the total population – and 64 percent of urban residents live in poverty. Since the early 90s, investment in productive infrastructure has stagnated. By the end of 2003, the national electrification rate was 55 percent (70 percent urban and only 30 percent rural). The current administration of Enrique Bolaños offers Nicaraguans hope for stability and continuity. Clearly, achieving sustainable economic growth requires policies and actions that increase access to productive and basic infrastructure services and strengthen the country's major institutions.

Sources: The World Bank (2004), D. Close and K. Deonandan (2004), R. Miranda and W. Ratliff (1993) and D. Close (1999).

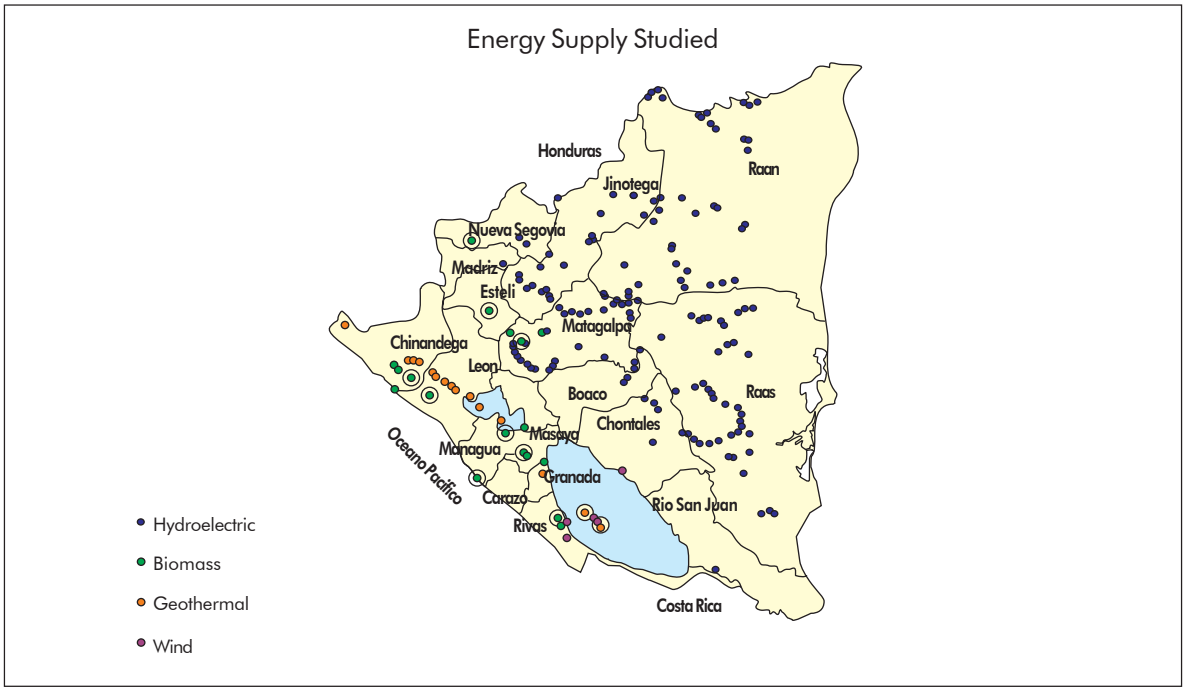
(1,700 MW), geothermal (*geotérmico*) (1,000 MW), wind (*eólico*) (200 MW), and biomass (*biomasa*) (100 MW) – was five times higher than the national power capacity. These RE resources, particularly hydropower, are of high quality. Moreover, they are spread throughout the country, providing an excellent balance for the power system (Figure 1.1).

The cost of production per kWh is competitive. Between November 2000 and June 2003 (before the 2004-06 increases in international oil, gas and coal prices), the average price for bulk power was US$60-71 per mega watt (s) per hour (MWh). To be commercially viable, geothermal power projects in Nicaragua require US$65-70 per MWh; several potential ROR hydropower plants are believed to have financial production costs below US$60 per MWh, while those of wind farms (at the better sites) are about US$54-66 per MWh.

Investments in Nicaragua's RE-based power generation, versus conventional power plants (diesel, coal, natural gas), offer additional advantages; they:

- Provide more employment and higher national value-added (GDP) per kWh;
- Save foreign exchange (in 2002, Nicaragua spent US$244 million to import 1.2 million ton equivalent of oil (Toe) of petroleum products, of which 34 percent was used in power

Figure 1.1: Spread of Nicaragua's Renewable Resources



Source: National Energy Commission.

production);

- Increase price stability of the power market;
- Reduce the country's exposure to the risk of potentially increasing fuel prices; and
- Because of their capital intensity, offer an opportunity to accelerate development of a national capital market.

Despite these advantages, RE's share in the national power generation has declined more than 30 percentage points over the past 25 years (from more than 60 percent in 1980 to 35 percent in 2005),[5] while that of diesel-fired power has continued to increase. The reasons why investments with clear economic and financial advantages are not preferred involve, as always, the business/regulatory environment. Various factors at the country's macro, meso and micro levels block private investments in RE-based power generation. Table 1.1 gives examples of these causal factors.

RE policy and strategy are concerned with finding appropriate responses to obstacles at the meso and micro levels. Macro-level factors – the country's overall political and economic context – act as constraints. For example, the price competitiveness of capital-intensive generation projects is affected by the country's small size and low per capita income, which lead to an underdeveloped capital market; while political insecurity adds a risk premium to foreign and local finance.

Failed Power Sector Reform

Lack of investor confidence has been fueled by the failed power sector reform of 1998-99. Errors in both design and implementation account for the reform's inability to accelerate private investment. Design criteria, which should have included increasing Nicaragua's rate of rural

[5] *The last RE investment dates to 1992, when a sugar plant added more bagasse-fired, power generation capacity.*

Table 1.1: Nicaragua's Business Environment for Private RE Investment

Level	*Obstacle*
Macro	– Continued deep political divisions following a legacy of civil war – Political confrontations between President and Parliament – Low national income
Meso	– Power sector reform not customized to the national context of potentially competitive, RE-based generation
Micro	– Lack of national legislation to regulate productive uses of natural resources (for example water, national parks) – Vague laws for RE promotion – Weak capital market for project financing

electrification and developing its rich RE potential, took neither into account. Institutional and financial arrangements to accelerate rural electrification were added as an afterthought (in 2006, the support structure was still undecided). The power market was not designed to facilitate investments in RE generation, and the market scheme prevented new RE generators from securing long-term supply contracts on a competitive basis. Unfortunate sequencing of implementation also contributed to failure. For example, privatization of the State-owned hydropower holding company failed because key legislation had not been passed at the time of privatization. In addition, the new private distribution company had difficulty fighting electricity theft because the legal framework had insufficient instruments for punishing it (Box 2.3).

Study Focus

The purpose of this report is to propose sound policies for overcoming perceived risks to investing in Nicaragua's RE-based power generation as a means to reduce the cost of national power supply, increase national value-added in power supply and accelerate the country's national electrification rate and poverty reduction efforts.

The policies and instruments proposed are based on a diagnosis of:

- Postreform situation as it affects RE investments and the macroeconomic consequences of the current bias toward conventional power generation in power-market arrangements;
- Roles of power sector institutions and their inter-relationships;
- Specific needs of potential geothermal, hydropower and wind farm projects; and
- International lessons that apply to the Nicaraguan context.

Organization of this Report

The next Chapter provides an overview of Nicaragua's power sector, including the implications of power sector reform, and the future regional bulk market for RE investment. Chapter 3 investigates the potential for geothermal, hydropower and wind energy resources and their current status of

exploitation. In Chapter 4, Nicaragua's policy and regulatory framework for RE investment is explored, and critical building blocks for success, as well as policy gaps, are identified. Chapter 5 then offers major policy initiatives and a coherent set of strategies to break the barrier of underinvestment in RE, and Chapter 6 concludes. Annexes 1-3, respectively, cover the RE legal and regulatory framework, a diagnostic of its compatibility with the proposed policy and international lessons in RE frameworks.

2. Power Sector Overview

In 2004, Nicaragua's total installed generation capacity was more than 600 MW.[6] Effective generating capacity of power plants, which depends on seasonality (affecting hydroelectric capacity) and plant maintenance schedules, is 450-490 MW. In 2003, peak demand was 435-440 MW and baseline demand 220-280 MW. In 2002, consumption was 1,600 giga watt (s) per hour (GWh). From 1985 to 2001, increased electricity consumption averaged 4.2 percent annually, while the population grew 2.6 percent per year. The National Energy Commission (Comisión Nacional de Enegía – CNE) expects an average growth rate of 4.4-6.6 percent over the next decade, leading to an annual increase in required generating capacity of 30-50 MW. According to CNE's forecasts, base load in 2013 could run 675 MW, with peak system demand of 850 MW.

RE Share in Electricity Generation

While demand growth is not ideal for planning and implementing investments in large-sized RE power plants, it is large enough to make them economically feasible if an appropriate framework is established.[7] For example, a 200 MW RE plant cannot get full capacity payments during initial years, but can sell its full energy potential each year into the power pool; diesel power plants cannot match the marginal short-term costs of RE plants.

Installed Capacity and Potential

Nicaragua's 147-162 MW of RE power provide about 30 percent of the country's available capacity, a sharp decline from the more than 60 percent provided in the early 80s and below the Central American average of 41 percent. As of 2005, available installed capacity included biomass (108 MW),[8] hydropower (98 MW) and geothermal energy (37 MW) (Table 2.1).

As Table 2.1 illustrates, installed RE capacity amounts to only 8 percent of Nicaragua's economic RE power potential of 3,000 MW: hydropower (1,700 MW), geothermal (1,000 MW), wind farm (200 MW) and biomass (100 MW).

Price Competitiveness

RE's decline in market share is not caused by a lack of price competitiveness. In Nicaragua,

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[6] *Since a high share of generation is derived from older high-maintenance thermal plants, underperforming geothermal resources, seasonal hydroelectric plants and cogeneration sugar refineries, there is some uncertainty about available capacity.*
[7] *Near-term demand for annual capacity additions are lower; in early 2004, Union Fenosa, the privatized distribution company, indicated it needed 20 MW of new generation by November of that year and an additional 20 MW in 2006.*
[8] *San Antonio and Timal biomass-based power plants produce for the National Interconnected System (SIN) during harvest time, when they provide peak load capacity. San Antonio is owned by Sugar Estates, Ltd., a Nicaraguan company that has participated as a cogenerator since 1992. Currently, it has a 38 MW installation, of which 15 MW are for plant processes and 23 MW for sale to bulk power market brokers.*

Table 2.1: RE Share in National Power Supply, 2005

	Installed Capacity			*Economic Potential*	*Generation (3,013 GWh)* (percent)
Power Supply Source	*MW (nominal)*	*MW (available)*	*Percent (available capacity)*	*MW*	*Percent*
Bunker Oil and Diesel	439	384	61	NA	65
Hydropower	104	98	16	1,700	14
Geothermal Energy	88	37	6	1,000	9
Biomass	127	108	17	100	12
Wind Energy	NA	NA	NA	200	NA
Total	**757**	**627**	**100**	**3,000**	**100**

Source: National Energy Commission.
Note: NA = Not applicable.

thermal power is the key determinant of the bulk power price; thus, bulk power is a good proxy for the cost of conventional power production. From November 2000 to June 2003, the average bulk power price varied between US$60 and US$71 per MWh;[9] the average price was US$73 in 2004, US$88 in 2005 and US$98 during the first three months of 2006.

Compared to these prices, at the level of required long-term power purchase agreement (PPA) tariffs, new RE projects would, in principle, be price-competitive, as follows:

- *Geothermal*. San Jacinto's PPA price (including drilling, field development and operation, and power plant construction) is US¢5.95 per kWh. To be commercially viable, future large projects will require US¢6.5-7 per kWh;
- *Wind Farm:* With competitive project financing, production cost at the better sites is US¢5.4-6.6 per kWh at year 2004 wind turbine prices; and
- *Hydropower*. Several potential ROR plants are believed to have production costs below US¢6 per kWh.

If the economic and financial value of long-term price stability is correctly priced into the evaluation of PPA offers – accounting for the portfolio value of new geothermal, hydropower and wind energy plants – RE power plants become even more price-competitive than diesel and heavy fuel oil (HFO)-fired plants.[10]

Power Sector Reform

In 1998-99, Nicaragua adopted and implemented a liberalized framework for the organization and regulation of its power industry. Through laws, presidential decrees and regulations, the 1998-99 power sector reform abolished the previous State monopoly of the vertically integrated Nicaragua Electricity Company (*Empresa Nicaragüense de Electricidad* – ENEL) (Box 2.1). Split horizontally and vertically, ENEL was transformed into a State-owned holding company. In addition, a bulk power market was established.

[9] *Over the same period, the spot price, a component of the total bulk power price, varied between US$34 and 59 per MWh (averaging US$46.5 per MWh).*
[10] *The term* portfolio theory *refers to the value of protection against fuel price fluctuations offered by the long-term fixed prices of PPAs signed with RE generators. For detailed discussion, see Awerbuch and Berger (2003); M. Bolinger, R. Wiser and W. Golove (2004).*

Box 2.1: Legislative Framework for Power Industry

The primary legislative framework for Nicaragua's power industry consists of parliamentary laws and presidential decrees (Annex 1). The most important are:

- *Law No. 272, 1998*. Electricity Industry Law (LIE). Defines the specific regulatory framework and industry structure for the power sector; and
- *Law No. 271, 1998*. Reform of the Founding Law of the Nicaragua Energy.

Institute (INE) (*Ley de Reformas a la Ley Organica del Instituto Nicaragüense de Energía*). Details INE functions and administrative set-up.

- *Presidential Decrees 42-1998* and *128-1999*, LIE Regulation. Defines the process for ENEL privatization. Secondary legislation, in the form of "normativas" issued by INE, establishes rules for sector operations.

Isolated grid systems could still be served by the vertically integrated entities. But, within the National Interconnected System (*Sistema Interconectado Nacional* – SIN), ownership of generation, transmission and distribution was vertically separated, except that distribution companies could own up to 10 MW of generation capacity.

While transmission and system operations were retained as a State activity, ENEL's generation and distribution assets within SIN were to be privatized. ENEL was to be the power supplier of last resort when no other economic agent was interested, as well as the holding company for generation assets not sold to private investors and of the National Electricity Transmission Company (*Empresa Nacional de Transmisión Eléctrica, SA* – ENTRESA).

Separation of Generation Assets

To create a competitive power generation structure for bulk market bidding, ENEL's generation assets were separated into various new companies. El Paso Energy, through Coastal Power, its associated subsidiary, bid-on and-acquired Western Electric Generation, SA (*Generadora Eléctrica Occidental, SA* – GEOSA). GEOSA had been assigned assets of the two ENEL-owned northern diesel power plants: Planta Chinandega (15 MW) and Planta Nicaragua (100 MW). Central Electric Generation, SA (*Generadora Eléctrica Central, SA* – GECSA) was assigned the city of Managua's two largest diesel power plants: Planta Las Brisas (66 MW) and Planta Managua (57 MW); however, they failed to attract any bid.

Nicaragua's two large hydroelectric plants, Plantas CentroAmérica and Santa Bárbara, were folded into the asset base of the Hydroelectric Generation Company (*Generadora Hidroeléctrica, SA* – HIDROGESA) and put out for public bid. However, the privatization ran afoul of a political process and Supreme Court litigation over assigning of water rights. The National Assembly has, by Law 440-03, stalled further privatization and assignment of hydropower concessions until adoption of the new Water Rights Law.

In 1999, the Momotombo geothermal field and power plant were semi-privatized. Through an international solicitation process, ENEL requested public bids to acquire a 20-year concession to expand and operate both. The only company to successfully tender an offer was Ormat, a private geothermal development company from Israel.

Division of Distribution

At the outset of power reforms, the sector-reform committee divided Nicaragua's distribution geographically:

- *Western*. The most developed region (with 85 percent of the total population), the western system was divided into two concessions: Northern Distribution Company (*Distribución de Electricidad del Norte, SA* – DISNORTE) and Southern Distribution Company (*Distribución de Electricidad del Sur, SA* – DISSUR) ; and
- *Eastern*. To facilitate privatization, the eastern system was not made a concession area, but may be served by any business entity, including the local government.

Union Fenosa successfully bid on both the DISNORTE and DISSUR distribution systems.[11] While Union Fenosa fulfilled its connection obligations, thereby assisting in raising the national connection rate, it has thus far been unable to solve the inherited problem of high system losses and insufficient bill collection rates. System losses persist, in part, because of structural factors beyond the management's immediate control; these include: 1) an entrenched consumer culture of electricity theft; 2) a culture of corruption among staff taken over; and 3) lack of legal instruments allowing a distribution company to take appropriate action against electricity theft.

Union Fenosa's regulatory contract and approved average tariff were based on system losses substantially below the 35 percent it now incurs; the resulting losses undermine the company's financial situation. For generators signing PPAs and banks financing investments in new generation, Union Fenosa's weak financial situation poses a significant off-take risk and, hence, a bankability problem. The risk premium, added to the project lending rates, undermines the competitiveness of capital-intensive, RE-based investments, in generation.

Transfer of Transmission

The transmission system, formerly ENEL-owned and - operated, was transferred to ENTRESA, which will remain in State hands; however, private owners and operators can build and own new segments of the transmission network. Through its National Load Dispatch Center (*Centro Nacional de Despacho de Carga* – CNDC), ENTRESA is the national dispatch center, system operator for SIN and administrator of the spot power market. The National Operating Council (*Consejo Nacional de Operación* – CON), comprises of stakeholder representatives, plays an advisory role to CNDC and National Energy Institute *(Instituto Nicaragüense de Energía Nacional* – INE).

The transmission tariff uses "postage-stamp" pricing. In 2004, at voltage levels equal to or higher than 69 kilo volt (kV), the transmission tariff was US$4.3 per MWh. The postage-stamp approach helps RE competitiveness because potential RE generation tends to be disperse and remote from consumption centers.

Bulk Power Market

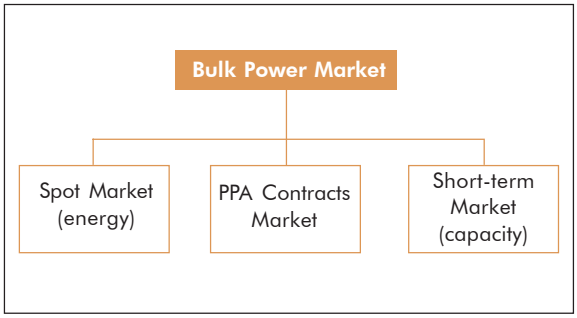
Consumers whose demand is larger than 2 MW (decreasing to 1 MW by 2007) can purchase power directly from the bulk power market, organized as follows (Figure 2.1):

- Bilateral PPA contracts between generators and consumers; and
- CNDC-operated spot market, which (like the PPA contracts market) prices energy and capacity separately.[12]

The average price of the PPA contracts and spot markets yields the bulk power market's kWh monomial price (*precio monómico*), which

[11] *Sale was completed in October 2000 at a price of US$115 million, some US$14 million more than the established base price.*
[12] *According to the current Nicaraguan market rules, intermittent sources of power supply, such as wind energy, are not entitled to a capacity payment in either the contracts market or short-term capacity market, which is settled daily.*

Figure 2.1: Organization of the Bulk Power Market



distributor Union Fenosa can pass on to final consumers through its tariffs.

Between November 2000 and June 2003, prices were US$34-59 per MWh for the spot market (averaging US$46.5 per MWh) and US$60-71 per MWh for the monomial price. In April 2004, when the average annual capacity price was US$215 per MW, the average monomial price was about US$60 per MWh.

Market operation rules require power supply generators to provide a spinning reserve equal to 5 percent of their dispatched capacity.[13] If they lack such capacity, they must contract capacity equal to 5 percent of the daily generation.

The small size of Nicaragua's power market, combined with the need for a certain amount of liquidity on the short-term market to ensure efficiency, led to adopting market rules biased against concluding long-term PPAs. Distribution company licenses require these at the end of the year so that PPA contracts equal a minimum of 80 percent of their forecast demand for the next year and 60 percent for the subsequent year.[14] Distribution companies must secure PPA contracts by tender in order for INE to accept contract prices for inclusion in the regulated retail tariff. PPA tenders are based on quoted MW and MWh prices, split into fixed and variable costs. Bids from thermal power producers include automatic adjustments for movements in imported fuel prices.

Because of Union Fenosa's demand-side dominance, Nicaragua's power market is best described as a monopsony.[15] In 2004, only five independent power consumers – two large cement plants, El Limón mine, Managua brewery and City of Managua – used more than 2 MW of electricity demand. The free market for selling directly to the 23 large consumers with power demand greater than 1 MW amounts to 47.3 MW or 9.3 percent of power in the SIN. If this large-consumer classification were reduced to 0.5 MW, the size of the free market would increase further.

The transaction costs of signing power supply contracts with individual generators are large for the 0.5-1.0 MW category of potential large consumers. Only in exceptional cases will they have the sophistication to begin trading on the Central American Electric Interconnection System (SIEPAC) regional market. Thus, if the eligibility limit is lowered, most of these consumers, as well as several in the 1-2 MW category, will likely retain their contracts with Union Fenosa.

Design of Nicaragua's bulk power market has three major implications for investments in RE-based generation:

[13] *The CNDC's goal is a minimum of 5 percent rolling reserve and 2.5 percent regulatory reserve (Article TOC 9.81, business operational rules). Currently, without hydropower plants generating, achieving the regulatory reserve of 2.5 percent is not possible.*
[14] *To facilitate the privatization of generation companies, Union Fenosa had, during its first year of operations in Nicaragua, about 80 percent of the nation's generation capacity under PPA contracts for more than two years. But the PPAs were so structured that, with each subsequent year, the take-or-pay capacities for sale under long-term fixed pricing decreased.*
[15] *The term* monopsony *refers to a market in which products of several sellers are sought by only one buyer.*

- The bilateral contract market (except for small RE projects) mainly concerns negotiating a PPA with Union Fenosa; thus, off-take credibility of this distributor is a key issue for lenders;
- The market scheme's short-term bias makes it difficult for generators to acquire long-term contracts (except for low-cost RE projects), which seriously handicaps RE project financing; and
- During PPA tender evaluation, RE-based bids do not receive premiums for long-term price stability; thus, tenders disregard a major competitive advantage of RE-generated power.

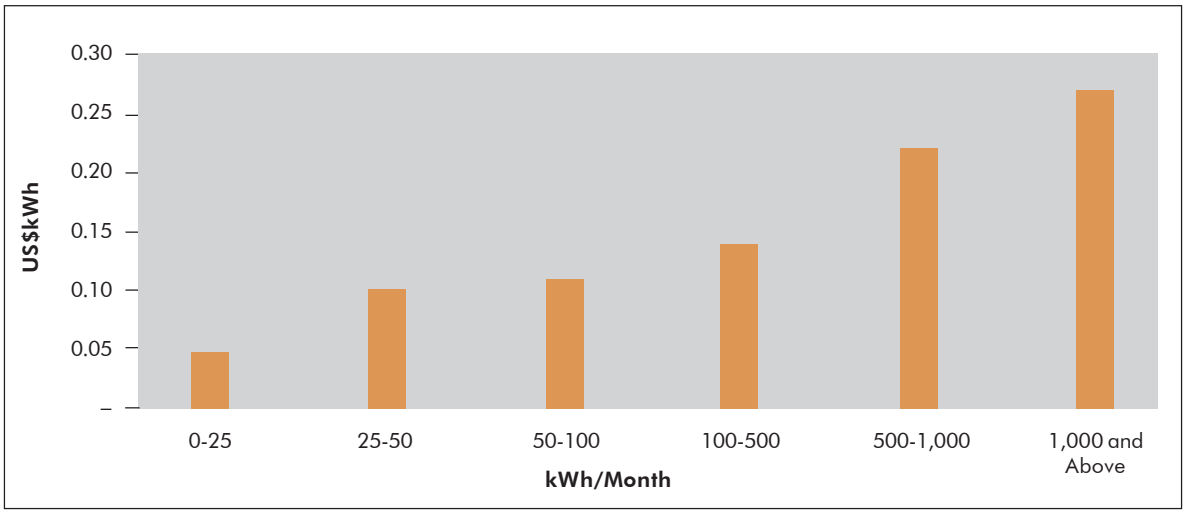
Retail Tariffs and Cross-subsidies

The Electricity Act of 1998 and INE regulations stipulate that Union Fenosa's tariff structure will not cross-subsidize between business and household consumers. But because Union Fenosa's tariff schedule applies to all consumers within its distribution network, in practice, two types of cross-subsidy occur: 1) urban to rural consumers; and 2) high to low monthly consumption households.

The residential tariff policy applies a lifeline rate with six stepwise increases (Figure 2.2). The lowest rate applies to the first 25 kWh of monthly consumption, while the highest applies to consumption above 1,000 kWh per month. In May 2004, households in Union Fenosa's distribution network paid US¢0.05 per kWh for the first 25 kWh and US¢0.27 per kWh for consumption above 1,000 kWh per month. The redistributive effect of the lifeline policy is largely regressive; that is, 98 percent of residential consumers receive their supply below cost, while 45 percent of households remain without electricity.

Excessive-cross subsidy in the household consumer category, resulting from the high number of steps, reduces the scope for urban-to-rural cross-subsidy. This, in turn, reduces the financial scope for rural electrification below the feasible level and, thus, the number of small-

Figure 2.2: Residential Tariff Structure, 2004 (US$ per kWh of monthly consumption)



Sources: National Energy Commission, Synex Consulting Engineers and Gerens (2004).

scale RE systems that would otherwise have been installed.

Public Governance

CNE and INE share public governance functions for Nicaragua's power sector (Box 2.2).[16] Since reform, these policy and regulatory institutions have voiced their differences on various issues. For example, they differ on the regulatory implications of public subsidies given to rural electrification investments when Union Fenosa takes over these assets. Such disagreement impedes a coherent approach to rural electrification. Outside the energy sector, but severely affecting the ability to implement hydropower projects, a battle between the ministries of industry, agriculture and environment over the institutional authority in assigning and regulating water rights, is holding up progress in adoption of the draft Water Law (*Ley de Aguas*). Such turf battles have increased investment risk and hurt promoters' ability to plan and implement projects.

The strained relationship between President Enrique Bolaños, elected in 2002,[17] and the

Box 2.2: Institutional Roles and Responsibilities

The 1998-99 reform process created new institutions and redefined the roles and tasks of existing ones. The Electricity Act of 1998 divided the public-governance functions for the power sector between two institutions:

- **National Energy Commission.** CNE is responsible for formulating sector policies, preparing national- and rural-power expansion plans, proposing energy sector laws and presidential decrees and implementing rural electrification projects. Thus, CNE's role now extends beyond electrification to responsibility for government strategic planning on all energy issues; and
- **National Energy Institute.** INE is responsible for issuing technical sector regulations and licenses and concessions for the power sector and petroleum industry. INE approves investment plans of licensed power companies. (Each year, ENTRESA, the national transmission company, presents INE its investment plan for approval; INE makes a decision after receiving the opinion of the CON.) INE also approves the power tariffs of transmission and distribution companies and monitors quality of all electricity sector service providers. INE's former responsibility for energy-sector strategy and policy was transferred to the CNE to enable INE to focus exclusively on its new role.

[16] *As a new institution, CNE assumed responsibilities that formerly belonged to INE, which had seen its pre1998 powers severely curtailed by the reform. When INE was created in 1979, it combined the functions of the Ministry of Energy with those of the national power and oil companies. INE operated power sector enterprises and supervised activities in the hydrocarbon sector. In the mid-90s, INE was still the lead governmental institution in the energy field, playing the role of regulator of energy utilities, planner of energy development and environmental control and potential purchaser of private wind farm output.*

[17] *In 2001, the Constitutionalist Liberal Party (PLC)'s Enrique Bolaños won the presidential election with 56.3 percent of the vote. President Bolaños lost support of the PLC in January 2002 when his government decided to take legal action against former President Arnoldo Alemán, who ruled Nicaragua from 1997 to 2002. In December 2003, Alemán was sentenced to 20 years in prison for fraud, money laundering, embezzlement and corruption.*

National Assembly prevented implementation of a new law, adopted in 2005, which created the Public Utility Superintendency as the regulatory authority for telecommunications, energy, water and sewage, eliminating sector regulators TELCOR, INE and Nicaraguan Sewerage ansd Aqueduct Institute (INAA).[18] President Bolaños refused to accept the legality of the law and Parliament's appointment of the superintendent and four commissioners.[19]

Organization of Rural Electrification

Nicaragua's Rural Electrification Policy aims to increase the national electrification rate to 71 percent by the end of 2013.[20] Electricity will be provided to 1.6 million currently unserved residents, at a total estimated cost of US$300 million.[21]

CNE Planning and Implementation

The Electricity Act of 1998 makes CNE the inter-institutional entity responsible for promoting and implementing electrification in areas where commercial agents show no interest in providing service. As rural electrification planner, CNE is responsible for:

- Defining policy;
- Preparing plans;
- Securing financing from bilateral donors and multilateral development banks; and
- Identifying, preparing; and implementing projects.

Because of separate institutional conditions, CNE must prepare two rural electrification plans for the country's western and eastern geographic regions. These are:

- *PLANERAC.* Electrification Plan in Concessioned Areas (*Plan Nacional de Electrificación Rural para el Area Concesionada*). Held by Union Fenosa, the western (concessioned) area had an electrification rate of 60 percent in 2003. The plan is needed because, according to the terms of the sale agreement for the two distribution areas taken over by Union Fenosa, the concessionaire is not responsible for providing electricity service to regions outside the concession area. CNE uses a set of well-defined, project selection criteria. Projects must be included in both the national development plan (PND) and municipal development plan (PMD), investment costs must be under US$1,000 per connected consumer and the tariff must cover Operations and Maintenance (O&M) costs; and
- *PLANER.* National Rural Electrification Plan (*Plan Nacional de Electrificación Rural*). The eastern (nonconcessioned) area, located along the Atlantic Coast,[22] had an electrification rate of 22 percent in 2003. The plan is divided into Five-Year Plans (2004-08 and 2008-13). CNE project selection criteria are less specific; they follow PND directives, which seek to develop productive clusters (small geographic agglomerations of enterprises and institutions) to serve as service centers and development poles for the surrounding area. The emphasis

[18] Ley de la Superintendencia de Servicios Públicos *(No. 511-2006).*
[19] *The point of contention was not over the value of the Superintendency – it makes good sense in view of the scarcity of regulatory expertise and the tendency of utilities to spread across several sectors – but with regard to the National Assembly's appointment of the Superintendent of Public Services and the Commissioners for Energy, Telecommunications, Potable Water and Sewage.*
[20] *Rural electrification policy is important for RE investments; indeed, RE-based generation is often the least-cost solution to supply power for new rural distribution areas.*
[21] *The 2005-06 program foresees investments of US$49 million to electrify 45,000 households; until 2013, annual financing of US$20-30 million will be needed to reach the target.*
[22] *The nonconcessioned area includes the two autonomous regions (North Atlantic Autonomous Region* [Region Autónoma Atlántico Nord – *RAAN]* and *South Atlantic Autonomous Region* [Region Autónoma Atlántico Sur – *RAAS]*) *and portions of five departments: Jinotega, Matagalpa, Boaco, Chontales, and Río San Juan.*

is on finding areas with productive use potential, population with a willingness-to-pay and potential for RE use.

Rural electrification in Nicaragua is understandably complex. CNE must play multiple roles, its responsibilities regarding rural concessions overlap with those of INE, and the issue of "concessioned" versus "nonconcessioned" areas is complicated. In addition, funding from multiple sources is uncertain, and essential ownership and regulatory issues (for example, rural tariff policy) remain unclear.

CNE's Rural Electrification Administration (*Dirección Electrificación Rural* – DER) acts as the executing agency for rural electrification projects financed by foreign donors and multilateral development banks. The DER's negotiations with Union Fenosa are difficult regarding projects extended from concessioned areas. Union Fenosa engages in DER programs only reluctantly,[23] requiring that the entire capital cost of new projects be covered by subsidy and that it be given management authority for all aspects of project development and construction. DER has itself implemented projects that it subsequently handed over to Union Fenosa.

In principle, any entity can identify, prepare and undertake rural electrification projects in the nonconcessioned area. In practice, however, DER initiates most projects.[24] ENEL acts as power supplier of last resort (when no other economic agent is interested). It holds concessions for Puerto Cabezas and Bluefield in the eastern region; in nonconcessioned areas, it provides electricity service through 32 isolated grids in the RAAN, RAAS, and central and northern regions, using diesel generators.

Financing Policy

Financing policy for rural electrification involves: 1) identification and securing of project financing sources (for example, consumer cross-subsidies and State budget allocations from domestic and donor funds); 2) division of project finance between investor equity, debt finance and subsidy; and 3) level of cost coverage through rural power tariffs.

In 2005, these financing issues, including the level of subsidies to individual projects, were still decided on an ad hoc basis. The 1998 Electricity Act referred to the establishment of the National Electricity Development Fund or (*Fondo de Desarrollo de la Industria Eléctrica Nacional* – FODIEN) to cofinance rural electrification projects under CNE-initiated programs. FODIEN cofinancing could be in the form of loans, subsidies or both. The Electricity Act established that the rural electrification program was to be financed through annual budget allocations.

Thus far, the State has not allocated any funds to FODIEN. As mentioned earlier, the DER has taken on the role of executing agency for rural electrification projects financed by foreign donors and multilateral development banks. The most important are:

- Rural Energization Development Strategy and Pilot Plan for Nicaragua, Inter-American Development Bank;
- Rural Electrification Program in Isolated Zones, The World Bank;
- Small-scale Hydropower Development for

[23] *Like many other recently-privatized distribution companies in Central America, Union Fenosa focuses mainly on improving its commercial and administrative systems and ensuring it can profit from areas it already serves; see Barnes and Waddle (2004).*
[24] *DER also implements and operates projects in the nonconcessioned area; however, it plans to shift to a facilitation role, serving as a secretariat for the National Electricity Development Fund (FODIEN), with local communities and private investors undertaking project preparation and implementation.*

Productive Uses in Off-grid Zones, United Nations Development Programme; and
- Atlantic Coast Electricity Development Program, Central American Bank of Economic Integration.

The growing need for electricity service in eastern nonconcessioned areas has required the construction of more ENEL-operated small power plants. In recent years, ENEL has installed more than 30 diesel-powered plants; they are reliable but expensive, requiring regular maintenance. ENEL has drawn on profits from operation of its hydropower plants to cover losses on rural electrification projects.

Cost recovery and rational tariff design are key to achieving sustainable rural electrification in Nicaragua. But tariffs are not yet differentiated by geographic region, and ENEL and CNE disagree on how to treat FODIEN funding for projects taken over by Union Fenosa. INE insists that they should be treated as loans, meaning that Union Fenosa would repay the full amount through increases in its average tariffs.

Failed Reform and Political Risk

Investor confidence has diminished as a result of the failed power sector reform (Box 2.3). The economic incentives provided under Decrees 12-2004 and 13-2004 cannot outweigh the negative effect of risk premium on the cost of capital (Annex 1).

The two major consequences of failed reform are that:

- Union Fenosa, the distribution company, is not a credible off-taker for long-term PPAs; and
- New investments in geothermal and hydropower face regulatory and planning

Box 2.3: Why Did Power Sector Reform Fail?

The 1998 Electricity Industry Law *(Reglamento a la Ley de la Industria Eléctrica)* failed to achieve its aims. The desired horizontal separation of distribution was not attained as distributor Union Fenosa won the tender for both concessions of the national grid system. The Nicaraguan government was unable to sell all State-owned generation assets, and Union Fenosa did not manage to reduce large system losses in distribution. As a result, the power sector attracted little private investment.

As an instrument for achieving key energy policy objectives, the reform was poorly designed. Measures to accelerate rural electrification were not integrated into the reform process, and market arrangements were not developed to favor new investments in RE generation. Despite the overwhelming scope for cost-effective RE investments, the reform failed to put a framework in place to allow new RE generators to secure long-term supply contracts on a competitive basis. And, despite low rural electrification rates, the power sector did not cater to its financing and institutional needs.

Sequencing in implementation was also unfortunate as certain key legislation had not been adopted at the time of privatization. For example, privatization of HIDROGESA failed because the new Water Rights Law had not been passed. Union Fenosa had difficulty fighting electricity theft because the legal framework lacked sufficient instruments for tackling cases of electricity theft.

hurdles (for example, the better geothermal sites are located on land to be declared national parks, and hydropower investments await clarification on the new Water Rights Law).

Risk Premiums

The resulting political risk greatly affects production costs. To finance offshore wind farm development projects, for example, banks add a 4 percent risk premium to their interest rate if the developer opts for a new turbine technology with a short operational track record. For 50 MW geothermal plants, annual risk premiums can run as high as US$5 million (an extremely large financial outlay to protect investing and doing business in a particular country). Since most developers must insure both project debt and equity for political risk – representing a 15-25 percent premium onto the weighted average cost of capital for a project – the fixed costs of RE generation are raised substantially.

The effect of a 4 percent increase in the interest rate depends on the maturity of debt financing (Table 2.2). In addition, one can distinguish between the increase in required tariffs during the amortization period and the effect of production costs over the 25-year economic lifetime of a plant.

Table 2.2: Risk Premium's Effects on Cost of Capital and Generation*

Debt Financing	*Project-type Financed*		
	Wind Farm (US$ per kWh)	*Geothermal (US$ per kWh)*	*Hydropower (US$ per kWh)*
10-year Loan			
First 10 Years	0.49	0.49	0.75
Lifetime Cost Increase	0.25	0.25	0.39
15-year Loan			
First 15 Years	0.50	0.50	0.77
Lifetime Cost Increase	0.36	0.36	0.55

Source: Author's calculations.
** Based on a 4 percent risk premium.*

Table 2.3: Effects of Loan Maturity on Generation Cost

*Loan Maturity (10 percent interest)**	*Plant-type***		
	Geothermal (US¢ per kWh)	*Hydropower (US¢ per kWh)*	*Wind Farm (US¢ per kWh)*
15-year	1.8	2.8	1.8
10-year	2.5	3.8	2.5

Source: Author's calculations.

**Loan represents 70 percent of investment.*
***Geothermal (US$2 million per MW, 80 percent capacity factor), hydropower (US$2.5 million per MW, 65 percent capacity factor) and wind farm (US$1 million per MW, 40 percent capacity factor).*

Immature Capital Market

In addition, an immature capital market reduces the length of maturity on project loans. For example, a reduction from 15 to 10 years adds US¢0.07 to the cost coverage tariff of a geothermal power plant and wind farm and US$1 to the tariff of a hydropower plant (Table 2.3).

Thus, in a country with a perceived high-risk environment, the combined effects of lower maturities and higher risk premiums on loan capital can easily increase the required tariff from US$1.4-1.6 per kWh.

Regional Power Market

SIEPAC entails the construction of transmission lines connecting 37 million consumers in Costa Rica, El Salvador, Guatemala, the Honduras, Nicaragua and Panama.[25] Costing an estimated US$320 million, SIEPAC was scheduled for completion in 2006. Mexico is linked to SIEPAC through the 100-km, 400-kV transmission line constructed between Tapachula (Mexico) and Los Brillantes (Guatemala) substations, while Belize is linked by the 195-km, 230-kV power transmission line between Santa Elena (Guatemala) and Belize City (Belize) substations (DOE 2003).

These investments will permit the creation of a Central American wholesale power market. According to the Framework Treaty for the Central American Electricity Market (*Tratado Marco del Mercado Eléctrico de América Central*) and the Transitional Regulation of the Regional Electric Power Market (*Reglamento Transitorio del Mercado Eléctrico Regional*),[26] two regional institutions will be created to govern this power market:

- Regional Electric Power Interconnection Commission (*Comisión Regional de Interconexión Eléctrica* – CRIE) – wholesale market regulator; and
- Central American Market Operator (*Operador del Mercado Centroamericano* – OMCA) – administrator of regional power transactions.

The upcoming regional power pool increases investor interest in two ways: 1) the larger-scale regional market allows for building larger power plants; and 2) regional competition for attracting generation projects reinforces investor confidence in the predictability of national regulatory frameworks.

For Nicaragua, opening up national markets to increased cross-national power supply provides both opportunity and risk. While the country stands to benefit from new RE investments, a regional market poses the threat that power sector investments may be redirected to neighboring countries. Investors in generation will focus on those countries that offer the best conditions in terms of :1) RE resource quality; 2) efficiency of sector regulations and project approval procedures; and 3) generosity of fiscal and other economic incentives.

Competition in improving the regulatory framework benefits all countries and stakeholders in the region. Competition in offering investors economic incentives in generation is a zero-sum game: total supply is defined by the regional demand for power and, therefore, not affected by sector-specific economic incentives. The result is a sub optimal sharing of resource rents between risk-taking investors, power consumers and State budgets. Therefore, the Nicaraguan government will discuss with other governments in the region how incentive regimes and policies can be regionally coordinated to prevent an "incentive-maximizing" race.

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[25] *In 2002, the region's total population was 73 million; electrification rates were 95 percent (Costa Rica), 84 percent (Guatemala), 83 percent (Panama), 78 percent (El Salvador), 63 percent (Honduras), and 47 percent (Nicaragua). At the end of 2003, installed generating capacity was 8 gigawatt (GW), comprised of fossil fuel (45 percent), hydropower (45 percent), geothermal (5 percent), bagasse cogeneration (4 percent) and wind energy (1 percent).*

[26] *Motivated by completion of the El Salvador-Honduras link.*

3. Resource Potential and Exploitation Status

Resource Potential

CNE studies estimate Nicaragua's economically viable RE resource potential at 3,000 MW, composed of 1,700 MW hydropower, 1,000 MW geothermal energy, 200 MW wind energy and 100 MW biomass-based power. This quantity is five times higher than the 2004 national power capacity.

As the following sections illustrate, the quality of Nicaragua's RE resource potential is equally impressive. The cost of production is price competitive with diesel power plants. In addition, RE resources allow for the development of base- and peak-load plants, as well as intermittent power supply.

Geothermal Energy

CNE's Geothermal Master Plan of 2001 projects that Nicaragua has nearly 5,500 MW of geothermal reserves. Of these, 303 MW are reservoirs established as proven reserves, 802 MW are probable reserves, and a further 4,375 MW are possible reserves (Table 3.1).[27]

Table 3.1: Geothermal Resource Projections for Nicaragua

Area	*Proven Reserves (MW)[1]*	*Probable Reserves (MW)[2]*	*Possible Reserves (MW)[3]*	*Commercial Development (in 10 years)*
El Hoyo-Monte Galán	–	148	491	50
Managua-Chiltepe	–	113	337	0
Masaya-Granada-Nandaime	–	172	1,285	50
Momotombo	142	–	190	50
Ometepe	–	–	584	5
San Jacinto-Tizate	161	–	207	150
Tipitapa	–	18	–	0

(Continued...)

[27] Proven reserves *are geothermal resources already encountered in commercial quantities by the drilling of deep exploration and production wells and extensively tested via extended time reservoir production.* Probable reserves *are calculated based on extensive geological, geophysical and geochemical data and surveys, combined with possible test wells; generally, there is enough geological and exploration data in such areas to have already targeted locations for at least the first deep exploration wells.* Possible reserves *are based on sound geological principles, combined with a certain degree of geophysical and geochemical testing and often nearby active volcanic activity (they are the least reliable form of projection).*

(...Table 3.1 continued)

Area	*Proven Reserves (MW)*[1]	*Probable Reserves (MW)*[2]	*Possible Reserves (MW)*[3]	*Commercial Development (in 10 years)*
Volcán Casita-San Cristóbal	NA	224	676	50
Volcán Cosigüina	NA	NA	425	0
Total	**303**	**675**	**4,195**	**355**
Total Power: 5,508				

Source: Global Power Solutions (2006).
Note: NA = Not applicable.

Potential Contribution to Growth

Geothermal resources account for only 30 MW of the electricity generated, a fraction of the estimated 1,200 MW of economically exploitable potential (Figure 3.1). Eight of the nine economically viable project sites are larger than 100 MW. To be implemented, such plants must attract foreign investors. But based on these resources, geothermal power could, in principle, account for 250-400 MW of growth over the coming decade.

Operating Mode and Production Costs

Geothermal power plants are base-load plants for reasons of cost and reliability. They have high fixed costs in terms of the ratio of the cost of investment versus per kWh of output

Figure 3.1: Distribution of Geothermal Energy Potential

Geothermal Potential

Area	MW
Casita-San Cristobal	224
Telica-EL Ñajo	127
San Jacinto-Tizate	161
Hoyo-Monte Galan	148
Momotombo	142
Managua-Chiltepe	107
Tipitapa	18
Masaya-Nandaime	174
Ometepe	100
Total	**1,200**

Source: National Energy Commission.

to the operating costs per kWh and the ratio of fixed operating costs to those that vary with daily MWh of production. Year-round reliability is high, with capacity factors easily above 85 percent.

The production cost of future geothermal power plants (or PPA tariff, which would have to be paid) is US$6-7 per kWh at the plant site.[28]

Hydropower

Nicaragua's identified hydropower potential is 3,760 MW, of which 1,700 MW (with an annual generating potential of 6,600 GWh) are considered economically feasible. This amount is four times the 2003 electricity consumption of 1,650 GWh.

Site Potential and Inventory

Possible hydropower sites range from "pico" and "nano" sites (of only a few kilowatts) to micro, mini, small, large and mega sites of 150 MW and above.

The CNE inventory of 104 hydropower projects comprise 30 potential projects in the mini market segment (100 kW-1 MW), 36 in the small segment (1-25 MW) and 38 in the medium- and large-scale (mega) segment (25 MW and above). The hydropower potential of these projects are estimated at 3,282 MW (Table 3.2).

Potential sites above 10 MW are well-documented by resource and feasibility studies. As shown in Table 3.2, they represent nearly 98 percent of identified MW potential. The economic potential of 1,767 MW comprises 13 sites, ranging from 17 MW (Larreynaga) to 425 MW (Tumarin) (Figure 3.2).[29]

Hydropower potential below 10 MW is estimated at 165 MW. But the 2-10 MW range has not been assessed systematically.

Table 3.2: Estimated Potential of Identified Hydropower Sites

Capacity Range (MW)	*Identified Sites (No)*	*Site Distribution (percent)*	*Total Estimated Capacity (MW)*	*Size Distribution (percent)*
0.1-1*	30	28.85	10	0.30
1-10**	14	13.46	60	1.83
10-25**	22	21.15	416	12.68
25-272**	38	36.54	2,796	85.19
Total	**104**	**100.00**	**3,282**	**100.00**

Source: Author's data compilation based on CNE hydropower inventory, IFC study and other documents.

* *UNDP-supported mini hydropower projects include El Bote and El Ayote (PERZA).*
** *Based on CNE inventory and studies (Wilwili, Salto Grande and Siempre Viva).*

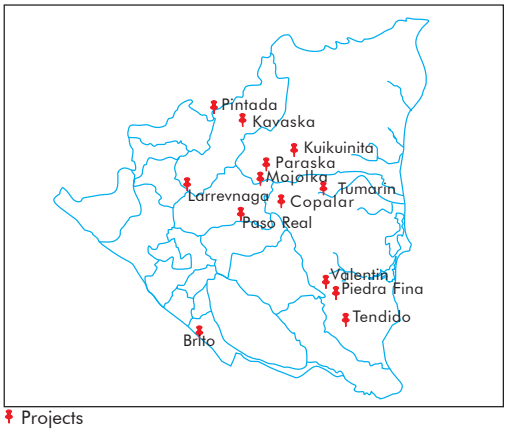
[28] *Ormat International is the concession holder of Momotombo, Nicaragua's only operational geothermal power plant. Ormat's price at the plant meter is US$4.5-4.8 per kWh. However, at the time Ormat entered into the contract, the project contained no substantive resource or development risk as Ormat took over a constructed operational field and plant. The PPA price of San Jacinto, a geothermal plant currently under development (including drilling, development and operation of a geothermal field and power plant construction), is US$5.95 per kWh; see GPS (2006).*

[29] *Potential projects (small-to-large in scale) that were the subject of update studies over the past decade are Mojolka (138 MW), Copalar (150 MW), Larreynaga (17 MW), Pantasma (24 MW), projects in the Upper and Lower Rio Viejo region (extension of the existing Central America Hydropower Plant [PCA] and Santa Barbara Plant [PSB]), and Y-Y River projects (estimated at some 27 MW).*

Figure 3.2: Distribution of Nicaragua's Hydropower Potential

Hydropower Potential

Range	Project	Basin	Capacity MW	Energy GWh
1	Tumarin	R Grank	425	1,830
2	Mojolka	Tuma	119	516
3	Brito	San Juar	260	1,138
4	Copalar	Grande	281	1,164
5	Valentin	Rama	62	270
6	Pintada	Coco	203	835
7	Kuikuinita	Prinzapol.	63	277
8	Paraska	Ivas	41	177
9	Kavaska	Bocay	54	235
10	Larrevnaga	Vieio	15	66
11	Piedra Fina	Rama	102	437
12	Paso Real	Grande	48	211
13	Tendido	Punta Gorda	94	411
			1,767	5,767



Source: National Energy Commission.

Potential hydropower sites below 2 MW are well-documented thanks to the ongoing small hydro program (SHP) funded by the United Nations Development Programme (UNDP) and the Global Environment Facility (GEF), as well as the World Bank-GEF supported PERZA program. Under the PCH program, ATDER-BL, a Nicaraguan non governmental organization (NGO), systematically assessed 30 mini hydropower sites; the purpose was to determine their potential use in rural electrification projects for power supply to isolated or regional grids or a mixture of local and national grid supply.

Mode of Operation and Market Segments

In terms of their power market application in Nicaragua, hydropower plants can be divided into three categories: 1) ROR plants; 2) plants of up to 25 MW; and 3) plants larger than 25 MW with year-round storage capacity.

ROR plants represent 15 percent of Nicaragua's economically viable, MW hydropower potential. Their storage capacity is limited to daily peaking purposes. Their power supply is seasonally intermittent. During the dry season, for example, they may produce at only a fraction of the installed capacity.

ROR plants can be further subdivided into two market segments: 1) noncommercial micro hydro plants; and 2) mini hydro plants for rural electrification, which depend heavily on grant support and commercial small hydro plants selling to the national grid.

Micro hydro plants, defined as grid-connected plants with less than 100 kW, can be used as stand-alone systems or for small-village grid systems; therefore, they depend heavily on donor support. Key actors in this segment are NGOs and Rural Electric Cooperatives (RECs).

Mini hydro plants, which range from 100 kW to 1 MW, mainly address the need for decentralized rural electrification, although plants with capacities toward the upper limit of the segment can also be connected to SIN. Although Nicaragua lacks a complete inventory of mini hydropower sites, the locations of 30 mini hydro plants are listed for the project area of the PCH program.

The small hydropower segment (1-25 MW) is meaningfully divided into three subsegments:

- *1-5 MW*. This market subsegment, requiring investments in the US$2-10 million range, falls under the favorable regulatory framework for small hydro projects of up to 5 MW. It attracts national investors who want to invest in Nicaragua, take a medium risk and do not wish to enter transnational consortia. Even though projects in this subsegment can be developed relatively quickly, only seven have been identified;
- *5-15 MW*. Projects in this range require significant investment and a medium-term planning horizon (two to four years). Associated technical and economic risks are greater for these projects than for those in the 1-5 MW sub-segment, and banks are more reluctant to finance them. These projects may attract joint ventures of national investors and foreign business partners who wish to invest in Nicaragua, but share associated risks with national developers. For this subsegment, the updated CNE inventory lists nine projects; and
- *15-25 MW*. This subsegment includes large projects in the Nicaraguan context requiring a planning horizon of at least three to five years. In past years, potential developers have shown interest and acquired temporary licenses to develop such projects as Larreynaga and Pantasma. However, the country's unfavorable legal framework (for example, suspension of the existing Water Law in 2002 and legal preference given thermal power generation) has blocked potential private investors from progressing in project development, including privatization of the HIDROGESA plants. The updated CNE inventory lists 17 projects in this sub-segment. Potential developers include consortia of national companies/banks and foreign companies willing to invest in the US$30-50 million range of the power sector. An example is the Banco Uno and Coastal Power consortium, which successfully participated in the HIDROGESA tender.

The 25-150 MW+ segment (subdivided into medium- and large-scale hydro) are mega projects for large international consortia. At the level of large hydro, mainly for export, Nicaragua is likely to face strong competition from neighboring countries (that is, Costa Rica, Guatemala and Honduras).

Wind Energy

More than a decade has passed since Nicaragua's public sector invested significantly in collecting data on the country's wind resource potential. In 1995, the National Rural Electric Cooperative Association (NRECA), under its Central America wind measurement program, partnered with INE to erect two wind masts with wind measurements of 15 and 30 meters. Since then, public sector investment has been limited to national meteorological-service data. But four to five private sector developers have invested in measurements on promising wind farm sites.

In consultation with these developers, CNE estimates that Nicaragua's high class, wind energy potential (that is, capacity factors greater than 35 percent) will permit 200 MW to be installed.

Estimated Production Cost

Financial analysis (Jiménez and Povedano, 2003), based on a 17 percent rate of return on equity, shows that the cost of wind farm production in Nicaragua varies between US$50 and US$66 per MWh, depending on the resource quality, ability to sell certified emission

reductions,[30] and introduction of the proposed 10-year tax holiday for wind farm income (Table 3.3). The cost of production does not include the incremental cost of balancing the system power to adjust for intermittent wind energy supply.

Scope for Grid Absorption

Intermittent power supply's effects on grid reliability, combined with the narrow gap between base load capacity and off-peak demand, mean that only a portion of wind power capacity can be integrated into the grid. Over the next four years (2006-10), up to 60 MW of wind farm capacity can be integrated into the grid system without significantly increasing operating costs. Penetration beyond that level would be uneconomic since power production from wind farms during some off-peak days would be higher than power demand. In 2006, these 60 MW amounted to about 10 percent of peak demand and 20 percent of evening demand, while the kilowatt-per-hour output represented 7 percent of the national power generation.

RE Project Experience

Geothermal Projects

Plants in Operation

Momotombo, whose field is located one hour northwest of Managua, is Nicaragua's only operational geothermal power plant. The Momotombo field and plant have been in commercial production for the past 20 years. During that time, more than 44 exploration wells have been drilled to depths of 2,500 meters, encountering temperatures in excess of 330°C. But the plant's 70 MW of installed capacity has never been reached for more than a few hours; by the 90s, production declined to only 14 MW. In 1999, Ormat International was awarded a 20-year concession to operate and maintain both the field and plant; it subsequently stabilized plant production at 30 MW.

Exploration Activities

Nicaragua's rich geothermal resources have attracted upfront investments from an array of

Table 3.3: Estimated Costs of Wind Farm Power Production

			Required Tariff (Average)		
Wind Velocity	*Plant Factor*	*Generation (average) (GWh)*	*Without CO_2 (US$ per MWh)*	*With CO_2 (US$ per MWh)*	*Plus Tax Holiday (US$ per MWh)*
8.5	0.40	70.1	66.0	63.0	62.0
9.0	0.44	77.1	60.0	57.0	56.0
9.5	0.47	82.3	56.0	53.2	52.5
10.0	0.49	85.8	54.0	51.0	50.0

Source: Jiménez and Povedano (2003).

[30] *A reduction of 0.8 tons CO_2 per MWh at US$ 5 per ton CO_2 yields a revenue of US$ 3 per MWh.*

exploration companies. Major sites and developers are:

- *El Hoyo-Monte Galán*. TransPacific Geothermal was leased the El Hoyo-Monte Galán concession in December 1995. The developer conducted extensive geological, geophysical and geochemical studies throughout the concession area. In 1998, TransPacific entered into a joint venture with Calpine Corporation; however, a PPA was never obtained and financing never acquired. In December 2002, INE withdrew the concession for lack of development;
- *El Ñajo*. In August 1997, Unocal, a major geothermal developer, was awarded the first exploration concession at El Ñajo. After two years of exploration activities (and major geothermal setbacks in Asia), Unocal returned the concession to the Nicaraguan government. In December 1999, SAI Geothermal was awarded the concession. After only one year, SAI requested that it be expanded into areas within the San Jacinto concession. When INE denied this request, SAI voluntarily returned the concession to the Nicaraguan government;
- *Managua-Chiltepe* and *El Hoyo-Monte Galán*. In April 2006, Enel and LaGeo jointly signed exploration contracts with INE to explore two areas of 100 km^2 each, located in Managua-Chiltepe and El Hoyo-Monte Galán.[31] Two years of exploration activities will be needed to confirm geothermal generation potential, currently estimated at 100-200 MW. Over the next two years, project investment will total US$15 million;
- *San Cristóbal*. In August 1999, Triton Energy, SA (a subsidiary of Black Hawk Mining, a Canadian company) was awarded an exploration concession for the San Cristóbal volcanic area. The developer already owned and operated the nearby El Limón mine. Triton Energy still holds the San Cristóbal concession; and
- *San Jacinto*. This project may represent Nicaragua's best opportunity to meet the government's interest in a geothermal component for the next 40 MW of new generation. The San Jacinto exploration concession was originally issued to a Russian-Nicaraguan consortium in May 1993. That consortium conducted extensive geological, geophysical and geochemical exploration activities, ultimately drilling seven deep exploration wells (to depths of 2,335 meters with temperatures of 290°C). Long-term reservoir testing on three of these wells proved the existence of a commercial reservoir exceeding 25 MW. The San Jacinto-Tizate concession is now held by a Nicaraguan-Canadian consortium of investors (owners of Triton Energy) and Germany's Daimler Benz group.

Currently, the San Jacinto Power Company, SA has three shut-in geothermal wells on site. These have been extensively flow-tested and proven to have a combined production capacity of more than 20 MW over a period of at least 30 years. San Jacinto, which already had a PPA, planned to have 10 MW on line by December 2003, 22 MW by June 2004, and ultimately 66 MW by 2006. Yet, for the past six years, construction has been delayed for lack of financing. The Nicaraguan government's most important participation in geothermal

[31] *Enel and LaGeo operate in Nicaragua through GeoNica, a dedicated joint venture with stakes of 60 percent (Enel) and 40 percent (LaGeo). Enel's extension of the Berlin power plant (with a 40 MW installed capacity) is scheduled to start operation in June 2006. That capacity will be conferred to LaGeo, and Enel will increase its stake.*

energy may be to use multilateral grants and funding to acquire Phase-I turbine units of this project and lease them to San Jacinto.

From the above list, one can note that substantial geothermal exploration activity has occurred over the past decade and continues. Investors have shown willingness to take on the risk of upfront investments in resource exploration. Yet, one also notes that little follow-up implementation has occurred. Indeed, over the past several years, more concessions have been returned to, than issued by, the Nicaraguan government.

Hydropower Projects

Plants in Operation

In 2004, Nicaragua's 104 MW of installed hydropower capacity generated an average of 364 GWh per year. That year, hydropower accounted for 11 percent of the national power generation. Installed capacity included two large hydro plants, three mini plants and one micro plant:

- *Large*. Central America Hydropower Plant (PCA), built in 1965 at Río Tuma and Santa Barbara Plant (PSB), built in 1972 at Río Viejo, each has a nominal generating capacity of 50 MW;
- *Mini*. Wabule (Wabule River) and Las Canoas (Malacatoya River), installed in 1989, each has a capacity of 1.5 MW feeding into the national grid (SIN); San José de Bocay, built in 1991, has a capacity of 230 kW; and
- *Micro*. La Chata, constructed in 1985, has a 100 kW capacity and supplies electricity to the rural population of El Cuá.

Projects under Consideration

Because of problems associated with adoption of the new Water Rights Law (still pending), hydropower activities since 2000 have focused heavily on segments below 5 MW. These activities are heavily donor-financed and mainly target use in rural electrification projects.

To date, Nicaragua has no specific program (at least, not covered by PCH or PERZA) to promote the systematic development of micro hydro plants. Development in this sector is sporadic, and no systematic site inventory has been conducted.

The PCH and PERZA programs attempt to develop mini hydropower projects. Located in central Nicaragua, the PCH program reaches 90,000 rural families in 67 municipalities across eight departments (Madriz, Nueva Segovia, Estelí, Matagalpa, Boaco, Chontales, Jinotega, and Río San Juan). The World Bank will cofinance (under CNE loan) up to three hydro projects in the PERZA program and up to three hydro plants in the PCH program. In 2005, CNE succeeded in getting Nicaragua's first public-private mini hydro project implemented. Known as El Bote, this 0.9 MW plant is located in Nicaragua's central highlands. The project is supported by the World Bank (PERZA program) and Swiss Agency for Development and Cooperation, at a cost of US$2.7 million. El Bote delivers power to 2,700 rural residents, who consume 25 percent of the energy generated; the other 75 percent is sold to the national grid. To date, 48 km of transmission lines have been built. The Nicaraguan government views El Bote as the start of a US$200 million project expected to develop 130 MW of RE-based generation. In all, 10 small hydro stations (ranging from 300 to 900 kW in size) are planned for construction.

Hydropower projects larger than 5 MW must await approval of the new Water Rights Law before they can begin development.

Projects in the 5-25 MW segment could attract consortia of national investors. Two projects – Larreynaga (17 MW) and Pantasma (24 MW) –

have attracted investor interest, which CNE should actively pursue.

The segment above 25 MW comprises 13 projects suggested by the International Finance Corporation (IFC) (of the World Bank Group). Four of these – El Carmen (100 MW), Piedra Fina (42 MW), Corriente Lira (40 MW) and Valentín (28 MW) – are planned for implementation in 2003-04, in accordance with the Electricity Sector Indicative Program.

Wind Farm Projects

Since the late 90s, three to four local project developers have each been prepared to invest in 20-40 MW wind farms, after having implemented wind measurement programs on their respective project sites and having secured backing from foreign finance sources. The wind measurements were cofinanced by potential turbine suppliers. Since the production cost per kWh of a 2004 wind farm was higher than the average spot market price, the option of investing in a merchant plant project, selling directly into the spot market, was not commercially viable. Since 2000, developers have tried unsuccessfully to negotiate a PPA with CNE/INE and the distribution company, Union Fenosa. Progress depends on INE and Union Fenosa organizing a tender for a 20-40 MW wind farm, as anticipated in the draft RE Promotion Law *(Generación Eléctrica con Fuentes Renovables)* and policy document.

4. RE Policy and Regulatory Framework, 1998-2005

By the end of 2005, to what extent had Nicaragua put in place a regulatory framework providing clear long-term goals for RE policy? To what extent had the government addressed the legal issues involved in natural resource exploitation? Did power market rules treat RE generators fairly? Were RE investors provided access to internationally competitive project financing? By exploring these and other related questions, this Chapter seeks to identify Nicaragua's building blocks for success, pinpoint critical policy gaps and suggest initiatives that can boost RE investor confidence.

Political Context and Policy Targets

In 1998, CNE, Nicaragua's lead institution for formulating energy policy, faced formidable political obstacles to putting in place a coherent RE policy.[32] Many politically influential individuals saw no need for special RE legislation since the 1998 power sector reform had supposedly created a freely competitive regime for power generation investments. Adoption of basic laws permitting the exploitation of water and geothermal resources for energy purposes was beyond CNE's scope. Moreover, it faced problems of institutional rivalry with INE, which defended its dwindling jurisdiction against perceived attempts of encroachment by CNE. More recently, the strained relationship between President Bolaños, elected in 2002, and the National Assembly, has increased the difficulty of passing new laws.[33] This situation has forced CNE into over-reliance on presidential decrees for implementing laws and a piecemeal approach to RE legislation.

During the 1998-2005 period,[34] Nicaragua did not adopt formal policy targets for RE penetration in the national power market. The key framework laws and regulations for the power sector, Electricity Industry Law *(Ley de la Industria Eléctrica)* (No. 272-1998) *(Reglamento a la Ley de la Industria Electrica)* and Electricity Industry Law Regulation (Decree No. 42-1998), contain no references to the promotion of RE and its integration into the power market. Rather, they reflect a blind faith in the ability of market arrangements implemented by the acts to produce economically desirable results in the power sector.

The primary Renewable Energy Promotion Law *(Ley para la Promoción de Generación Eléctrica con Fuentes Renovables)* (No. 532-2005) declares that RE-based power generation is of national interest, states that RE should be given

[32] *CNE was created by the 1998 Electricity Act.*
[33] *For example, Law No 511-2006, creating the Public Utility Superintendency as the regulatory authority for telecommunications, energy, water and sewage (eliminating sector regulators TELCOR, INE, and INAA) was not implemented. President Bolaños rejected the law's legality, not because he disagreed with its value but because of the National Assembly's appointment of the superintendent and four commissioners.*
[34] *Despite RE's share having gradually eroded on the national power market since 1980.*

priority when contracting new generation, and confirms the economic incentives introduced previously by presidential decrees; however, it provides no quantified RE targets. Similarly, the most important secondary law for RE, National Energy Policy (Decree No. 13-2004) *(De Establecimiento de la Política Energética Nacional)*, confirms RE's importance and introduces economic incentives, but offers no quantified goals.

It is at the level of implementing regulations – CNE's Strategic Electricity Plan (2003) and Electricity Sector Indicative Generation Plan (2003-14) – that quantified targets first appear. The Indicative Generation Plan includes one 66 MW geothermal project and one 20 MW wind farm in the short term (2004-06) and 561 MW of medium- and large-sized hydropower plants in the medium and long term (2007-14). Yet, the targets in these plans have no binding force, being indicative only.

Thus, except for the policy drive of CNE, Nicaragua's political attention to RE remained surprisingly passive at the end of 2005 – this despite RE's impressive potential, its cost-effectiveness in Nicaragua and the macroeconomic benefits of RE investment.

Resource Management Laws and Regulations

General Laws and Regulations

Nicaragua's general laws and regulations for resource management include (Annex 2):

- Political Constitution, Article 102. Designates water and geothermal resources as national heritage (a State concession is required for resource exploitation);[35]
- Civil Code. Affects, inter alia, rights to water resource management;
- Geothermal Resource Exploration and Development Law *(Ley de Exploración y Explotación de Recursos Geotérmicos)* (No. 443-2002), replaces geothermal regulations established under the General Law on Natural Resources Exploitation;
- Water Rights Law (in draft bill stage), replaces water regulations established under the General Law on Natural Resources Exploitation;
- Forestry Law *(Ley Forestal)* (No. 462-2003), establishes the regulatory framework for forest resource protection and sustainable development (for dendro energy resources, regulations cover secondary forest management, energy plantation promotion and transformation of forest and agricultural by-products and waste); and
- Environment and Natural Resources Law *(Ley General del Medio Ambiente y los Recursos Naturales)* (No. 217-1996), stipulates that environmental impact assessments (EIAs) be prepared for power generation projects above 5 MW and transmission projects above 69 kV (Ministry of Environment and National Resources – MARENA is the regulatory authority).

Geothermal Exploitation

The Geothermal Resource Development Exploration and *Ley de Exploración y Explotación de Recursos Geotérmicos* Law (No. 443-2002) and its regulations, by putting in place a logically coherent framework for assigning geothermal exploitation rights, provide developers a concession regime for resource exploration and

[35] *Wind farms, established mainly on private lands, utilize wind, which does not require a concession for exploitation.*

development. Developers must obtain concessions from the INE. The application includes basic information on the developer's experience in geothermal development, and project aims and objectives. The concession is usually valid for three years (with available extensions, depending on the agreement between INE and the developer).

Once commercial amounts of geothermal energy are proven within the designated geographical area, the developer can obtain an exploitation concession within that area, gaining the right to produce commercial volumes of geothermal resources. After INE issues the exploitation concession, the developer can apply for an electricity generation license, authorizing him or her to build, own and operate an electrical power plant and generate electricity over the long term (usually up to 30 years). Once INE approves this license, the developer must pay the State a granting right fee equal to 0.1 percent of project assets and post a guarantee bond for 1 percent of the project's base assets, which remains in effect for one year after the scheduled completion of plant construction.

Although an environmental study or plan is not required for issuing a geothermal concession, all work done on the concession, as well as drilling activities, requires that MARENA approve all environmental impact applications and studies.

While Nicaragua's overall legal and regulatory regime for geothermal exploitation is satisfactory, two critical observations should be noted:

- *Land use*. A significant obstacle facing geothermal development in Nicaragua involves land use. The Environment and Natural Resources Law (Article 106) states that "renewable and nonrenewable natural resources found in legally protected areas will not be subject to exploration and exploitation." Geothermal development will, therefore, be severely impeded if the Nicaraguan government enacts the protected areas regulation, which expands many existing nature reserves and establishes new municipal and national parks, whose boundaries will be defined by all lands above 300 meters in elevation. If the regulation is adopted, most prime geothermal development targets would lie within lands with restricted development use.[36] The Nicaraguan government must seriously consider the effects of such sweeping proposals for protected area status; it should perhaps consider joint use lands as a way to address the manifold uses sought (for example, Kenya's geothermal development); and
- *Licensing fees*. INE application fees for electricity generation licenses are higher for RE projects than conventional ones because they are fixed according to the investment size rather than power capacity.

Water Resources Exploitation

The legal basis for water concessions, suspended in 2002, is the subject of the Water Rights Bill *Anteproyecto Ley del Uso de Agua-2003,* which replaces water rights sections of the General Law on Natural Resources Exploitation.[37] Adoption of the new Water Rights Law has been delayed by conflicts between stakeholders and public institutions that regulate water rights among various uses, including hydropower generation.

[36] *Law No. 272 establishes electricity-industry activities as indispensable for national progress and of national interest. The Environment Law permits natural resource exploitation in national parks, where prime geothermal resources are located, provided it is done in accordance with an approved environmental management plan. In practice, however, these measures may not suffice.*
[37] *The Electricity Act of 1998 exempts hydropower plants below 1 MW from having to obtain water-use concessions.*

Two major challenges are:

- Potential investor risk in watershed areas vulnerable to reduced natural flow. Under the Water Rights Bill, authorities may suspend, revoke or modify valid hydropower concessions in areas of reduced natural flow (induced by climate change) to ensure fair and equal resource distribution. Such action, in turn, may economically harm hydropower project performance and increase investor risk (particularly since water for human consumption is a stated national priority). It addition, banks may be less willing to finance such projects; and
- Lack of clear definitions, inter-institutional coordination and transparency. The approval process for hydropower projects is complex, requiring authorizations by multiple institutions.[38] But respective authorities often lack sufficient technical criteria to justify their decisions. Without clear definitions and transparent decision-making criteria (for example, for ROR schemes), otherwise qualified proposals and applications may be rejected.[39]

Power Market Rules

Bidding for Generation

Nicaragua's bulk power market rules are biased against RE generation bidders in two ways: 1) they do not favor concluding long-term PPAs;[40] and 2) they pay no premium for protection against the risk of price volatility or future upward shifts in contracted power prices.

Union Fenosa's bid evaluation method for medium-term PPA tenders does not adjust for differences in the price risks of offers.[41] For the off-taker, diesel power generation bids carry two risks: 1) price volatility; and 2) risk of higher prices per kWh over the next 10-20 years, compared to the previous 10-20 years. With regard to price volatility, from November 2000 to June 2003, average power market prices varied between US$34 and 59 per MWh for the spot market (averaging US$46.5 per MWh) and US$60 and 71 per MWh for the bulk market. In terms of higher prices for imported fuel oil and diesel, average monomial prices (per kWh) over a three-year period were US¢7.3 (2004), US¢8.8 (2005) and US¢9.6 (2006). This trend illustrates the risk of a long-term upward shift in international fuel prices, which most experts have come to accept.

Various methods are used to price risk differences for volatility. One approach uses the market price of hedged fuel prices as fuel price in the financial-economic modeling of levelized power plant prices. If consumers and the government value long-term price stability, a comparison of the levelized cost of renewable to diesel/fuel oil-fired

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[38] The Ministry of Development, Industry and Trade (MIFIC) is responsible for aspects related to water of use concessions. The Water Rights Bill created the Nicaraguan Water Resources Council (CNRH) as the planning entity for hydrological resources. Within the MIFIC, the Natural Resources Administration (DGRN) (via AdAguas) acts as the administering entity for hydrological resources in coordination with MARENA, Nicaraguan Institute of Territorial Studies (INETER) and Ministry of Agriculture and Forestry MAGFOR.

[39] CNE, however, managed to push through adoption of the Hydropower Promotion Law in 2003, which enables ROR hydropower plants up to 5 MW to obtain the necessary water rights from MIFIC. The 2005 Law Amending the Hydropower Promotion Law expands this option for plants up to 30 MW.

[40] RE generators need long-term PPAs because they face higher market risks than coal-gas, and- diesel-fired power plants. They have a higher upfront investment per future kWh output and less protection against the effect of lower prices on the spot market because of low variable costs of operation. For a thermal power plant, less revenue from a lower spot market price is offset by lower operating costs, whereas the net revenue of an RE generator is hit fully: the highs and lows of spot prices are usually caused by variations in the prices of imported fuels for generation, except on markets with a high share of hydropower generation, where they can be caused by filled reservoirs due to heavy rainfall; yet, even in that case, the diesel power plant, being outpriced, saves its variable costs of generation. The positive side of price uncertainty is that RE generators benefit fully from higher-than-expected, spot market prices. Yet, even if that risk reward is sufficiently attractive for an equity investor, lenders usually base their decisions on conservative estimates of future uncertain revenues and, on top of that, request a risk premium. Thus, the ability of RE-based generation projects to reach financial closure depends on their capacity to show a signed long-term PPA with a fixed tariff.

[41] The "externality" problem in this case is that the price volatility hits consumers, the national economy and RE generators (due to higher net revenue uncertainty) but has little effect on diesel generators as long as price volatility is caused by variations in the price of imported fuels.

generation should be based on a hedged fuel price input, rather than an uncertain fuel price forecast. Instead of relying primarily on uncertain, long-term forecasts of spot prices for imported fuels, CNE power planners (and Union Fenosa under INE regulations) can use prices that are locked in through futures; swaps; or fixed price, physical supply contracts ("forward prices"). A US study of the difference between spot and forward prices (premium for price stability) of natural gas contracts ranges from US¢0.05 to US¢0.08 per million British thermal unit (MMBTU) (Bolinger, Wiser and Golove, 2004). Assuming a highly efficient, gas-fired power plant, this adds US¢0.04 to US¢0.06 per kWh to the levelized cost of the power plant.

Another approach to modeling the cost of price volatility – or, conversely, the value of reduced price volatility – is to apply the modern portfolio theory,[42] making use of the capital asset pricing model (CAPM) to derive discount factors for various levels of uncertainty (Awerbuch and Berger, 2003). Using lower discount factors for uncertain fuel costs increases their net present value (NPV) and, thus the cost of production (per kWh) of plants using these fuels. This approach assumes that a portfolio of assets is the best way to hedge possible future outcomes to handle uncertainty. From this position, it follows that conventional and RE sources are best evaluated not on the basis of their stand-alone cost, but on that of their portfolio cost (that is, their cost contribution relative to their risk contribution to a portfolio of generating assets). The numerical results from such simulations yield even higher value estimates of reduced volatility and can include the value of the protection against long-term shifts in the average fuel price.

What the 2000-2006 experience bears out is that the costs of risk from uncertainty are real. With the benefit of hindsight, any observer can see that concluding long-term PPAs with Union Fenosa would have resulted in lower average power tariffs, at least during this period, and reduced price volatility.

Intermittent Supply Rules

Given that wind energy is an intermittent source of power supply, the entry of wind farms on Nicaragua's bulk power market has several implications.

Underestimated Capacity Value

First, according to Nicaragua's market rules, an intermittent supply source is not entitled to a capacity payment in either the contracts market or short-term capacity market, which is settled daily. For wind farm developers, the relevant benchmark for comparing wind energy's price competitiveness is the spot market price.[43] The market rule underestimates the capacity value of wind farms.[44] A power system must have sufficient reserve capacity to cover the demand for peak power when units are hit by unscheduled production stops. The wind farm capacity to reduce investments in thermal power capacity, while keeping the loss of load probability constant, is debatable. Because the de facto power output of installed wind farm capacity depends on wind, it is not firm capacity like thermal power. Wind farm

[42] *Modern portfolio theory (sometimes referred to as mean-variance analysis) emphasizes that risk is an inherent part of higher reward. It shows how rational risk-averse investors use diversification to optimize their portfolio, and how an asset should be priced, given its risk relative to the market as a whole. According to the theory, it is possible to construct an "efficient frontier" of optimal portfolios offering the maximum possible expected return for a given level of risk.*

[43] *In 2000-2003, the spot market price averaged US$2 lower per kWh than the monomial price.*

[44] *The term capacity value refers to the savings in investment in new conventional power generation capacity made possible by the availability of wind farm capacity. Wind power's load-carrying capability is expressed as a percentage of the rated megawatt capacity of the wind farm.*

output can be zero at any time, a fact that has led few power system planners to conclude that wind farms have no effect on investment in thermal power capacity; but this view is simplistic. An optimized power expansion plan aims at the level of capacity, which provides the system the optimal loss of load probability or load expectation.

Probability analysis is multiplicative, not additive: what is the probability that the large thermal unit shuts down on that rare day of peak consumption when all wind farms are not producing? Sophisticated power system simulation models can estimate thermal power investment needs for cases with and without wind farm production. Simulations show that the capacity value for low levels of wind farm penetration is roughly equal to the wind farm's capacity factor[45,46] but that it falls rapidly at higher levels.[47] The country's market rules, therefore, fail to pay wind farms the full value of their supply to the power system.[48]

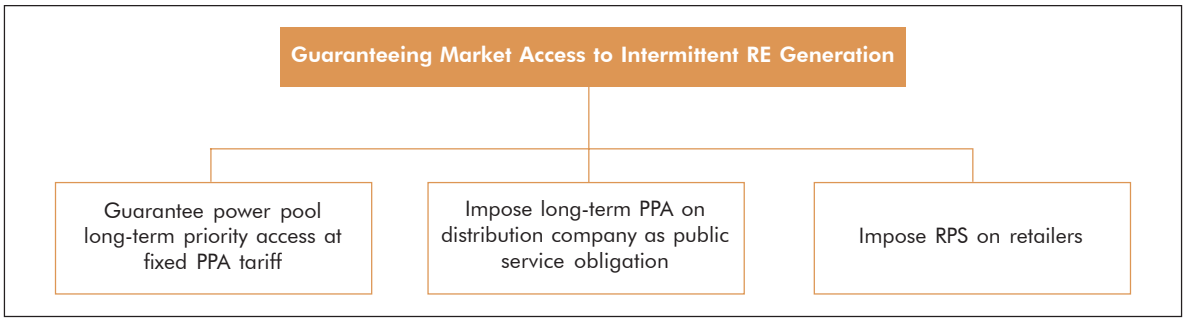
Low Capacity Factor

Second, wind farms have a lower capacity factor than thermal power plants. Therefore, the requirement of 5 percent of installed capacity reserve presents wind farms a greater financial burden.

Seeking Rational Penetration Targets

Third, the cost of intermittent power supply to the national operating system increases with the size of wind power penetration of the national power market. The need to contract thermal spinning reserves and other regulating power increases. Finding the maximum, economically rational penetration target is a challenge. It makes little economic sense for installed wind farm capacity to be larger than off-peak demand (that is, excess supply from peak production during those periods would be dumped). A recent CNE-supported study recommended installing no more than 50-60 MW of wind farm capacity during the next few years; after the first tender for 20-40 MW of capacity and before authorizing each new wind farm project, it recommended that CNDC conduct a detailed study to establish the effect of additional capacity on the transmission system and the power market's absorption capacity (Jiménez and Povedano, 2003).

Figure 4.1: CNE Options for Intermittent Power Access



[45] The capacity factor is equal to the ratio of average to rated power of the wind farm (equal to the annual delivered MWh to the grid, divided by the installed megawatt times 8,760).
[46] Since capacity-credit results depend heavily on what happens during the utility's peak hour(s), most calculations determine the average capacity factor for the upper 10-30 percent of hourly peak loads. Some refine the analysis by calculating the capacity factor for the hours during which the risk of not meeting the load is highest.
[47] In Ireland, simulations based on an annual capacity factor for wind energy (up to at least 800 MW) resulted in a capacity-credit of about 20 percent. An early paper on the Electricity Supply Board (ESB) system determined a capacity-credit of 35 percent of wind capacity for the first few MW (that is, approximating the annual capacity factor), falling to 14 percent for 2,000 MW and 11 percent for 3,000 MW; see Commission for Energy Regulation/OFREG NI, p. 40 (2003).
[48] In the United States, standard market-design rules proposed by the Federal Energy Regulatory Commission allow wind farms to participate in the capacity market. For example, PJM Interconnections allows wind generators to claim and sell capacity credits within its six-State operating area, providing wind generators revenue of about US¢0.01 per kWh. Capacity value is based on a three-year rolling average of a wind farm's performance during PJM's peak hours.

Intermittent power supply also affects micro and small hydropower output. Plants of up to 50 MW capacity are ROR, without seasonal storage capacity (any storage is for regulating daily peak load). Thus, in the case of hydropower, intermittent supply is seasonal (after the rainy season, for example, supply may drop to zero during all or part of certain days).

CNE's Challenge

For CNE, the challenge posed by intermittent wind energy and small hydropower output has been to identify the ideal protected or mandated market arrangement. In theory, it could have chosen among three alternatives (Figure 4.1).

Introducing a renewable portfolio standard (RPS), accompanied by green certificates for trading, made no sense in the Nicaraguan context. The power market is too small; furthermore, it is dominated by a monopsony buyer.[49] Imposing on the distribution company the public service obligation of holding a tender for a specified amount of wind farm capacity and signing a long-term PPA with the least-cost bidder was feasible, but not ideal. First, selling intermittent supply to the spot market, where short-term wind energy fluctuations can be treated as negative demand, is more rational than selling projected output through long-term PPAs with a final off-taker. Second, it would lead to the question of how surcosts arising from the PPA could be assigned to industrial firms purchasing their power directly from the bulk power market. Third, Union Fenosa's weak financial situation would lead banks to impose a risk premium on wind farm loans. Thus, CNE opted to provide intermittent suppliers long-term priority access to the power pool at a fixed PPA tariff.

Under Presidential Decree 12-2004, wind farm and ROR hydropower projects (installed within six years of promulgating the decree) are guaranteed priority access to the power market at a fixed tariff per kWh, valid for 12 years from start-up of operations[50] (tariffs are US$5.5-6.5).[51] CNDC administers the market arrangement, paying the hydropower plants for their kilowatt-per-hour supply and charging electricity purchasers costs above the power pool price on a pro-rated basis, in accordance with their market purchases. INE is entrusted with the task of adopting the necessary rules and regulations for implementing this policy (by resolution of the INE Advisory Council).

The scheme provides RE generators two benefits: 1) eliminating market risk (certainty of average kilowatt-per-hour tariff); and 2) reducing the payment risk for supplied energy (compared to the alternative of long-term PPAs with Union Fenosa). For wind farms, the proposed procedure is as follows:

- Developers apply to INE/CNE. If more than one developer expresses interest in setting up a 20 MW wind farm, CNE and INE will organize a tender for a 20 MW wind farm. The bidder requesting the lowest tariff gets a wind farm generation license from INE, which defines the terms of the PPA ;
- ENTRESA (the State-owned national transmission company), through its CNDC, pays RE generators for their supply, and

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[49] GPS (2006) recommends that Nicaragua develop a separate market by establishing a RPS of 30 percent in 2006 and 40 percent by 2013. Either CNE or Union Fenosa could be chartered the task of collecting/holding the RECs associated with new renewable generation. In turn, they would be expected to market the RECs to the highest bidder, with proceeds used to offset the higher cost of renewables in the Nicaraguan market. This recommendation, however, overlooks which market Union Fenosa should target (the five industrial firms with direct access to bulk power purchases are tiny and lack the liquidity for efficiency).

[50] DNE could have introduced the option of paying RE generators a fixed "green" premium (to be received on top of the spot market price). To preserve part of the fixed price advantage, the premium could have been subject to a limit on the total monthly average remuneration per kWh (for example, US$70 per MWh). Based on spot market prices from November 2000 to June 2003, an RE wind farm premium of US$10 per MWh would have resulted in an average revenue of US$56 per MWh. While the procedure would have brought payments to RE generators more in line with daily spot market prices, it would have increased the risk to RE generators and reduced the RE price stabilization effect.

[51] Originally, the maximum price for hydropower was US$5.9 per kWh.

charges any financial losses on it (that is, the difference between the fixed PPA tariff and the power pool prices) to off-takers from the power pool on a pro-rated basis, according to their purchase levels; and

- Developers can apply to set up additional wind farms in future years. But project authorization requires, as part of the proposal process, that they finance a system impact study that proves that the integrated power system can economically absorb the wind farm.

It remains unclear how future negotiations between CNE/INE and project developers will occur. It is also left open how project developers will finance system impact studies when more than one investor is interested in a follow-up license.

Asking developers to pay for the study before the project is tendered is unattractive to losing bidders (unless the winning bidder covers their costs). Since it is expected that more than one developer will apply for a follow-up license, it is more rational for CNDC to finance and prepare the system impact study and recuperate the cost from the winning bidder by asking him or her to cover the study cost as part of the license fee.

Grid Connection Rules and Prices

Grid connection rules encompass several elements. They involve the right of RE generators to connect to the transmission system or distribution grid. They also cover the terms of connection cost, whether the pricing policy applied is "shallow" (covering direct cost only) or "deep" (also including the cost of grid reinforcement). In addition, they involve transmission cost, which is fixed by a national "postage-stamp" tariff policy. For other issues, INE, in consultation with CNE, develops rules and regulations.

Is a Mandated Market Needed?

Mandated market instruments are rules imposed on the power market that give RE generators access to the market on preferential terms. Such instruments take many forms, the main distinctions being between feed-in tariffs, tradable green certificates/RPS and periodic tenders for specified types of RE generation.[52] Mandated market instruments are introduced to address specific weaknesses of RE generators that prevent them from competing efficiently in the market.[53] An example is Presidential Decree 12-2004, which gives intermittent wind farm and small-scale hydro generators in Nicaragua guaranteed market access (that is, they may bypass general rules for selling power to the market).

Discriminatory pricing rules prevent RE generators from obtaining prices for their output that reflect their value to consumers and the national economy. Eliminating such rules from Nicaragua's power market should, in principle, suffice for RE generators other than wind farm and small-scale hydro to out-compete diesel generators.

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[52] *See Annex 3 for a review of international experience with RE promotion schemes.*

[53] *Mandated market instruments were developed for countries where – unlike Nicaragua – the production costs of RE generators (other than medium- and large-scale hydropower) are not competitive with the supply prices of conventional power plants. These countries promote RE penetration in the power market in order to reap environmental benefits, improve security of supply caused by a reduction in imported fuels and reduce the production cost of future RE systems since creation of a larger market is expected to accelerate RE product development and productivity increases. In that context, the mandated market tool has the dual purpose of 1) creating a niche or start-up market for beneficiary RE generators, giving them a larger share than a purely commercial market would permit; and 2) financing the subsidy burden of increased RE penetration through higher electricity bills, thereby replacing the need for taxpayer-financed incentives.*

Yet, the question remains: could Nicaragua benefit from mandating a minimum market for RE generation, including geothermal and hydropower plants?[54] The goal would not be to create a niche market for RE generators; rather, it would be to transform RE generation into the country's dominant source of power supply. RE could be broadly justified as the least-cost source of power supply, which could relieve investor uncertainty. The mandated market would be faster and more cost-effective than investment incentives, which could be eliminated.

Standardized Administrative Procedures

What Is Nicaragua's Concession Policy?

Geothermal and hydropower projects are constructed on State-owned land. They are subject to a dual authorization regime: a concession for exploitation of the natural resource and a license for power generation.

For hydropower plants and wind farms, resource exploitation and power generation functions are united in a single production unit;[55] for geothermal energy, however, resource extraction and power generation are separate functions: hot water extraction and steam production for power plant generation. This opens up the possibility that a geothermal exploration and development company holding the concession for resource exploitation would undertake heat extraction, while a power company holding the license for producing electricity at the site would produce electricity using the heat resource. Contractual arrangements between the two parties can vary (GPS 2006). The geothermal company can sell heat to the electricity plant. Under a tolling arrangement, the geothermal heat extraction company provides steam to the power plant at no cost and accepts power generated from the plant against a conversion fee. In Nicaragua, the most likely scenario is that a single geothermal power company would undertake both functions, holding both the concession and the license.

Because geothermal and hydropower projects exploit a public resource on public land, the question arises: what policy should Nicaragua pursue regarding ownership of a geothermal energy or hydropower plant when the concession and the license end after 20-30 years? The transfer arrangement sure to create the highest NPV for the State as resource owner is build, own, operate, transfer (BOOT), whereby the State becomes the plant owner at the end of the concession period free of charge. In this case, it must be decided at the project outset who the assets recipient will be at the end of the concession and license period. The most logical candidate is ENTRESA, the State-owned holding company.

At the time of transfer, ENTRESA has several options. It could arrange for an extension with the developer. Alternatively, it could sell the project to a third party. An open auction to the highest bidder, with both the original developer and prospective third parties invited to bid, might provide the highest value to the Nicaraguan government.[56] A third option would be for ENTRESA itself to operate the hydropower or geothermal power plant. In the case of a geothermal plant, ENTRESA would have a fourth option: It could sign a management and operating

[54] The indicative expansion plan (IEP), prepared and published by CNE, identifies various RE projects as the least-cost option for new power generation capacity. Although the 1998 Electricity Act stipulates that investment in new power generation must consider CNE's IEP in practice, this regulation has proven too soft to serve as a mandated market tool for RE generation. It does not prevent potential investors in conventional power generation from tendering and winning bids for new PPAs, as long as INE is willing to issue generation licenses to new conventional thermal power plants.

[55] Except for multipurpose dams, which are constructed for irrigation and/or as storage reservoirs for potable water; small hydropower plants are attached to such dams.

[56] If that option is selected, GPS (2006) suggests that auction revenue would be in lieu of royalties during the initial contract period.

contract with the company handing over plant operation and undertake the power production function. The Nicaraguan government must decide these transfer arrangement issues before a concession contract is signed.

Prefeasibility Study Licenses

Power station and transmission facility projects using RE require that INE issue a temporary license for a maximum period of two years. The project developer must pay INE a fee equal to 0.1 percent of the total investment. The current law does not provide for an extension of the temporary license. However, if resource data must be gathered, the two-year period is insufficient. The option of extending the license (up to five years for hydropower) should be introduced at the investor's request.

Contracts and Bidding Procedures

An effective way to reduce transaction costs, investor uncertainty and time spent on project preparation and implementation is to prepare standard documents for most anticipated contracts. Important documents include (but are not limited to) the following:

- Concession documents for the exploitation of hydropower and geothermal resources;
- Contracts for BOOT or build-own-transfer (BOT) arrangements;
- Grid connection contracts with ENTRESA and distribution companies;
- Contracts for transmission and power wheeling (for example, RE generator connected to a distribution grid);
- PPAs with Union Fenosa;
- Supply contracts with CNDC for intermittent power;
- Construction permits; and
- Formats for EIAs.

Several documents already exist in standard format, while others are in table-of-contents format; their formalization is a future area of high public return.

CNE and Union Fenosa could jointly establish a standardized contract program, which would periodically solicit power supply bids from developers. Timing of the requests and the amount of capacity requested would be determined by a planning process based on growth in peak-and base-load demand. Economies of scale would be an important consideration in solicitation size. Based on expected load growth, solicitations would be made every two-to-five years for 50-100 MW. The planning process would anticipate needs approximately five years ahead (the time required to develop a power plant).

Allowing bids from planned geothermal power plants to reserve the right to bid at defined points in the future would allow a developer to take advantage of economies of scale and reduced risk through knowledge of the geothermal resource to provide a competitive bid. Similarly, this could allow ENTRESA to build the expected incremental capacity into transmission lines, thereby realizing its own economies of scale.

Standardized contracts would be completed within five years. For oversubscribed solicitations, CNE and Union Fenosa would negotiate first with the bidder with the lowest offering price. Otherwise, pricing would be negotiated into standardized contracts or set in advance by them.

One-stop Shop for Developers

The Renewable Energy Promotion Bill of 2005 anticipated establishment of a one-stop clearinghouse (a function that CNE might perform), which would serve as a focal contact for coordinating interventions by government institutions involved in RE project planning and approval. The clearinghouse would support developers in securing access to financing by expediting licenses and concessions, land acquisition and access to foreign technical assistance. Implementing this function

would require providing CNE an adequate financial budget.

Local Approval Regulations

Typically, weak local planning guidelines and procedures for EIAs delay progress in project implementation around the world. In Nicaragua, local responsibilities (as listed in the Municipalities Law [Article 7]) include issuing opinions on contracts and concessions that aim to exploit natural resources in the municipality. Before it can issue a license or concession, the issuing body must receive the opinions. While local authorities' involvement in RE project approval is marginal, it must be tested, in practice, whether local land use regulations and construction permits pose problems for project implementation.

Incentives Regime

Government's Risk-sharing Role

The Nicaraguan government has an essential role to play in RE risk-sharing. It can accelerate the commercial development of geothermal energy and hydropower by taking on high-risk investments in upfront resource development. For geothermal energy, this means investing in geological and geophysical programs, heat-flow surveys and deep-exploration drilling to evaluate and promote resource areas. For hydropower, it means investing in water-flow measurements and prefeasibility studies. Ultimately, private investors who take on the subsequent development of commercially interesting sites must cover the cost of this investment. Private investors could pay a royalty after the first 10-15 years of operation, when project debt is paid off (or substantially paid down). In the area of government-financed resource surveys, Nicaragua has advanced far.[57]

To encourage foreign investment, the Nicaraguan government – like governments throughout the developing world – must finance geothermal energy and large-scale hydropower projects based on long-term PPAs with sovereign government guarantees.[58] Offering long-term PPAs, together with innovative pricing structures, will permit higher returns in early years to pay down the large debt required for such projects, combined with lower pricing in later years. The government has already adopted this approach for wind farms and hydropower plants of up to 5 MW by introducing a 12-year PPA contracts (after this period, investors must rely solely on the free market).

Investment Incentives

CNE has struggled to introduce economic incentives for RE investments through a variety of ad hoc laws, presidential decrees and regulations. The most important of these have been the Hydropower Promotion Law and Decree No. 12-2004 (Supporting Wind Energy and ROR Hydro). CNE recognizes that the piecemeal approach has not worked and that transparency has been inadequate. Thus, it has amalgamated the incentives already adopted into the RE Promotion Law, adopted by Parliament in late 2005[59] (the same fusion of incentives was undertaken a year earlier via Presidential Decree 13-2004 (Establishment of a National Energy Policy). The RE Promotion Law exempts new projects (for a 15-year period from adoption of the law) from paying import duties and taxes and value added tax (VAT) on equipment, materials

[57] *CNE, in close coordination with INETER, should decide on immediate steps to secure and improve river-flow measurements for high priority sites listed in the project investment guide. This may require that CNE acquire appropriate software for evaluating flow measurement data and conduct training in applying respective methods.*
[58] *Financing projects with corporate guarantees from Union Fenosa is not feasible (Union Fenosa in Spain refuses to do so, and the distributor cannot provide lenders the creditworthiness they seek).*
[59] Ley para la Promoción de Generación Eléctrica con Fuentes Renovables.

and other accessories for isolated-system generation, transmission and distribution. It also exempts these projects from paying income taxes (for a seven-year period after start-up of commercial operation). No municipal taxes are owed during construction and the 10-year period after start-up of commercial operations. No stamp duties are owed for 10 years, and all taxes related to natural resource exploitation are waived. In addition, wind energy and ROR hydropower projects are not required to provide reserve and balancing capacity.

According to Jiménez and Povedano (2003), the combined value of these incentives amounts to US$3 per MWh for wind farms, which is generous. Yet, since nothing is wrong with the basic economic cost-competitiveness of RE generators, the incentives are somehow misplaced, reflecting regulatory failure.

Subsidized Infrastructure

Wind farm, hydropower and geothermal projects can provide new regional and local infrastructure in the form of access roads and transmission lines. Access roads can benefit many local economic activities beyond the RE project. Transmission lines may make it economically viable to expand grid service to previously unconnected rural communities or those served by isolated, diesel-powered grids. In such cases, cost-sharing of infrastructure investments by private RE investors and public budgets may be justified. However, the effectiveness of such subsidies in promoting new RE projects depends on whether cost-sharing is required to make marginal projects financially viable for the private investor. Such a situation is limited to small-scale RE projects. Currently, CNE has no specific policies in this area, but one may expect flexibility if the need arises. Payments for deep-connection costs are a separate issue, as they can determine the commercial viability of even mid-sized RE plants.

Project Finance Conditions on National Capital Market

Nicaragua's local capital market is incapable of providing long-term financing of investments in geothermal energy and hydropower plants and wind farms. In addition to the high cost of finance, the country's banking sector is plagued by a liquidity squeeze and bad loans in its portfolio; both factors limit banks' ability to finance new investments, particularly larger-scale ones.[60] This situation, in turn, reduces local investors' ability to engage in RE projects, making the investment level in Nicaragua too dependent on foreign perceptions about the country's investment climate. In addition, it leads to a large part of the annual value, added from projects and foreign exchange savings, being transferred abroad. In short, the local-capital-market barrier reflects a vicious cycle,[61] justifying the case for assisted market development.

Despite the national capital market's scarcity of long-term financing on reasonably good terms, large-scale RE investments have precisely that level of demand-side quality that can bring forward a supply of good project financing. Financial assets that derive their income from RE projects and have long-term PPAs with reliable off-takers offer financial investors seeking long-term, low-risk assets an ideal profile.

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[60] By law and in light of their precarious balance sheets, Nicaraguan banks in the late 90s had to restrict individual lending to a maximum of US$1 million. In 1997, the nominal interest rate was 24 percent, while inflation was 9-10 percent.

[61] Nicaragua lacks a capable capital market because of insufficient demand from private industry and services and no demand from high quality, large-scale infrastructure projects for long-term local financing. But such projects seek financing from abroad for lack of a local capital market capable of providing long-term financing.

CNE and traditional collaborating development banks are aware of the situation and the benefits of introducing new forms of project finance and risk instruments on the national market. But because of Nicaragua's difficult financial and debt situation, these partners can provide only limited funds to State institutions.

Support to Local Supply Industries and R&D

The past 20 years has witnessed the Nicaraguan government's gradual loss of motivation to actively engage in a support program to build national research and development (R&D) and private consultancy, construction and developer expertise. One exception, however, has been decentralized rural electrification. In this area, the country has made great strides in building the expertise of NGOs, self-help organizations and communities. Even so, a recent hydropower study indicated that support was still needed in the following areas (Scheutzlich, 2004):

- Promoting the work of NGOs, cooperatives and communities in mini hydropower development for rural electrification;
- Building local expertise in planning, construction, operation and maintenance of complete mini hydro plants (up to 1 MW);
- Initiating technology transfer of micro- and mini-hydro turbine technology (mainly for Pelton and crossflow turbines), using proven designs;
- Supporting local manufacture of pico- and micro-hydro turbines (up to 100 kW) through workshops and craft centers;
- Promoting local manufacture of hydro-mechanical structures (for example, sluices, valves, gates and penstocks); and
- Promoting local manufacture of posts and electric accessories for the local, low-voltage distribution grid.

What Is Missing in Nicaragua's RE Policy?

Lessons from international experience suggest that two factors are critical for RE policy success: 1) a comprehensive regulatory framework;[62] and 2) government's adoption of published, quantified targets for RE penetration into the power market by specified years (Annex 3). This Chapter review shows that, by the end of 2005, Nicaragua's RE policy and regulatory framework contained many of the relevant building blocks but lacked critical fundamentals: quantified targets for RE penetration, adequate natural resource laws and appropriate power rules for tendering new generation.

Beyond CNE's Policy Drive

Faced with the difficulty of obtaining essential natural resource and RE laws passed by Parliament, CNE made use of presidential decrees and its power planning instruments to get an RE policy in place. But presidential decrees cannot substitute for the long-term regulatory certainty of a law passed by Parliament. Moreover, they cannot create such basic elements as a Water Law. The RE Promotion Law of 2005 and earlier RE decrees and regulations offer project investors generous investment incentives. But failure to correct fundamental flaws in the power sector regulatory framework render these incentives powerless. Within its scope of influence, CNE accomplished what was feasible. But the RE regulatory framework covers only the needs of smaller power systems. Outside the donor-supported area of small-scale RE for rural electrification, where projects have been implemented since 2000, Nicaragua has little to boast.

Not surprisingly, Nicaragua's experience – including difficulty in getting parliamentary adoption of a modern Water Law – is similar to that of other Central American countries who liberalized their power sectors in the 90s (Annex 3). These countries share an interest in designing rules for the regional power market that facilitate investment in RE-based generation in their countries (Box 4.1).

Box 4.1: Postreform: A Regional Perspective

Power sector reform across Central America in the 90s was based on privatization, liberalization and market forces. All six countries had signed regional policy declarations favoring RE. Ironically, by the end of 2002, RE share in total power generation was only 59 percent, 32 percent lower than in 1990 (ECLAC, 2004). Costa Rica – the only country not to have privatized its State- and cooperative-owned power sector – saw its RE share in generation rise to 98 percent; it fell in all other countries, with Nicaragua at the bottom (23 percent).

Private foreign investment went into oil-fired power plants and a single coal-fired plant. Major reasons were conventional energy's shorter gestation period and lower capital intensity, lack of clearly defined water rights and biased bulk-power-market rules. Like Nicaragua, El Salvador, Guatemala, Honduras and Panama faced difficulties implementing national legislation that could have transformed the reform process into a greater success. In hindsight, the backlash of poorly sequenced reforms proved costly (Walker and Benavides, 2003). Today, a decade after civil war and authoritarian rule, Central American countries have an opportunity to boost economic recovery through regional integration.

Beyond 2005: Policy Wake-up Call

By late 2005, Nicaragua's hitherto hesitant policymakers could no longer ignore the previous year's mounting international prices of crude and imported fuel oil. In response, the National Assembly adopted several laws:

- *Energy Service Stability Act (No. 554-2005) (Ley de Estabilidad del Servicio de Energía Eléctrica en el País)*. This law aims to reduce the sociopolitical effect of rising transport and power prices. It introduces a series of short-term emergency measures to remain in effect as long as the price of crude oil remains above US$50 per barrel and fossil fuels' share of power production is higher than 50 percent. It eliminates power sector import duties and taxes on fuels, keeps tariffs for up to 150 kWh per month at the early 2005 level,[63] and introduces power plants to price controls for fuels and power prices in the spot market. In addition, it makes theft of electricity illegal, authorizes the government to take credits from the international financial market for investments in RE projects and creates two energy funds: Fund for the Development of Energy Investments and Energy Crisis Fund;
- *Renewable Energy Promotion Law (No. 532-2005) Ley para la Promoción de Generación Eléctrica con Fuentes Renovables.* Beyond declaring RE to be of "of national interest," this law requires the distribution company to tender 10-year PPAs with RE generators. It also provides generators selling on-the-spot market more favorable terms (by confirming the US$5.5-6.5 per kWh); and
- *Amendment to the Promotion Law for Hydropower (No. 531-2005) Ley de Reforma a la Ley 467 de Promoción al Subsector Hidroeléctrico*. Adoption of this law authorizes the

[62] *A comprehensive RE framework must comprise: 1) clear rules and regulations to enable RE generators to connect to the grid and sell the power market their output on acceptable terms; 2) financial incentives for investment and power sales; 3) clear procedures and guidelines for project planning and central-and-local project approval; and 4) access to project finance.*
[63] *Financed from the VAT revenue on power sales; distribution companies withhold the cost of required subsidies from their VAT payments to the treasury.*

Ministry of Development, Industry and Trade (MIFIC) to grant ROR hydropower plants up to 30 MW water rights after consultation with the pertinent local authority.

These laws, to a certain degree, build on CNE's earlier policy efforts. Law No. 554-2005 takes an important step by declaring theft of power an illegal act. Law No. 531-2005 expands on the Hydropower Promotion Law (No. 467-2003) *(Ley de Promoción al Subsector Hidroeléctrico)* by increasing the plant size limit for granting water rights (from 5 to 30 MW). On the other hand, Law No. 532-2005, which echoes the economic incentives of earlier presidential decrees, lacks quantified RE targets.

As this Chapter demonstrates, breaking the barriers to investment in RE requires moving beyond the status quo. Indeed, comprehensive and coherent policy initiatives and strategies are required to correct fundamental flaws.
The next Chapter's recommendations seek to fill this policy gap.

5. Breaking the Cycle: Renewable Energy (RE) Policies and Strategies

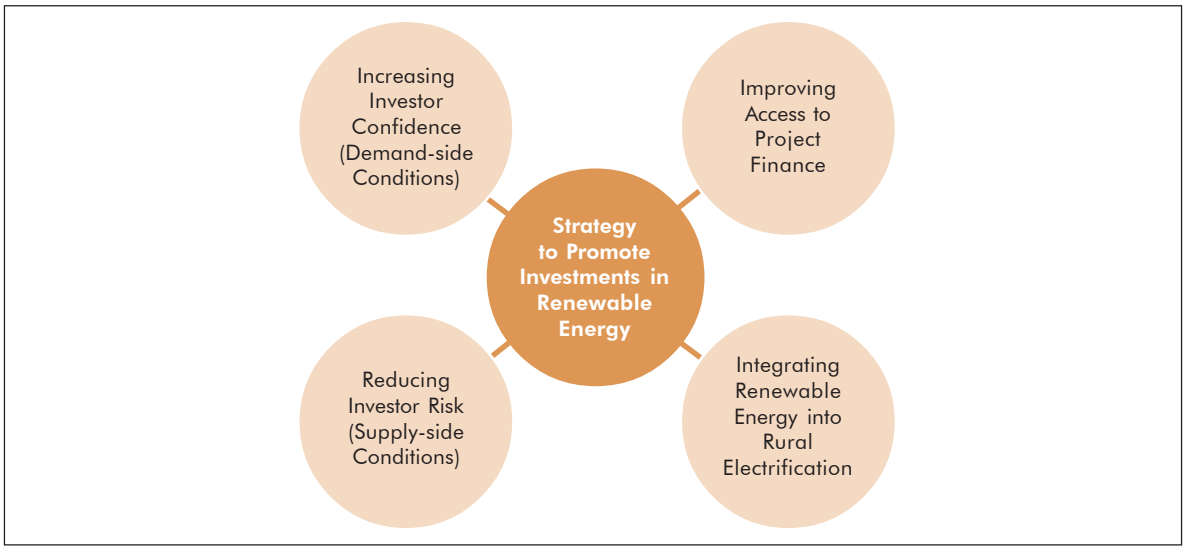
To move towards a more virtuous circle of RE investment, the Nicaraguan government must initiate a comprehensive and coherent set of policies and strategies that unlock the country's RE potential and, at the same time, reduce political and regulatory risk for investors. To this end, two major policy initiatives are required:

- Elimination of the fundamental, legal and regulatory obstacles to investment in medium- and large-scale RE generation. For geothermal energy, this implies making adjustments to the National Park Law; for hydropower, it means adopting the new Water Rights Law; and
- Parliament's adoption of a RE law. This law sets minimum RE penetration targets in the national power market by 2010, 2015 and 2020; it also provides a coherent set of policy, regulatory and incentive measures to eliminate market-distorting barriers.

Fixing RE penetration targets is a vital tool for building investor confidence, rallying political support for adoption of the new RE and water laws and changes to the National Park Law, and maintaining the long-term momentum of national RE policy. Quantified targets can enable Parliament and the Nicaraguan people to hold their government accountable for progress towards achieving the targets.

The proposed strategy for promoting RE investment in Nicaragua offers a comprehensive, cost-effective approach to reducing demand- and supply-side barriers to investment, improving access to project finance and integrating RE promotion into the rural electrification policy (Figure 5.1).

Figure 5.1: Proposed Strategy for Promoting RE Investments



The strategy's four modules highlight two key terms: *comprehensiveness* and *risk management*. RE experience in Nicaragua and around the world has underscored the lesson that comprehensive – not partial – approaches are more effective at unlocking a country's RE potential. The strategy aims, above all, to eliminate investor risk of political and regulatory uncertainty.[64] In Nicaragua, reducing risk and uncertainty provides investors a stronger signal and is more cost-effective than investment incentives.[65] Indeed, investment incentives are a minor complementary and, in the end, dispensable part of the RE strategy: under the right regulatory conditions, RE investments in Nicaragua are fully competitive with thermal power projects. Next in importance are measures to reduce market risks for RE generators.

The RE risk mitigation policy, which cuts across the strategy's four modules, has five pillars:

Creation of a legal and institutional environment for the power industry in which project developers face minimal regulatory, off-take and shifts-in-policy risks.

- Promotion of the Central American power market to provide economies of scale for new RE investments and dismantle the monopsonistic structure of the bulk power market;
- Public investment in data collection on RE resources in Nicaragua and cost estimates for their project development made publicly available to investors;
- Public risk-sharing of upfront investments in RE project development; and
- Involvement of multilateral and bilateral development banks in providing credit lines and partial risk guarantees and political risk insurance for RE investments in Nicaragua.

Increasing Investor Confidence

On the demand-side, the strategy must respond to four off-take risks for RE generators. First, as mentioned in previous sections, Nicaragua's power market is small, dominated by only one off-taker. Second, annual growth in power demand is relatively low. Third, Union Fenosa, the major off-taker, represents a payment risk because of its large technical and nontechnical losses, which undermine the distributor's financial balance. Finally, in the absence of risk analysis and criteria, the country's tariff evaluation method in tenders for new generation is skewed towards thermal power. The proposed strategy's four recommendations, discussed below, aim at reducing off-take risk for RE generation.

Reduce Off-take Risk of Sales to Union Fenosa

Assist Union Fenosa in Reducing Distribution Losses

Issue. Union Fenosa's inability to resolve its problem of high system losses and low bill collection rates is caused, in part, by several interrelated factors beyond the company's control. These are: 1) a culture of theft among a minority of consumers; 2) absence of laws making electricity theft a criminal offense; and 3) absence of court capacity allowing a distribution company to take repeat offenders to court.

Recommendation. CNE, INE and the justice system should work with Union Fenosa in a collaborative spirit to find solutions that reduce the distribution company's losses and restore its

[64] *Traditionally, the literature distinguishes between the terms* risk *and* uncertainty *as follows: risk is subject to empirical measurement (described by the fluctuations around the average of a probability calculus), while uncertainty is nonquantifiable (the fluctuations of a variable cannot be described by a probability calculus).*

[65] *Project risk and uncertainty deter investments by increasing the cost of capital and hence the price of power from new projects. High risks lead to absence of investment if the risk premium makes a project commercially nonviable or project risk surpasses the risk limit of investors and lenders.*

financial viability.[66] The Energy Service Stability Act of 2005 *(Ley de Estabilidad del Servicio de Energía Eléctrica en el País)*[67] which declared theft of power – illegal connection, sale to a third party and meter alteration – an illegal act, was an important step.[68] A supplementary step forward would be to introduce a small case court for the rapid prosecution of repeat offenders.[69]

Use Risk- and Benefit-adjusted Prices in Tenders for New Generation

Issue. The 1998 Electricity Act requires that, at the start of each year, Union Fenosa have PPAs covering a minimum of 80 percent of forecast power demand for the year and a minimum of 60 percent of forecast demand for the following year. The PPAs must be secured through competitive bidding. Currently, the bid tariffs for new generation are compared without adjusting for the objective financial value of long-term fixed prices versus bids that link the offered tariff to development in the prices of imported fuels. Nor are the macroeconomic benefits of higher domestic employment effects and foreign exchange savings taken into account.[70]

Recommendation. CNE, INE and the Public Utility Superintendency should adjust the tender evaluation method to include the risk value of bids offering fixed tariffs for one-, five-, 10- and 15-year supply contracts. A study (drawing, inter alia, on results of financial portfolio theory and the CAPM) could be conducted to develop an objective method for quantifying the economic-financial value per kWh of fixed price contracts. Evaluation of bids would be based on shadow prices for power, which add the quantified value of price stability to the price per kWh of generators linking their bid tariff to developments in a fuel price index. This will lead to a more objective comparison of offers, giving renewable generators a fairer chance to compete. To date, Nicaraguan legislation has not introduced this adjustment. But the adjustment to the RE Promotion Act improves RE power's competitiveness by insisting that the price of tariff bids from conventional generators include duties and taxes in its calculation.

Introduce Power Brokers in the Bulk Market

Issue. Power brokers are market integrators; they broker the relationship between generators and large consumers by signing power supply contracts with the former and power sales contracts with the latter. Even if power brokers do not sign 10-15 year PPAs with RE projects, they reduce the off-take risk for generators by providing a free market for one to three year contracts.

Recommendation. To make the free market for bulk power more efficient, consumer transaction costs should be reduced when purchasing power from suppliers other than Union Fenosa, and the size of the free contract market should be expanded, the Nicaraguan government should encourage power brokers to enter the bulk market.

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[66] The instrument for reducing widespread theft raises the cost of theft to offenders: the probability of being detected, multiplied by the sum of reconnection costs and the penalty incurred by detection. Union Fenosa, through its commercial-loss-reduction initiatives, can increase the risk of theft detection and, through the systematic removal of installations, increase the cost of reconnection; but only the State can raise the penalty.
[67] This law introduced State-financed tariff subsidies for those consuming less than 150 kWh per month to mitigate the effect of high fuel prices on average power tariffs.
[68] The act reduced Union Fenosa's accepted level of distribution losses from 15 percent in 2005 to 14 percent in 2006, with a further 1 percent reduction in subsequent years.
[69] Bringing repeat offenders to the traditional court system is too expensive for Union Fenosa.
[70] While this is not an issue for industrial countries with high employment rates, creation of domestic value-add is an important policy objective for countries with high levels of underemployment.

Power brokers should be able to enter the power market as independent brokers and dealers, provided they register with INE and CNDC as market participants. Yet, because the Electricity Act does not mention the power-broker concept, a legal problem may need to be resolved (Annex 2).[71]

Use Appropriate Mandated Market Instruments

Issue. The mandated market instrument allows the designated RE portion of the bulk power market to bypass the free market scheme using rules that allow RE to be sold under privileged conditions. Applied appropriately, mandated market instruments can build investor confidence in the RE market and trust in the effectiveness of the regulatory and financing environment.

Recommendations. In Nicaragua's case, two "hard" mandated market instruments are appropriate: 1) a niche market for intermittent power supply from wind energy and ROR hydro; and 2) a 10-year moratorium on the construction of conventional power plants in order to develop the mass RE market.

Regarding the niche market for intermittent power, Presidential Decree 12-2004 offers priority access to the spot market at a guaranteed monomial price, valid for 12 years of operation, to an initial 20 MW of wind farm capacity and ROR hydropower projects completed within six years of promulgating the decree.[72]

Recommendations for the spot market arrangement (defined in Annexes to the generation license) include the following:

- CNDC administers the market, pays generators for supplied power and charges participants in the pool market surplus costs compared to spot market prices in proportion to their electricity purchases;
- The tariff range for the monomial price paid to eligible wind farm and hydropower generators is set at US¢5.5-6.5 per kWh; and
- The tariff formula in the tender documents may translate the monomial price into seasonal and daily peak and off-peak prices, maintaining the guaranteed price as a year-round average. This arrangement favors suppliers whose respective wind and water resources most closely match the profile of peak demand or who can combine wind energy with power from a new small hydro supply. It also brings prices more in line with movement in spot market prices, which facilitates CNDC's ability to assign incremental costs from intermittent supply contracts to individual market participants.[73]

Regarding the supplementary option to impose a 10-year moratorium (except for peak and balancing power purposes) on constructing conventional power plants, exploitation of potential geothermal and hydropower sites represents the least-cost expansion path for power generation over the next 20 years. The moratorium would reduce the cost of power supply by eliminating higher-cost conventional plants and reducing the risk of RE project investment.

Law No. 532-2005 provides CNE and the Superintendency the legal tools to implement such a moratorium. This law declares RE of national

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[71] *Similarly, Guatemala's electricity law makes no reference to powerbrokers.*

[72] *Growth in national power demand and aging of diesel generators calls for bringing 30-60 MW of new power capacity on line within the next two years. Power projects in advanced stages of project preparation comprise the San Jacinto geothermal power plant, three to four wind farms and two ROR hydropower projects. Getting enough of these projects implemented to satisfy demand for new capacity calls for a contracting framework that: 1) is fast; 2) provides more negotiating security than bilaterally-negotiated PPAs; and 3) is tailored to the characteristics of projects that have ready investors. Decree No. 12-2004 fulfills these requirements.*

[73] *Minimizing the differences between hourly pool prices and tariffs paid to wind farm-generated electricity also complies with the condition set forth in the Electricity Industry Law (No. 272-1998)* Ley de la Industria Eléctrica, *which states that RE prices should deviate little from free market prices.*

interest, confirms that RE is to be given priority in development of new generation projects and authorizes CNE and the Superintendency to impose an RE-percentage requirement on distribution company tenders for new capacity. Since the law does not place a fixed limit on the percentage requirement, it could be fixed at 100 percent for new capacity.[74]

Promote Regional Power Market

Issues. When completed in 2008, SIEPAC, the regional power market, will gain rapidly in importance, with RE-based generation providing the bulk of supply. CNE and INE collaboration with Central American counterparts in developing SIEPAC's structure and market rules will expand the potential market for medium- and large-scale RE generators, allowing them to sell their output through PPAs with several off-takers. The larger size of the Central American bulk power market will improve Nicaragua's RE investment climate, mitigate market risk and enable large-scale power projects to be implemented in the country.

In terms of coordinating power market rules, the two critical issues are how all countries can agree on: 1) rules that promote RE penetration into the Central American market; and 2) limits to the national economic incentives offered to RE investors to avoid a "race to the bottom," as each country tries to attract foreign investment toward development of its own resources. In a competitive Central American power pool, power tariffs will be defined by the marginal cost of power (that is, the cost of conventional power generation). Generous RE economic incentives, therefore, will not benefit consumers through lower tariffs, but simply increase the economic rents of developers who acquire the least-cost sites.

Recommendation. Nicaragua, which is well-positioned regionally in terms of the quality of its RE resource base, must put in place a regulatory, planning and project approval regime which is second to none in the region.

Reducing Investor Risk

Implementing these demand-side measures will go a long way toward increasing investor confidence in the existence of a market for RE-generated output. Yet, to increase the necessary competition in supply and reduce production cost per kWh of output from future RE generation, the Nicaraguan government must act to improve supply-side conditions for investment. The following six major areas of supply-side interventions are recommended.

Adopt Regulations for Resource Exploitation

Issue. Geothermal and water resources are considered national heritage, meaning that the State assigns project developers resource exploitation rights. To reduce investor risk, the assignment of rights and obligations in primary legislation and concession contracts must be done in a legally clear, ordered manner.[75] The recommendation here aims to provide investors needed clarity and eliminate ambiguities.[76]

As the Natural Resources Law failed to properly assign water rights unequivocally, the legal basis for water concessions (except for hydropower plants under 1 MW) was suspended in 2002. A first step toward correcting the situation was adoption of Law No. 467-2003 and its

[74] Mandated emphasis on RE and introducing a positive RE bias in tenders for new generation raise the issue of how sufficient competition can be introduced in such tenders.
[75] It should be noted that, in cases of conflict, primary law takes precedence over contract law.
[76] In the water-management field, the main challenge is equal and fair distribution of water resources in a given watershed area for which the natural decrease of water flow, caused by climate change, is the main risk. The new Water Rights Law addresses this issue by allowing authorities to suspend, revoke or modify valid concessions in cases-of-natural flow-reduction. The concession defines the compensation in such cases.

adjustment in late 2005 (No. 531-2005), which authorize the MIFIC to grant water rights to ROR projects up to 30 MW.

Recommendation. The new Water Rights Law must be approved immediately. Until this law is adopted, investor interest in larger hydropower projects with storage capacity will remain blocked.

Streamline Approval and Planning Procedures

Agreed-on Actions

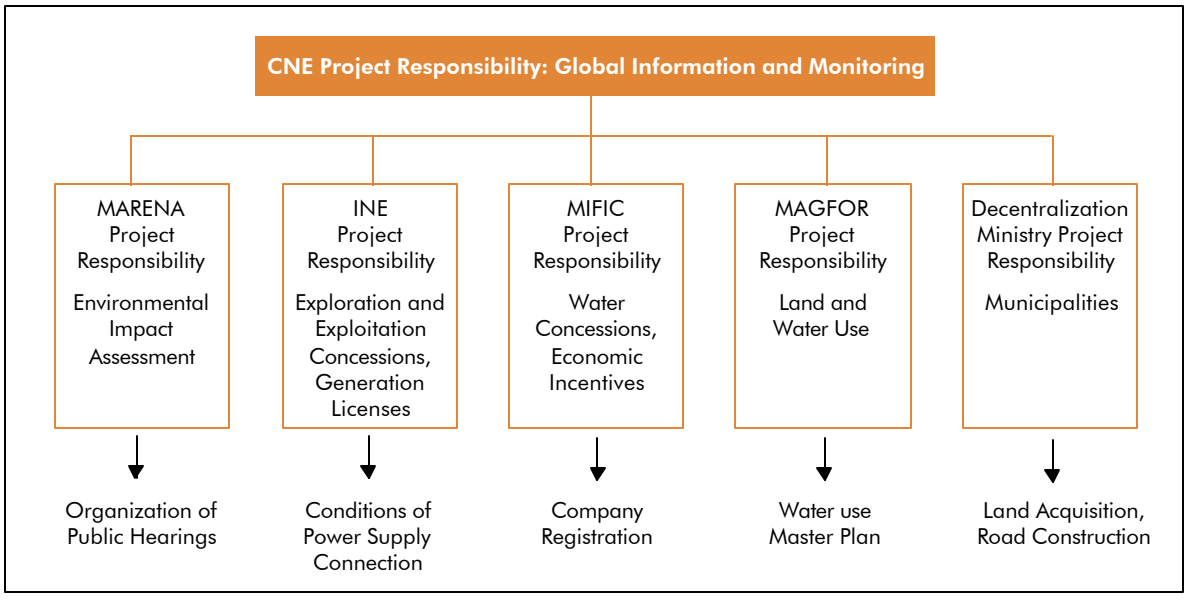
Conduct Government Review. The government of Nicaragua, in consultation with the investor community, will have to review existing planning and approval procedures to identify areas for streamlining.

Establish a One-stop Clearinghouse. Multiple national, regional and local government institutions are involved in the granting of authorizations, concessions and public hearings on environmental impact, land use and water rights issues. Other organizations are involved in the granting of economic incentives and company registrations. This process must be rationalized and streamlined through preparation of standard documents and checklists and assigning institutions direct responsibility for processing of applications for approval and investor requests for information.

CNE, jointly with INE, Nicaraguan Institute of Territorial Studies (INETER), Ministry of Agriculture and Forestry MAGFOR, MARENA, MIFIC and other ministries and institutions, will establish a one-stop clearinghouse for foreign and domestic investors interested in RE projects (Figure 5.2).

One person in CNE (and one substitute) will be nominated and trained as the focal contact for investors wishing to stay informed about rules and regulations and economic conditions for investment in geothermal and hydropower projects. The CNE officer, who will have direct contact with nominated staff in the above-mentioned ministries, will be personally responsible for providing technical assistance to, coordinating with and monitoring the work of lower level institutions which at various stages, become involved in the project preparation and implementation process. For example, the nominated ministry staff person, responsible for local governments, will assist local authorities

Figure 5.2: One-stop Clearinghouse Organization



in processing work related to land compensation, resettlement and approval of road construction.

During the exploratory phase of project investment, the one-stop clearinghouse set-up serves as a consultative mechanism, whereby a potential investor introduced to the cross-institutional core team, which would follow the project, gains confidence in the smooth processing of requests. During project implementation, the group is held responsible for administrative clearing of obstacles and potential misunderstandings.

Consider Regulation for Joint Land Use in National Parks. Basic obstacles to geothermal development in Nicaragua are new national land use laws and regulations that expand national parks to include all lands above 300 meters in elevation. Most prime geothermal development targets lie within restricted use areas. One possible solution for combining energy and environmental goals is to introduce a regulation for joint use lands. The Nicaraguan government will analyze the experience of other countries, including Kenya, who have adopted this approach.

Streamline Preparation and Approval for Environmental Studies and Plans. While an environmental study or plan is not required for issuance of a geothermal concession, for all concession work and drilling activities, MARENA must approve environmental impact applications and studies. CNE and INE will consult with MARENA on how to streamline the process if it should cause investors delays or increase their transaction costs.

Develop Standard Contracts for Grid Connection,Transmission and Generation. CNE/INE will collaborate with ENTRESA to develop a standard grid connection contract that includes conditions stipulating the relationship with CNDC, the grid-operating authority. The generation license may include a clause that entitles investors to compensation if changes in national laws modify the operating regime.

Invest in Resource and Project Cost Information

Have CNE Conduct Resource Assessments and Prefeasibility Studies. Getting CNE to collect relevant data and conduct research on projects and their locations can substantially reduce investor uncertainty.

The National Energy Policy (Decree No. 13-2004) *(De Establecimiento de la Política Energética Nacional)* confirms CNE's central role as undertaking prefeasibility and feasibility studies for projects identified in the Indicative Plan. The Fund for the Development of Energy Investments, established by the Energy Service Stability Act (Law No. 554-2005) *(Ley de Estabilidad del Servicio de Energía Eléctrica en el País)* provides CNE an independent source of funding for these activities, reducing its dependence on donor grants. Study results will be fed into the Nicaraguan Energy Information System (*Sistema de Información Energética de Nicaragua* – SIEN) and Documentation Center (*Centro de Documentación*). Unclassified information will be made freely available via CNE's website.

Promote Public Risk-sharing in Geothermal Exploitation

Issue. Geothermal project experience in Nicaragua shows that private investors consider drilling expenses a risk they are hesitant to take on.[77] To accelerate much-needed investment in this perceived high-risk sector, The Energy Service Stability Act (Law No. 554-2005, Article 6)

[77] *In geothermal energy, the key concerns are: 1) long lead times (for example, planning consents); 2) exploration risk (for example, unexpected temperature and flow rate); 3) drilling expense and associated risk (for example, blowout); and 4) critical component failures (for example, pump breakdowns).*

(Ley de Estabilidad del Servicio de Energía Electríca en el País) authorizes the Nicaraguan government to take loans from the international capital market to invest in RE-based power generation, opening up its direct involvement in energy sector investment.

Agreed-on Actions

CNE, in consultation with private investors and bilateral and international donors, will investigate four public-private risk-sharing arrangements to determine which are the most cost-effective for accelerating private geothermal and hydropower investments. The extent of the government's cofinancing of energy sector investments will depend on how maximum gearing of private investment can be achieved within a defined time frame and the government's ability to conclude loan agreements.

Tolling Arrangement. Using this instrument – the highest level of government risk-sharing in geothermal energy – a government entity invests in the exploration and development of a geothermal resource. Once the commercial feasibility of resource exploitation is established, the State entity invests in the geothermal extraction plant, while the national energy regulator issues a tender for the electrification portion of the project. The tender can be for either a steam-purchase or steam-to-electricity contract. In the former case, the generator sells the electricity in the power market. In the latter case, the entity provides steam to the plant at no cost and accepts power generated from the plant against a conversion fee. Any resource rent is effectively appropriated by the State or electricity consumers in the form of lower power tariffs.

Upfront Government Finance of Resource Development with Tenders for Concessions together with INE's License for Power Generation. Under this arrangement, the government invests upfront in resource evaluation and promotion (through geological and geophysical programs, heat flow surveys and deep exploration drilling). It recuperates the cost from investors, who develop the geothermal resources identified by the program. Winning bidders of tenders for exploitation concessions for identified commercial deposits are charged a fixed fee.

Partial Risk Guarantees and Contingent Finance for Private Investment. Under this scheme, private developers invest in exploration and development, while the government provides them risk guarantees and contingent financing. This instrument could be set up in Nicaragua or at the Central-American regional level;[78] but its viability presupposes financing of a fund by a development bank or the GEF. The fund would have a partial-risk-guarantee window, partially ensuring investors against the short-term risk of exploration or the long-term risk of a deposit with lower-than-expected temperature, higher-than-expected levels of mineralization or difficult reinjectivity. Otherwise, the investor would, as part of the investment, have to establish a reserve account within the package of project finance as a safeguard for lenders. In addition, it might have a further investment financing window providing contingent project development grants and low-cost loans.

Exploration Investment Write-off of 250 Percent. This arrangement would become effective during the first three years of geothermal plant operation. It would not reduce investor risk, but would offer investors a risk premium.

[78] *The World Bank's Geothermal Energy Development Project covers Bulgaria, the Czech Republic, Hungary, Poland, Romania, Russia, and Slovakia; the GeoFund covers the geological risks of geothermal investments.*

Next Steps

With the exception of the tolling arrangement, the above instruments can exist concurrently, giving private investors freedom of choice. The 250 percent write-off can be introduced soon and be made available to drilling investors without taking recourse to contingent finance.

CNE will seek to establish information and experience exchange with Guatemala, which is developing a geothermal exploration and development program under a UNDP/GEF project.

Install Appropriate Incentive Regime

Issue. Law No. 532-2005 installs an incentive package, previously announced in Decree No. 13-2004, granting investors exoneration from import duties; VAT; municipal taxes on components, machinery and equipment; and national and municipal taxes on temporary equipment imports. It also grants a seven-year tax holiday from start-up of commercial operations, exoneration from municipal taxes during construction and reduced municipal tax payments during the first 10 years of operation (75 percent, first three years; 50 percent, next five years; and 25 percent, last two years). In addition, it grants a five-year holiday on natural resource taxes, exoneration from stamp duties and a holiday on all taxes related specifically to natural resource exploitation over the 10-year period.

Recommendation. INE could fix the granting-right fee and guarantee bond, paid to INE upon issuance of a generation license, on a per megawatt basis rather than the estimated amount of investment. The latter arrangement imposes higher costs on capital-intensive renewable generators than on diesel generators.

Strengthen National R&D and Supplier Base

Issue. Because of Nicaragua's wealth of RE resources and the large RE investments waiting to be implemented, the country's market for RE technologies is sufficiently large to make it economically feasible to construct a national know-how base.

Recommendation. Using the Energy Development Fund, the Nicaraguan government can, inter alia, assist national universities in establishing collaboration agreements with the University of Reykjavik and U.S. research institutions in geothermal energy and encourage national engineers and manufacturers to investigate how a small country like Iceland succeeded in building a competitive supplier industry in geothermal exploration and development. In June 2006, for example, CNE signed a cooperation agreement with the government of Iceland to exchange technical information of relevance to geothermal energy.

Improving Access to Project Finance

Competition for new projects can be increased and the cost of production and bid prices per kWh reduced if private investors – both national and foreign – gain access to national and regional sources of project finance. CNE will actively explore whether it is possible to facilitate national investors' access to project finance on competitive terms by introducing: 1) new sources of project finance; and 2) new guarantee instruments in the national capital market. Because RE projects differ substantially in size, technology and cost per MW, financing options must be flexible. CNE's strategy comprises initiatives in the seven areas discussed below.

Tap National Debt and Equity Capital: Bond Issues

Issue/Recommendation. Nicaragua's long-term potential for investing in geothermal and hydropower plants and wind farms provides an opportunity to develop an incipient capital market. Such projects are of high quality: they are capital-

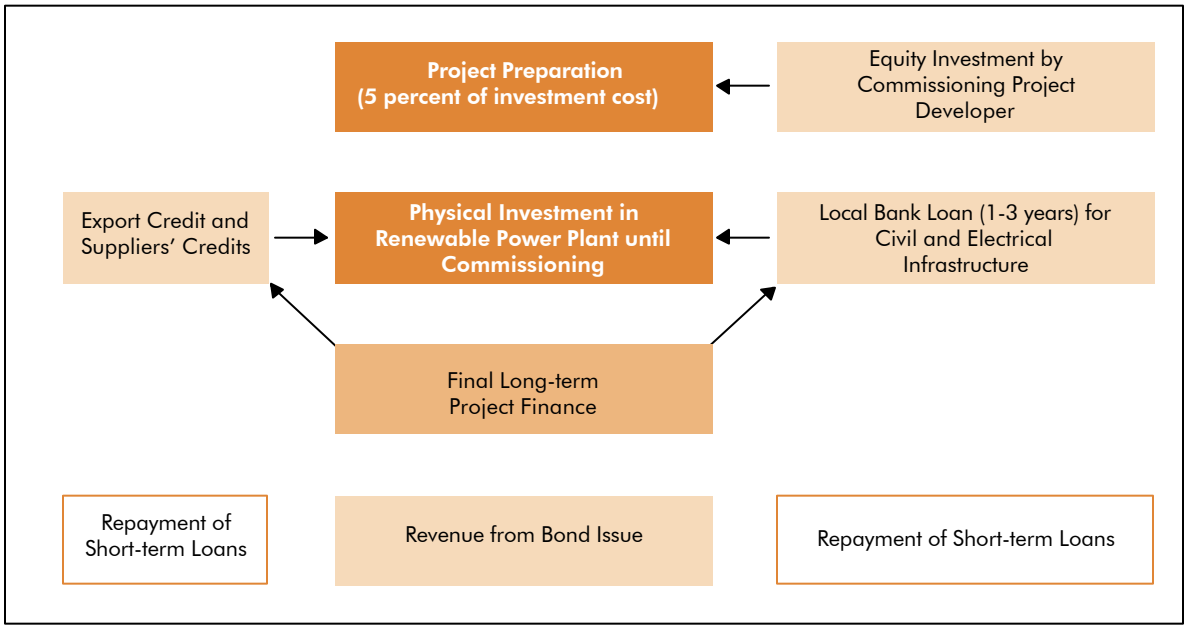
intensive, large in scope and scale and have acceptable risk levels and profiles.[79] CNE will discuss with project developers, the financial sector and potential portfolio investors (for example, military pension funds) potential financing instruments with longer maturities and lower capital costs that could be introduced successfully in the national market.

One option is to issue revenue bonds with 15-20 year maturities backed by the revenue stream of financed projects. In principle, bonds are ideally suited to finance geothermal and hydropower plants and wind farms, which can prove to the financing community that they have long-term PPAs for most of their output. For potential investors (for example, pension funds, insurance companies and private individuals), bonds issued for power companies represent low risk and relatively high returns. For project developers, the attraction is longer maturity and a lower requirement for investor equity than long-term bank loans.

The fixed annual income for revenue bonds is based on the future net revenue generated by the power plant, and is secured by the plant's physical assets. A financial buffer, in the form of purpose-specific accounts established upon bond issuance, provides added security for payment ability. Certain accounts cover risks prior to commercial operation (if issuance occurs before construction); others safeguard the ability to pay fixed annual dividends in years with below average water or wind availability.

At the outset of the project cycle, developers use their own equity and short-term bank loans to finance development up to the point of construction. The initial construction investment is financed by a mix of short-term national bank loans and export and supplier credits. When

Figure 5.3: Revenue Bonds and the Project Finance Cycle



[79] *The strength of the U.S. and U.K. capital markets was founded in the late 19th century when capital demand was heavy for large-scale private investment in infrastructure: canals, railways, ports, and electricity. In developing countries, State-owned companies typically obtain financing from either State-owned national development banks or bilateral or multilateral development banks.*

construction begins, an investment bank, chosen by the investor, prepares a revenue bond issue to finance the investment. The investment bank fee for the bond issue is about 6-7 percent of project finance, partly because of the risk to the bank in underwriting the bond issue (that is, the bank commits to purchasing bonds not sold at a specified date at a predefined price). Revenue from the bond issue is then used to cover all creditors and any outstanding construction and working capital (Figure 5.3).

Because Nicaragua currently has no bond market, an initial issue faces a lack of both depth and liquidity in the local capital market. Lack of depth (absence of similar financial products in the market) makes it difficult for investors to price the issue; except for alternative investments abroad, they have no reference benchmarks with which to compare the asking price for a bond issue. Lack of liquidity means it may take a bond seller several weeks to find a buyer. For an individual project, the risk of launching a long-term bond issue on a small untested market is high: the resulting cost-of-capital risks are substantially higher than for a traditional bank loan. Thus, Nicaraguan banks may hesitate to underwrite a long-term bond issue or may lack the required capital to do so.

Agreed-on Action. CNE will discuss with potential donors how a risk-sharing arrangement for overcoming the initial market hurdle could be grant-financed. One possibility is to use a contingent fund to cover the underwriting risk and a performance-based contract signed with an investment bank to undertake the bond issue. If the bond issue fails and is withdrawn, the investment bank's risk is limited to the incentive part of its pay.

Introduce Partial Risk Guarantees and Contingent Finance

Issue. In the context of rural electrification, partial risk guarantees and contingent finance can decisively bring private investments forward. In this case, the issue is not resource-risk but the ability to pay risks linked to rural poverty. In marketing household photovoltaic (PV) systems, international experience has demonstrated that the market takes off as soon as loan finance is made available for consumer purchases and PV dealer investment and working capital. Yet PV system dealers and developers of rural electrification and small-scale RE projects with viable business proposals may have difficulty getting conventional loans because they cannot offer sufficient assets as collateral.

One possible scheme for making PV systems accessible to more rural households which lack access to electricity is to triangulate risks among the Nicaraguan government, PV-system dealers and commercial banks that offer rural household and dealer credits. To this end, the small firms loan guarantee (SFLG), a joint venture between the U.K. Department of Trade and Industry (DTI) and approved lenders, can serve as a model for how commercial lending can be directed from banks to PV-system dealers and project developers who want to expand. Administered by the small business service (SBS), a DTI agency, the SFLG scheme allows small businesses with workable proposals that lack security to borrow money from approved lenders.

Using the rural electrification fund (REF) approach, a business development organization is usually contracted to provide rural entrepreneurs technical assistance on a cost-shared basis. Potential borrowers must present a viable business plan for the investment. Loans are provided by approved lenders, who make all commercial borrowing decisions. Through the SFLG, the government provides the lender a guarantee for 75 percent of the loan (up to a maximum loan of £30,000). The business pays the government an annual 2 percent premium on the outstanding loan amount.

A second possible scheme is to have solar home system (SHS) dealers reach collaborative risk-sharing agreements with local microfinance institutions for SHS purchases. Under this arrangement, the bank agrees to accept solar panels as collateral when providing loans to purchase SHSs from a dealer. In cases of default on loan repayment, the dealer agrees to take back the panels, paying the bank the nonamortized portion of the loan. The dealer can then sell the panels to another consumer, while the bank is responsible for taking down the panels.

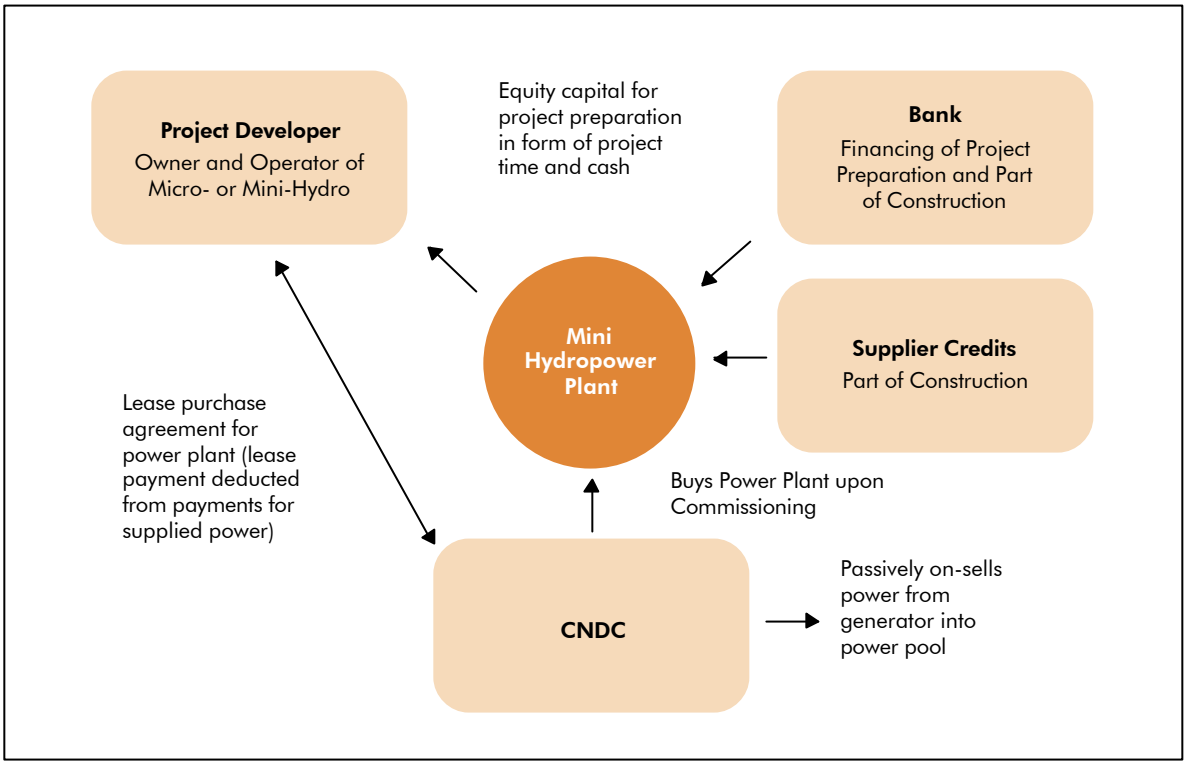
Agreed-on Action. In connection with the preparatory work to establish FODIEN, CNE will analyze the need to provide partial risk guarantees to consumer and dealer credits.

Analyze Feasibility of Mini-hydro Leasing Schemes

Issue. Investments in preparing and developing mini-hydro projects to supply previously unserved local communities and sell the surplus power to the national grid are most efficiently undertaken by local businesses and communities. But they may face challenges in raising the needed capital, on competitive terms, to move the project into construction. The ideal, least-cost solution would be a scheme that combines the respective comparative advantages of local private entrepreneurs in project development and larger power companies in project finance.

Under a potential lease-buy-back scheme, CNDC, the power system and market operator, would be the off-taker fed by mini-hydro plants into the national grid (Figure 5.4). Against a small administration fee, CNDC would on-sell the acquired power passively into the power pool (as now done under Decree 12-2004). Local developers would undertake all project preparation. After completing a feasibility study confirming the scheme's economic and financial viability, the developer would negotiate a lease-financing arrangement with CNDC for the mini-

Figure 5.4: Organization of Mini-hydro Lease-Buy-back Scheme



hydro plant. To finance the plant, CNDC would, in agreement with CNE and INE, set up a subsidiary to lease-finance small-scale RE projects developed by independent power producers (IPPs), drawing on funds from a long-term loan facility provided by a donor or development bank. After signing the lease-finance agreement, the project developer would use a mix of own equity, supplier credits and a local bank loan to finance the cost of investment up to commissioning the installed plant.

At commissioning, CNDC would purchase the physical plant from the developer against a 10-year, lease-buy-back contract. In principle, the plant price would equal the debt finance used for development and construction, but would be within the maximum fixed amount in the lease agreement, as the developer and the cofinancing bank would have to carry the risk of construction cost overrun. Thus, the leasing fee would equal the amortization payments and other financing costs, which the power company would incur on its loans from the development banks, plus a risk and administration fee for the power company. At the end of the lease period, the plant would be returned to the developer against a nominal US$1 payment. The developer would use the sales revenue to repay debt for project development and would operate the plant. When paying the IPP the monthly payment for delivered and sold power into the pool, CNDC would deduct the lease fee from the amount due.

The lease-buy-back scheme eliminates the need for collateral, reduces project lending risks, provides long maturities and results in lower capital costs than those of any alternative scheme, making the financing conditions of small biomass-fueled generators and mini-hydro projects more competitive with supply from conventional plants.

Agreed-on Action. CNE will analyze whether it is feasible and meaningful to develop a lease-buy-back arrangement for mini-hydro plants, which would resolve the collateral problem and reduce capital cost.

Use Subsovereign Guarantees for Community Investment

Recommendation. As an alternative to facilitating rural communities' investment in mini hydropower plants, subsovereign guarantees can be used to enhance the creditworthiness of local communities willing to invest in and operate such plants. This option can enhance investments in plants not connected to the national grid where the lease-buy-back option with CNDC is not applicable. In Mexico, for example, a developer secured loan financing for a wind farm selling power to the local municipality by arranging a partial payment guarantee through the development bank BANOBRAS. If needed, this bank could enforce payment from the off-taker by withholding funds it would otherwise channel into the municipality from federal and State sources.

Use Environmental Finance

Recommendation. Using environmental finance, mainly the clean development mechanism (CDM), can narrow the gap between the monomial price of conventional power and RE generators. The certified emission reductions (CER) payments facilitate promotion of and investment in RE technology. To avoid "additionality criterion" problems associated with a mandated market scheme, CNE/INE may fix an upper cap on the tariff per kWh, which is so low that it makes projects dependent on CER revenue commercially viable.[80]

The GEF offers another potential funding source for high-priority projects. Nicaragua's high barriers to potentially large-scale, commercially

[80] *Otherwise, the RE plant could be considered part of the baseline, and the project rejected for CDM registration.*

viable RE investments present an opportunity to identify cooperation projects that fall within the framework and priorities of GEF's Operational Program 6 (promoting RE adoption by removing barriers and reducing implementation costs), as they will contribute to meeting the strategic priorities of CC-2 (increased access to local sources of financing for RE and energy efficiency) and CC-3 (power sector policy frameworks supportive of RE and energy efficiency).

Use Bank Credits

Recommendation. Using soft loans, multilateral and bilateral development banks can play an essential supplementary role in cofinancing RE investments since they have a lower rate of return risk perspective than conventional banks. However, the Nicaraguan government's current borrowing capacity is limited by its international agreements as a highly-indebted country. That a private, not a government, company would access such loans makes no difference since development banks require a sovereign government guarantee for their loans.

Introduce Risk Guarantees for Foreign Investments

Issue. CNE believes that Nicaragua's economic reform program and the strength of its democratic stability are now recognized by the international community. It also believes that results of its RE strategy in such areas as legislation, regulation, finance, and intensified regional cross-country trading of electricity give investors a reasonable investment climate. In other developing regions of the world, geothermal energy projects have been financed on the basis of long-term PPAs backed by sovereign government guarantees. But in the Nicaraguan context, this approach is not acceptable since the off-takers are private distribution companies, not State-owned power companies.

Recommendation. To protect against political risk in Nicaragua, foreign investors can access instruments of the World Bank and Multilateral Investment Guarantee Agency (MIGA). The World Bank offers a partial risk guarantee to cover debt-service defaults on private sector project loans caused by the government's failure to meet its contractual obligations.[81] The major risk categories covered are: 1) breach of contract; 2) availability and convertibility of foreign exchange; 3) changes in law; and 4) expropriation and nationalization.

MIGA provides eligible foreign investors guarantees against certain noncommercial risks – political risk insurance – for qualified investments in developing member countries. The Agency insures new cross-border investments originating in any member country destined for any other member country. Types of foreign investments covered include equity, shareholder loans and shareholder loan guaranties, provided the loans have a minimum three-year maturity. Equity investments can be covered up to 90 percent, and debt up to 95 percent; coverage is typically available for up to 15 years (20 in certain cases). MIGA may insure up to US$200 million. Pricing is determined on the basis of both country and project risk; the effective price varies, depending on the type of investment and industry sector. The investor has the option to cancel a policy after three years; however, MIGA may not cancel the coverage.

Typically, coverage protects against the risks of transfer restriction, expropriation, war and civil

[81] *As its name implies, a partial risk guarantee covers a portion of the financing for which it provides support.*

disturbance and breach of contract. The World Bank partial risk guarantee requires a counter-guarantee of the host government. MIGA does not require a counter-guarantee, but requests host country approval before issuing a guarantee. The World Bank only insures debt instruments, while MIGA covers equity as well.[82]

Integrating RE into Rural Electrification

Micro- and mini-hydropower plants; small-scale, biomass-fired power plants; and solar PV systems will be promoted effectively wherever they can reduce the cost of power supply in rural electrification projects, both on- and off-grid.

Analyze Financing Options

Issue. CNE's initiatives to lower the cost and increase the supply of RE project finance will benefit smaller projects in rural areas. Rural RE projects, which expand local residents' access to electricity, will have access to special financing lines within the overall financing packages available for rural electrification.

Recommendation. While donors will continue to play a key role in providing funds for rural electrification, additional financing must be generated within Nicaragua to accelerate the rate of rural electrification. Currently, HIDROGESA (owned by ENEL as portfolio steward until privatization) acts as generator of national rural electrification funds. Its operating surplus covers the financial deficit incurred by ENEL on isolated grids served by diesel generators, as well as GECSA's deficit. If HIDROGESA is privatized, financial support for rural electrification could be maintained by placing revenue from the sale in a FODIEN account to cofinance investments. Alternatively, the level of debt in HIDROGESA could be increased by making a company bond issue. It will be investigated with the financing community whether the State can raise more money for FODIEN via this route than by selling the company equity.

Support DER as FODIEN Secretariat

Issue/Recommendation. Although FODIEN's organizational structure is still under investigation,[83] a strong possibility is that the fund will be set up independently, overseen by a board, with DER mandated to serve exclusively as secretariat (but formally continuing as a unit under CNE). This structure would eliminate CNE's conflicting roles as policymaker and project implementer. Compared to setting up a separate secretariat under FODIEN, this alternative would offer administrative and operational cost savings, along with flexibility of employment for staff and continuity of knowledge transfer to FODIEN.

Support FODIEN's Subsidy Functions

Issue. FODIEN's subsidy policy and cofinancing modalities have not yet been decided, as CNE is awaiting recommendations of an ongoing study. Most likely, FODIEN will provide cofinancing grants to investments in rural electrification projects, with the dual objective of helping project developers get needed finance in place and making the cost of electricity supply affordable to poor rural households.

Recommendation. The top-down, rural electrification approach of PLANERAC and PLANER – identifying priority projects and scoring them against predefined criteria – will continue. But FODIEN's potential subsidy-financing line for bottom

[82] *Details are available at www.worldbank.org/html/fpd/guarantees/.*
[83] *CNE has contracted a strong team of consultants to propose an organizational structure for FODIEN (the team presented an excellent introductory report in June 2004). Thus, this section is premature and is included for the sake of completeness.*

up proposals from communities and developers should also be encouraged. Viable projects could access subsidies with fixed published rates (per connected consumer for distribution projects and per installed kilowatt capacity kW for RE generators). This would allow communities that believe they have a viable electrification project with the subsidies offered take electrification into their own hands.

Promote Stand-alone Systems in Absence of Grid

Issue/Recommendation. Grid-based electrification is the highest-quality approach to electricity supply; therefore, consumers consider it the ultimate electricity service. Stand-alone power systems owned and operated by individual consumers are too noisy (for example, small gasoline and diesel gensets) or much weaker (for example, PV systems) than grid-based service. CNE's rural electrification strategy acknowledges that the SHS is not intended to substitute for grid-based electrification; rather, it plays a supplementary role, offering consumers a power supply option when grid-based electricity is unavailable.

Final Observations

The CNE and Ministry of Finance and Public Credit (MHCP) must carefully investigate whether the incentive regime established strikes the right balance between providing investors an attractive environment in which to accelerate investments and achieving the appropriate sharing of resource rents between the State, electricity consumers and private investors.

The generous tax incentives of the first seven-10 years of operation, combined with the conclusion of 10-year PPAs for their output, assure private investors and their cofinancing banks that the cash flow will allow a rapid payback on loans and invested equity. While this arrangement may provide projects the certainty needed to secure financial closure, the question remains: what happens when the 10-year PPAs expire? Will resource rents (low costs of production) be transferred to the State via water and geothermal concession fees, to consumers via efficient annual bidding arrangements for new power or to investors in the form of higher profits?

In the worst-case scenario, RE generators would sell most of their output directly to a Central American power pool – whose prices are determined mainly by the marginal cost of conventional power plants – without paying the State resource rents. In such a case, the benefits of price stability and low prices from RE generators would be lost. The tariffs paid to RE generators would vary according to the fuel costs of thermal power generation; and private investors would reap the economic rents, except for the small share returned to the State via the company tax. Once such scenarios are modeled, appropriate policy recommendations derived from them must be formulated.

6. Concluding Remarks

Nicaraguan policymakers' naïve belief in the 1998-99 reforms – that a free power market, through competitive pressure, could generate the optimal generation mix – has evaporated. By 2005, the high cost of international prices of crude and imported oil on the Nicaraguan economy could no longer be ignored. Growing momentum for RE projects is likely to be proved unstoppable.

As discussed in Chapter 4, the National Assembly recently adopted several laws – Energy Services Stability Act (No 554-2005) *(Ley de Estabilidad del Servicio de Energía Electríca en el País)* Renewable Energy Promotion Law for Hydropower (No 532-2005) and Amendment to the Promotion Law (No 531-2005) – that build, to a certain degree, on earlier policy efforts by the CNE. Adoption of these laws reflects a lessening of the deep political divisions that have long haracterized Nicaragua's business and regulatory environment and, in turn, damaged investor confidence.

In terms of public governance, establishing the Public Utility Superintendency as the regulatory authority can ease institutional tensions between the CNE and INE. It should also accelerate adoption of the country's new Water Rights Law, whose delayed passage has further fueled the perception of investor risk.

More recent events suggest further easing of barriers to RE investment. In July 2006, CNE issued an open invitation to potentially interested parties to submit requests to INE for generation licenses to develop one or more of the 12 hydropower projects, ranging in size from 2 to 30 MW, for which prefeasibility studies had been conducted. The invitation refers to Law No 532-2005, which declares RE of national interest and Law No 554-2005, which underscores the urgency of including more RE in the national energy matrix. The invitation also refers to future issuance of water rights by the MIFIC. Several months earlier, INE had signed geothermal exploration contracts with Enel and LaGeo to explore two areas of 100 km^2 each, located in Managua-Chiltepe and El Hoyo-Monte Galán (Chapter 3). Finally, wind farm developers, keenly awaiting issuance of a public tender, stand ready to invest in the 20-40 MW category.

In sum, the improving political environment sends a clear message to potential investors: RE is in and new diesel generation is out. Yet, despite the favorable situation, adoption of the proposed comprehensive package of measures discussed in Chapter 5 – needed to ensure solid progress – is unlikely in the near term. More likely, new components, building on those already in place (Chapter 4), will be adopted through a learning-by-doing process as practical problems arise during project preparation and implementation.

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Annex 1
RE Legal and Regulatory Framework

Nicaragua's key power sector framework laws – Electricity Industry Law (No. 272-1998) (Ley de la Industria Electrica) and Electricity Industry Law Regulation (Decree No. 42-1998) *(Reglamento a la Ley de la Industría Eléctrica)* – contain no references to promoting or incorporating RE into the country's power market. However, the Nicaraguan government can use certain articles to introduce instruments and measures that promote RE.

Electricity Industry Law: RE-related Articles

In Law No 272, RE-related Articles include:

- Article 2. Requires CNE/INE to identify and use sound project evaluation and approval methods;
- Article 3. Makes general reference to public utility "declarados;"
- Article 24. Requires new power investors to take the CNE-formulated expansion plan into account, giving CNE an instrument for steering the composition of upcoming generation projects toward RE;
- Article 51 (8). Authorizes CNE, via INE, to impose a management function on CNDC to purchase RE from the spot market;
- Article 68. Establishes INE procedure for granting temporary licenses to power and transmission stations. (INE is paid 0.1 percent of the total investment; since power stations using RE are more capital-intensive than conventional power plants, their fee per kilowatt hour kWh is higher);
- Article 112. Confirms INE approval of CNE-formulated, final-consumer tariffs, giving CNE an opening to pass on RE surcharges to consumers; and
- Article 130. Exempts investments in machinery and other power generation inputs from taxes and import duties for three years.

In addition, the country has put in place a comprehensive, but not yet coherent, framework of laws and regulations to facilitate RE investment. These can be divided into three broad (and sometimes overlapping) categories:

- Umbrella framework (including CNE's Strategic Power Plan [2003] and National Energy Policy [Presidential Decree 13-2004] *De Establecimiento de la Política Energética Nacional);*
- Natural resource management (geothermal and hydropower); and
- Economic investment incentives.

Umbrella Framework

CNE strategic plans and reports that favor RE include:

- Electricity Sector Generation Indicative Plan (2003-14). Includes one 66 MW geothermal project and one 20 MW wind farm in the short term (2004-2006) and 561 MW of medium- and large-sized hydropower plants in the medium and longer term (2007-14).

Successful implementation of this plan would substantially raise RE share in the national power mix. Yet, development of RE-based generation potential is influenced by: 1) competitiveness of potential Nicaraguan projects in the regional power market; and 2) availability of natural gas for regional power generation;
- Strategic Power Plan (2003); and
- Nicaragua Electricity Sector Indicative Report (2001). Predicted that 106 MW of geothermal plant would come online in 2001–05 through rehabilitation of the Momotombo plant.

CNE has also published in-depth studies on RE-resource potential. A master geothermal plan has evaluated 10 potential areas. Feasibility studies have updated small-, medium-, and large-scale hydropower potential. Another study has identified biomass potential in power production. Rural electrification studies have investigated the potential application of micro-hydro plants and PV systems.

The National Energy Policy (Presidential Decree 13-2004) *(De Establecimiento de la Politica Energética Nacional)* lists key advantages of RE-based power policy: price competitiveness, foreign-exchange earnings, supply security, contribution to power-price stability and employment generation. This decree:

- Gives priority to exploiting national sources of energy supply;
- Confirms CNE's central role in State investments in the sector and requests financial resources to conduct prefeasibility and feasibility studies identified in the CNE plan;
- Provides for special RE support, including CNE studies on resource potential, promulgation of laws promoting RE incentives and rational energy use and development of strategies on implementing regional scale geothermal and hydropower projects;
- Calls for studies on establishing a bulk market power broker and jointly proposes with the MIFIC a one-stop shop for foreign investors; and
- In rural electrification, imposes National Rural Electrification Plan (PLANER) preparation and calls for reforming National Electricity Development Fund (FODIEN) statutes, making subsidy policies more transparent and promoting PV systems in areas without access to grid-based supply.

Natural Resource Management

RE-related laws and regulations in natural resource management are:

- Political Constitution (Article 10). Designates water and geothermal resources as national heritage, meaning a State-issued concession is required for exploitation. The Civil Code affects resource management rights (inter alia with regard to water resources);
- Natural Resources Law. Geothermal regulations were replaced by the Geothermal Resource Exploration and Development Law (No 443-2002); water regulations will be replaced by the new Water Rights Law;
- Forestry Law (No 462-2003) *(Ley Forestal)*. Establishes the regulatory framework for forest resource protection and sustainable development. Dendro-energy regulations consider management of secondary forests, promotion of energy plantations and transformation of by-products and waste from agriculture and forestry;
- Municipalities Law (Article 7). Municipalities are responsible for issuing opinions on contracts and concessions for natural resource exploitation. The issuing body must receive the opinions before issuing licenses or concessions; and
- Environment and Naturasl Resources Law (No 217-1996) *(Ley General del Medio*

Ambiente y los Recursos Naturales). Permits resource exploitation in national parks, in accordance with approved environmental management plans. Power generation projects over 5 MW and transmission projects with voltages above 69 kV require EIA preparation and approval. MARENA serves as the regulatory authority.

Economic Investment Incentives

Under the Hydropower Promotion Law, the Renewable Energy Promotion Bill extends economic incentives from hydropower to RE projects generally (incentives of the Bill are listed in Decree 13-2004).

Under the Presidential Decree 12-2004 (Wind Energy and Run-of-the-river Hydropower Policy) *(Política Específica de Apoyo al Desarrollo de los Recursos Eólicos e Hidroeléctricos de Filo de Agua)* wind farm and run-of-the-river projects are given priority access to the spot market at guaranteed fixed prices over a 12-year period. Under this decree:

- INE is authorized to grant a generation license to establish initial 20 MW wind farm capacity. Wind farm developers can install other wind farms later if they conduct, in coordination with the National Load Dispatch Center (CNDC), a system impact analysis whose results show that the grid can absorb wind farm MW without negatively affecting grid operating costs or power quality;
- While hydropower projects have no fixed MW limit, they must be installed within six years of decree issuance;
- Maximum tariffs are fixed at US$0.0575 for wind energy and US$0.0590 for hydropower; they are valid for 12 years after start-up of operations. Consumers pay the output cost in proportion to their electricity consumption;
- If more than one wind farm bidder complies with concessions and licensing regulations, INE awards the 20 MW generation license to the one with the lowest monomial price; and
- INE is entrusted with adopting the necessary policy implementation regulations; revised regulations are adopted by resolution of the INE Advisory Council.

Annex 2
Compatibility of Legal Framework with Proposed Policy

Bill Promoting Electricity from Renewable Energy Sources

Electricity Industry Law No 272, published in *The Official Daily Gazette* (No 74; April 23, 1998), was the vital link in Nicaragua's energy sector restructuring process; its reform objectives for the electricity subsector were to:

- Improve sector efficiency and competitiveness;
- Introduce competition wherever economically and technically feasible;
- Facilitate insertion of private sector provision of energy services to support electricity infrastructure implementation requiring large sums of financial resources; and
- Create the necessary mechanisms to establish short- and long-term electricity markets.

The reform objectives (Law No 272, Article 2) established that activities in the electricity industry would be adjusted according to the following rules:

- Efficiency in allocating energy resources to provide electricity services at the least economic cost; and
- Expansion of capacity to generate energy and electricity services.

Law No. 272 is the legal framework for Nicaragua's electricity sector and the binding legal reference for reaching consensus on any law related to the country's electricity sector.

Nicaragua's Securities Market

Over the past decade, Nicaragua has developed its own modern economic public policies, which promote a free market, trade liberalization, free foreign currency transactions by financial entities and other such economic advances, including creation of the Securities Exchange in 1993 and the Stock Exchange in 1994.

The current Legal Framework for the Securities Exchange consists of:

- General Law of Banks and other Financial Institutions;
- Commercial Law;
- General Law of Securities Certificates;
- General Rule of Securities Exchange;
- Internal Rule of Securities Exchange; and
- Banking Supervision Regulations.

Decree No. 33-1993, published in *The Official Daily Gazette* (No. 122; June 29, 1993) promulgated the General Securities Exchange Regulation, whereby:

- The government was interested in completing the development and modernization of the financial market with issuance of the regulatory rule permitting development of the Stock Exchange; and
- Through authorization of the Securities Exchange, the development of efficient and transparent intermediary mechanisms was facilitated to stimulate and promote savings and productive investment in the country.

The regulation aims to control the brokering of transferable securities, understood as those securities that grant certificate holders rights of credit, ownership or participation in the capital of legal entities (public or private), such as stock shares, bonds, short-term securities, savings plans, mutual fund shares, investment fund shares and other securities transactions that may originate through brokerage bids.

The existing legal framework for the Stock Exchange is restricted, incomplete, insufficient and out of date; likewise, the volume of transactions is small. In response, the National Assembly is in the process of developing the Capital Market Bill in Nicaragua. At the President's initiative, the Bill was presented on December 10, 2002 (it was to have been approved by 2005). It will provide the capital market a fully modern, legal framework with which to broaden and develop its operations, in addition to permitting Nicaragua's participation in global markets.

New concepts that the Bill lays out include paperless tradable securities, regulation of public offerings (both sale and purchase), investment funds, securitized funds and company administrators and risk specialists. In general, the Bill's objectives are to regulate capital markets and natural or legal intervening entities and related market contracts and business securities.

Thus, the country's new capital market legislation is an excellent way to obtain financial resources for developing RE investment projects. It will be possible to capture more resources for project development, investors will have more options, transactions will be streamlined and general sector prospects will be good.

The importance of the Stock Exchange is that it strengthens relations between the development of the stock market and economic growth, which can help finance productive long-term projects, attract foreign investment, bring about jobs and greater production, lower long-term interest rates and increase income levels. This makes it especially attractive for seeking financing of RE projects.

The CNE, in accordance with the general requirements of the Electricity Industry Law, establishes that the industry's activities will be adjusted to promote competition effectively and attract private capital to the sector and that provision of electricity service will adhere strictly to relevant environmental protection and conservation regulations. The Commission has promoted policies and strategies that facilitate achieving sustainability of the country's natural resources by improving the energy balance through wind and ROR hydropower.

The Environment

Natural Resources in the Constitution and Nicaraguan Law

The 1987 constitution and its reforms of 1995 and 2000 establish in Article 102 that "natural resources are a national heritage." This definition determines what one may call the State's eminent domain. In this regard, Supreme Court Ruling No. 101 states:

"To understand this argument, this Supreme Tribunal considers it necessary to show what is the State's heritage and natural resources within its domain. The State's heritage has been defined as the collection of goods and rights, resources, and investments that, because of the constituent elements of their social structure or as a result of normal activity, the State has accumulated and has title of ownership or proprietorship with which to assign or affect, in a permanent way, the direct or indirect provision of public services in its care or implementation of its own social and economic policy goals and objectives."

The Ruling continues: "The State has sovereign legal authority over its territory, a real institutional right or, put more precisely, a fully defined, pure

property right by international law, if one complies with its modern meaning. The State also has the right to regulate all public and private property that it awards or concedes to private individuals, the individual substituting for the State in the exercise of private rights, but the State retains a superior right to regulate property control as a social function in the public interest. Some sources designate this supreme right of the State as an eminent right, in its current sense, which differs from the old feudal right. In summary, the State has authentic property rights over the territory it governs, according to domestic and international principles or provisions of public law and, in accordance with the constitution, this property is passed on to private individuals, subject to legal regulations."

Continuing, the Supreme Court states in the final section of Article 102: "(The State) can sign contracts to rationally exploit these resources when national interest requires it."

In these final sentences, one discovers the establishment of the State's most important requirement and responsibility: to establish the interest of society or the public as an important principle. Societal interest is safe from traditional forms of protecting private interest.

Protected Areas in Nicaraguan Environmental Legislation

The World Convention to Protect Flora and Fauna and Scenic Beauty in Countries of the Americas, ratified by Nicaragua in 1946, constitutes the first legal instrument whose primary objective is to protect spaces of world ecological importance. This Convention requires states to take a series of legal steps to protect their natural resources.

The Convention establishes a series of important definitions, as follows:

- *National Parks:* Areas established to protect and conserve natural scenic beauty and flora and fauna of national importance which the people can better enjoy if placed under official vigilance;
- National Reserves: Areas under official vigilance established to conserve and use natural wealth; flora and fauna are accorded total protection compatible with the goals of creating the reserves;
- Natural Monuments: Areas, objects or living animal or plant species of scenic interest or historic or scientific value that are accorded absolute protection. Natural monuments are created to conserve a specific area, object or species of flora and fauna; they are declared inviolable, except for properly authorized scientific research and government inspections; and
- Pristine Areas Reserves: Areas administered by authorities featuring natural flora and fauna and primitive living and communications conditions without roads for vehicular traffic that are protected from all commercial exploitation.

In Nicaragua, conservation and development of protected areas was initiated in 1958, when the Cosiguina Peninsula was declared a wildlife refuge zone; 13 years later, Mount Saslaya was declared the first national park in the North Atlantic Autonomous Region of the country; it is now incorporated into the Bosawas Biosphere Reserve.

In December 1974, the first Meeting on Conservation of Natural and Cultural Heritage initiated the creation of national parks as a pilot project for developing the country's protected areas system.

Law No. 217, General Law of the Environment and Natural Resources, states:

- Article 17: Creation of the National System of Protected Areas, which comprises all areas declared as such from the date this Law entered into force and those so declared in the future.

- Article 18: The major objectives of the establishment and legal declaration of natural protected areas are to:
  - Preserve natural ecosystems representative of the country's diverse biogeographic and ecological regions;
  - Protect watersheds, hydrologic cycles, aquifers, indicators of biotic communities, genetic resources and genetic wild diversity of flora and fauna;
  - Promote and develop appropriate technologies for the rational and sustainable improvement and attainment of natural ecosystems;
  - Protect natural landscapes and the surrounding environments of historic, archaeological and artistic monuments; and
  - Promote recreational activities and tourism in coexistence with nature.

Likewise, the Law established the protected area categories, as follows:

- Nature Reserve;
- National Park;
- Biological Reserve;
- National Monument;
- Historic Monument;
- Wildlife Refuge;
- Biosphere Reserve;
- Genetic Resources Reserve; and
- Protected Terrestrial and Marine Landscapes.

The development and control of protected areas falls under MARENA. Decree No. 14-1999 established the Regulation of Protected Areas of Nicaragua, which was published in *The Official Daily Gazette* (March 2-3, 1999); this regulation is the instrument that captures the main aspects of regulatory interest in this area.

The Environment and Natural Resources Law (Article 106) establishes expressly that "renewable and nonrenewable natural resources found in legally protected areas will not be subject to exploration and exploitation." The protected area declaration is made into law.

This prohibition on exploration and exploitation refers mainly to mining, hydrocarbons and forestry. With regard to hydroelectric and wind energy in protected areas, such as buffer zones, such exploitation would be possible with respective environmental impact studies, documents and management plans; such cases are in accordance with Law No. 272, which establishes that "the activities of the electricity industry, an indispensable element for national progress, are of national interest." Thus, in this case, national and societal interests take precedence.

Concept of Public Service

Public Service Concept in the Constitution

Nicaragua's Constitution establishes the legal framework for public service, in addition to defining what are considered public services. Article 105 states:

"It is the State's obligation to promote, facilitate and regulate provision of basic public services in energy, communications, water, transportation, road infrastructure, public ports, and airports; the access to which the population has an inalienable right. Private investments and methods and private concessions in these areas will be regulated, in each case, by law."

In the case of public services, the constitution defines:

- The State's obligation to promote, facilitate and regulate the provision of public services;
- Basic public services: energy, communications, water, transportation, road infrastructure, ports and airports; and
- Specific private investment and concessions methods regulated by law.

The basic public services to which the constitution refers are first and foremost those that involve

individual subsistence, such as provision of potable water and other basic community services without which the modern State could not exist (for example, communications, transport, ports, airports and electricity service).

One should note that the General Law of Telecommunications and Postal Services (Law No. 200, Article 9), establishes, for the first time, the concept of public service:

"Public services are those that are essential and of utility and importance for the majority of the country's residents…."

Since electricity generation is considered a public service, its generation using RE thus falls within this concept.

Rights and Declaration of Public Usefulness

Law No. 272, Article 3, states that "activities of the electricity industry, being an indispensable element of the nation's progress, are of national interest;" therefore, private and State property and rights can be affected by the rights or declaration of public usefulness.

Stating that electricity industry activities are of national interest is equivalent to saying that they are of general interest. The law sets forth how rights can affect property through soliciting concessions or licensing title and taxes by the regulatory entity. It also permits establishing mutually accepted rights between parties without regulatory intervention; that is, the law anticipated the two possibilities: with and without regulatory intervention.

With regard to the effect of public usefulness on property, Article 44 of the constitution clearly establishes that:

"The private-property rights of movable and immovable assets, as well as the instruments and methods of production, are guaranteed. By virtue of the property's public usefulness or social interest, this right, in practice, is subject to the limitations and requirements that the laws may impose. The immovable assets mentioned above can, in accordance with the law, be the object of expropriation, advance cash payment for fair compensation…. Confiscation of assets is prohibited."

Similarly, in the 1937 Law Bulletin, the Supreme Court establishes that expropriation is not, strictly speaking, a transfer by which one pays for the price of something; rather, it is a forced cession, conducted in the social interest, for which one makes reparations for the damage caused.

Thus, to guarantee development of the electricity industry activities, property can be declared useful through an administrative process, and just compensation must be paid in advance to make expropriation effective.

Creation of the Energy Sector Power Broker

The Electricity Industry Law establishes economic agents as those that develop electricity industry activities, such as generators, distributors, transmitters, and self-producers; no market activity is created in the electricity market per se.

Despite this, Law No. 272, Article 110, states:

The free price regime comprises electricity transactions between generators, cogenerators, self-producers, distributors, marketers and large consumers.

In formulating Law No. 272, the power-broker was much debated; it was argued that the cost of surplus energy would increase. But the Law refers to power-brokers as distinct from distribution, laying the foundation for developing the concept.

Consultations with both public and private agents about the power broker concluded that the marketing activity would not be viable in the

current context, given that there is only one buyer and the market is generally small; basically, it would raise costs, which would result in increased tariffs, one of the sector's major problems at this point of time.

Conversely, if one could dispel the belief and demonstrate that the power-broker activity would lower transaction costs, it would become viable. In any case, it would require an additional reform to the Electricity Industry Law, which would create the power-broker activity as such and the economic agent of the marketer.

Law No. 272 establishes in Articles 26, 29, 34 and 41 how to avoid the formation of monopolies in the electricity industry and vertically integrated firms, as follows:

Article 26: "Economic agents, subsidiaries and shareholders dedicated to generation activities cannot be proprietors or shareholders of transmission installations and/or distribution.

"Without affecting what the above paragraph sets forth, generators can own Secondary Transmission Systems which will be connected to the National Interconnected System (SIN)."

Article 29: "Economic agents dedicated to the activity of transmission cannot buy and/or sell electricity."

Article 34: "Economic agents that own lines and other components of the distribution system are required to give other economic agents and large consumers permission to connect to their installations, in compliance with rules that control the service and corresponding payments.

"Only distributors, including any subsidiary or associate, that have a combined generation capacity of up to 10,000 kilowatts (kW) when interconnected to the SIN can provide distribution service."

Article 41: "Distributors generally cannot transmit electricity. Without affecting what is set forth above, distributors can own secondary transmission systems to be connected to the SIN."

Law No. 272 clearly prohibits owners or shareholders in generation, transmission and distribution firms from participating in more than one electricity industry activity in order to prevent an industry monopoly and so that integrated firms, as was the State firm before the electricity sector restructuring and reform, comply, thereby bringing about competition in each industry activity; the general rule is that a generator cannot be a distributor and vice versa; likewise, economic agents in transmission cannot buy or sell electricity.

However, Law No. 272 also anticipates exceptions to this rule, as follows:

- Generators can own secondary transmission systems connecting their stations to the SIN;
- Isolated system generators can set up integrated firms and participate in transmission and/or distribution; and
- In cases where generation is connected to the SIN, a generator can own a distribution system, if the combined generation is less than 10,000 kW.

Decree 12-2004

Publication of Decree 12-2004, which established the specific policy supporting development of wind and run-of-the-river hydropower resources, caused a great controversy in the National Assembly's Infrastructure, Energy and Transportation Commission, given that it established maximum monomial prices of US$0.0575 and US$0.0590, which encroached on the regulatory entity's authority until affirmed by the National Assembly.

But these concerns are excessive. Perhaps the greatest controversy derives from the perspective of the nascent party itself; generally, Decrees of

the President of the Republic, referred to as regulations, occur when a law specifically sets forth that it should be regulated and exactly which Articles must be regulated; in the case of this Decree, no law is referred to.

Although Article 150 of the constitution states:

"The following are attributions of the President of the Republic: To pronounce Executive Decrees in administrative matters…."

One can infer that establishing maximum wholesale energy prices is an administrative matter; Law No. 272, Article 109 of the Tariff Regime, states:

"For the purpose of this Law, the Tariff Regime is classified in the Free Price Regime and the Regulated Price Regime. In the Free Price Regime, transactions are carried out without State intervention. In the Regulated Price Regime, transactions are remunerated via INE-approved prices."

Article 110, Free Price Regime, comprises electricity transactions among generators, cogenerators, self-producers, distributors, marketers, and large consumers.

Public Services Superintendence Bill

The energy, telecommunications, potable water, and sewage and sanitation sectors will be affected by creation of the Public Services Superintendence Bill, approved by the National Assembly's Communications, Transportation, Energy and Construction Commission (June 9, 2004).

This Public Services Superintendence signals a significant change in how the country's basic public services are organized. The basic argument for creating it is the State's duty to guarantee quality control of goods and services and provide the population these basic services. This means:

- Control, supervision and regulation of all public services contained in only one legal regulatory body;
- Election by the National Assembly of a public services supervisor and four administrators, supposedly to guarantee independence and objectivity;

In Chapter III of the Energy Sector Administration Bill, sector functions are defined as follows:

- Supervise compliance with norms, criteria, specifications, technical rules, and regulations governing the inspection, exploration, exploitation, utilization, production, transport, transformation, distribution, management, and use of energy resources in conformity with energy regulations and policy;
- Produce, put into effect and supervise compliance with rules and regulations designed to exploit energy rationally and efficientl;
- Produce, put into effect, and supervise compliance with technical rules and regulations on electricity generation, transmission, distribution and use;
- Award, modify, extend, or cancel inspection permits for any energy source;
- Ensure that electricity service runs smoothly and define indicators of quality, reliability and safety;
- Approve, publish, and control the toll for use of electricity transmission and distribution networks;
- Apply sanctions in cases anticipated by laws, rules, regulations, concessions, and licensing contracts and other dispositions;
- Resolve controversies between economic agents who participate in the energy sector, according to what is set forth in the Electricity Industry Law;
- Award, extend, declare the expiration of, or cancel energy generation and transmission licenses, as well as distribution concessions;
- Supervise compliance with the exercise of

rights and responsibilities of license holders and concessionaires;
- Designate inspectors, where appropriate;
- Establish categories of large, medium and small consumers, based on technical and economic parameters when the law or subject determines it;
- Approve and inspect the work and installations of license holders and concessionaires for electricity generation, transmission, and distribution;
- Approve, inspect and control the measurement instruments installed by concessionaires and license holders for the electricity production and delivery registry;
- Prepare and adopt the necessary measures to avoid restrictive competition practises in supplying or providing products and services regulated in the electricity subsector;
- Supervise compliance with environmental protection regulations by license holders and concessionaires;
- Establish and maintain the information system of the sector's most important variables;
- Develop and present the executive office sector-related bills to be considered by the legislature; and
- [Conduct] any other function the Law grants within its scope.

This proposal has its opponents within the executive branch, regulatory entitites and even the World Bank public opinion; but the project continues moving forward and [was] expected to be approved in November 2004.

Table A 2.1: INE Opinion on the CNE Bill Promoting RE Generation

(US$ per kWh)	*INE Opinion*	*Comments*
Article 2. Definition. The following definitions are established for this Law: Economic agent: Any qualified individual or legal entity residing in the country that develops well defined activities in the electricity industry under any ownership regime Generation activity: Electricity production requiring the exploitation and transmission of any energy source	These definitions are already established in Article 8 of the Electricity Industry Law	Even though these definitions are well defined in Law No. 272, it is valid to include them for reasons of consistency with the new law
	Article 2. The Nicaraguan State, via the Nicaraguan Energy Institute (INE), will offer all the incentives contained in the current Law to national and foreign investors who qualify as economic agents, in accordance with the	It is suggested that CNE, the responsible entity for planning and defining the country's electricity sector strategies, not INE, the established regulatory entity, certify investor-related incentives, using them to steer investment toward RE

(Continued...)

(...Table A 2.1 continued)

(US$ per kWh)	*INE Opinion*	*Comments*
	Electricity Industry Law, Rule and Regulation on Licenses and Concessions	
Renewable Energy Generation Project (PGEFR) Preparation Period: Period in which activities related to feasibility studies and final project design (not including concept and prefeasibility stages) are implemented under the appropriate license and/or concession. The duration of this period, along with CNE certification and its development, will be *verified* by INE	Article 68, Law No. 272, sets forth:"The implementation of studies for electricity generation stations using natural resources…requires a provisional license granted by the INE for a maximum period of two years" Article 3. To implement studies for electricity generation stations using natural resources, economic agents must obtain the relevant provisional license, in accordance with the Electricity Industry Law (Articles 68 and 116 and following Regulation)	This apparent contradiction can be resolved by stating that this period will be *authorized*, rather than *verified*, by the INE
Isolated system: The electric power station or combined stations of generation, transmission and distribution systems not interconnected to the National Transmission System	This term is already defined in Law No. 272	Even though this definition is already there in Law No. 272, including it here facilitates its use by users and operators
Article 5. National interest is declared as the rational development and exploitation of RE resources	Law No. 272 has already established that activities of the electricity industry are of national interest	The concept of national interest is critical in this Law; energy generation involves using natural resources in protected areas and their buffer zones. Thus, it is valid to expressly state independently in this Bill what is set forth generally in Law No. 272
Article 6. Certification: The CNE will certify, in accordance with what the current law and its regulation require, authorization of a PGEFR, specifying a maximum operational period for this classification so that the project begins its preinvestment work. Once preinvestment is initiated,	Article 71. Law No. 272, Regulation: A work project must be carried out in accordance with the technical rules and principles that INE draws up and must take into account the general urban development plans in effect	There is no contradiction, given that CNE will only *certify*; the Article does not state that CNE will *authorize* or establish technical rules and principles. Logically, however, it should be assessed whether adding another step makes the process more bureaucratic; generally, any additional steps in the administrative process are not advisable

(Continued...)

(...Table A 2.1 continued)

(US$ per kWh)	*INE Opinion*	*Comments*
the term can be extended with due justification, according to the current Law's regulation	Expansions that require licensing are already anticipated in the rules of Concessions and Licenses, Chapter 2.3a: Generation Licensing and/or Expansion	INE's opinion is valid, given that the procedure for such cases is already established. The Bill incorporates CNE certification so that the economic agent that wishes to carry out expansions can benefit from the incentives established in the Law. This would add another step to the process, making it more complicated
Article 7. Expansion: PGEFR economic agents who wish to substantially expand their installed capacity can solicit it from CNE, requesting a PGEFR to benefit from the new investment incentives set forth in the new Law	Article 4 states: "Economic agents of operative Electricity Generation Projects who wish to substantially expand their installed capacity can request it from INE, in accordance with the established rule of Licenses and Concessions. Once the contract addendum is signed, they can take advantage of the new investment incentives under the current Law"	
	Tax Regime	This is not feasible; regional market rules should be applied
	Article 5. Economic agents will be free to export the energy generated, minus a percentage, annually fixed by the regulatory entity, which will target domestic consumption	Similarly, in reference to PGEFR certification to determine the actual period within four years that will be applied to exonerate payment of income and municipal taxes, INE proposes eliminating CNE's role. This should be assessed based on what is more advisable for promoting RE investments; the deciding rule must be used to make these types of decisions
Article 10. The tax incentives and benefits established in the current Law will be administered by the Ministry of Finance and Public Credit (MHCP), on authorization of the Ministry of Development, Industry and Commerce and CNE certification	Article 6. The tax incentives and benefits established in the current law will be administered by the MHCP, on authorization of the regulatory entity, which must supervise work progress and require compliance with obligations of the economic agents	The opinion insists on eliminating CNE as the one that certifies so that investors can access incentives; similarly, it eliminates the Ministry of Development Industry and Trade (MIFIC)

Note: Generally, INE's organizational contributions to the Law are positive, but its core motions are to eliminate CNE's certification role so that investors can access incentives; this platform must be analyzed, assuming that the deciding rule is to direct efforts to promote RE generation investments in order to diversify the energy matrix. Thus, insofar as possible, a flexible mechanism should be created that avoids bureaucracy and smoothes the access process. CNE's certification role is interesting from the perspective of defining the country's energy sector strategy and planning; if this mechanism helps CNE fulfill its role as a promoter of investment in RE production, it should be allowed the certification role.

Annex 3
International Experience with RE Frameworks

This Annex reviews successful international experience with RE frameworks of relevance to Nicaragua. The first section considers wind energy policies in countries of the Organisation for Economic Co-operation and Development (OECD). The second one summarizes lessons from emerging economies in attracting private investment to small-and large-scale hydropower. Finally, the third offers regionwide policy lessons from Central America, as well as country-specific experience from Costa Rica, El Salvador, Guatemala, Honduras and Panama.

OECD country experience underscores the importance of having quantified policy targets and providing markets the needed instruments to achieve them. In emerging economies, small-scale hydropower schemes emphasize private sector investors' need for a certain tariff regime and sales conditions. For large-scale hydro, it is possible to find willing investors – even in difficult country environments like Nicaragua – if long-term Power Purchase Agreements (PPAs) can be signed. In Central America, all of the countries which implemented power sector reform have experienced similar problems, including difficulty in passing parliamentary-approved water laws and a bias toward power sector investments with short payback periods. Costa Rica, in stark contrast, demonstrates the demand- and supply-side advantages of maintaining State control over the entire vertical chain, from generation to distribution.

OECD Countries: Carving Out a Wind Farm Niche Market

In OECD countries, hydropower resources are nearly fully exploited. Large-scale promotion of new sources of RE generation focuses on biomass-based power, geothermal energy, wind energy, and, to a smaller extent, wave energy. Wind energy, however, is the outstanding success story in terms of installed MW. A range of instruments have been used to carve out a niche market for a commercially nonviable technology.

The experience of OECD countries underscores the importance of setting quantified policy targets and providing the market the instruments needed to achieve them. Countries that have introduced the mandated market approach – either the mandated tariff or the mandated quantity variant – have achieved large-scale RE penetration; in countries that have not used this tool, RE remains a marginal option.

Of the two variants, the mandated tariff approach results in faster, more dynamic market development, but the incremental subsidy cost per installed MW is slightly higher. But there are ways to reduce the size of the surcost (and the economic rent of wind farms at sites with the best wind regimes). For example, the premium tariff can be limited to a fixed number of GWh hour per installed MW. The difficulty of designing a

mandated quantity scheme should not be underestimated.[84]

In OECD countries, widespread adoption of the mandated market approach has shifted the balance away from taxpayer-paid subsidies toward consumer-paid electricity subsidies. A second strong international tendency has been the increasing elimination of special market and pricing rules for wind energy. Rather than a fixed tariff, the tendency has been to give renewable generators a premium per kWh on top of the pool price, with an overall price cap (power pool tariff, plus premium), which eliminates the premium if power pool prices are above a ceiling price.

Emerging Economies: Attracting Private Investment

In emerging economies, there is still large scope for developing small- and large-scale hydropower. Thus, mass RE penetration into the bulk power market depends on hydropower investments.

Small-scale Producer Schemes

For emerging economies like the OECD countries, certainty of the tariff regime and sales conditions is critical for the private sector.[85] Published tariff schemes and associated model PPAs for small-scale, grid-connected schemes are an effective key for unlocking private investment in power generation; where developers must negotiate PPAs individually with the off-taking utility, private sector interest in small hydro is limited.[86]

In no country with a small-hydro promotion scheme is the private developer exposed to a fully liberalized power market.[87] The starting point for such tariffs is generally avoided costs or long-run marginal costs, as specified by the grid operator or national utility. If the avoided-cost principle in thermal power were interpreted strictly, the PPA tariff would be adjusted regularly, being indexed to a range of variable cost elements in thermal power. A key variable would be fluctuations in the fuel price that power plants use. Such a direct link would undermine an advantage of expanding the percentage of RE systems in national power supply: to introduce an element of price stability into the power market and protect the economy against the risk of tariff increases over the long term. The avoided cost-pricing principle is, therefore, applied differently in the national schemes. Variations concern whether:

- The tariff is differentiated according to the time of power supply (avoided cost of thermal power depends on the time of day). Because of the flexibility in adjusting the level of power output from a hydropower plant, it is advantageous to provide project developers the right price signals with regard to the value of adding limited storage capacity to the hydropower dam. Yet, countries apply different payment policies for time variations in the value of supplied power; one can observe: 1) fixed kilowatt-per-hour tariff, irrespective of season and time of day; 2) seasonal variations in annual tariffs (the kW-per-hour tariff paid is

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[84] Associated transaction costs are higher for a mandated quantity scheme than for a mandated tariff scheme. In mandated tariff schemes, the economic terms and conditions of contracts are law-based; contracts between wind farms and other power market operators become formal confirmation of the economic conditions defined by law. Contracts may even not be used (e.g., Denmark in the 90s) or are standard documents stating that power off-take is paid according to terms defined by law. By contrast, mandated quantity schemes are contract-based; the economic terms and conditions for power off-take and grid use are not defined by law; rather, they are the outcome of negotiated deals between commercial parties. Thus, for wind farms, the economic terms are defined in the details of the commercial contracts that link wind farms to the power market.

[85] This section draws heavily on Scheutzlich (2004) and Ferrey (2003).

[86] The share of renewable small power projects to the national electricity supply is 2 percent in Sri Lanka and nearly 4 percent in both India and Thailand. Standard PPAs with standard tariffs are a powerful instrument for all grid-connected, private power investment. In Latvia, published power tariffs for combined heat and power plants with less than 5 MW output of electric power have quickly resulted in private industrial companies seizing the opportunity.

[87] The definition of small-scale differs. In the five Asian countries analyzed by Ferrey (2003) – India, Indonesia, Sri Lanka, Thailand, and Vietnam – the cut-off rate range was 20-50 MW.

higher during peak than off-peak season); and 3) daily peak and off-peak tariff. Indonesia uses steep incentives for on-peak hourly delivery of small power producer (SPP) power and decreases off-peak hourly prices so that the weighted average tariff equals avoided cost. Sri Lanka uses a seasonally differentiated tariff to reflect peak system premium requirements. In India, the state of Tamil Nadu provides a higher tariff to base-loaded biomass projects than to intermittent wind projects;

- The tariff is adjusted periodically during the contract years and how the adjustment is linked to specific indexes (avoided costs change during the years due to changes in fuel prices, general inflation and the exchange rate). Tariff escalation (linked to the dollar or oil price) is usually specified for the first five years from contract signing so that the developer can meet debt payments;
- Payment is split into a capacity payment kW tariff) and an energy payment kW-per-hour tariff) (short-term avoided cost refers to savings in variable cost, mainly that of fuel; long-term avoided cost includes savings in thermal capacity). In terms of separate recognition of capacity value, one can observe various practices: 1) standard energy payment kW-per-hour tariff) for all RE generators; 2) energy payment higher for firm power than intermittent power; and 3) separate payment for energy (kilowatt-per-hour tariff) and capacity (tariff per MW of firm capacity); and
- Subsidies are paid on top of the avoided cost tariff (for reasons of power supply diversity, a country may wish to develop hydropower sites whose production costs are higher than those of thermal power). Power subsidies from small-scale RE generators are fixed and are administered differently in country schemes. Observed solutions include: 1) a single, above avoided-thermal-cost tariff to all small hydro projects; 2) power purchaser payment of a fixed avoided-cost tariff (or the pool market price) on top of which the small-hydro plant is paid a fixed RE premium from a fund; and 3) an RE premium established on a project-by-project basis through periodic tenders for a specified number of MW(s), awarded to the bidder, asking for a minimum subsidy per kWh.

Compared with the SPP tariffs in other countries, Nicaragua's US$5.9 per kWh (offered under Presidential Decree 12-2004) is generous. Nepal has respective dry- and wet-season tariffs of US$5.9 and 4.2 per kWh. Indonesia's tariffs are US$4.1-5.2 per kWh, Sri Lanka's are US$5.2-5.4 per kWh; while that of Himachal Pradesh (India) is US$5.5 and the Philippines is US$3.4.

In Thailand and Indonesia, PPAs for firm supply are 20 years, while those for nonfirm supply are limited to five years. Sri Lanka and Andhra Pradesh (India) do not distinguish between firm and nonfirm hydro; PPAs are for 15 and 20 years, respectively.

Not all programs pay the long-term avoided cost for long-term firm power commitments. Some countries pay short-term energy-only avoided cost, regardless of the type of PPA obligation. Generally, payment is based on bulk energy supply without considering capacity (i.e., the utility must keep capacity reserves in order to maintain adequate supply security).

Many dispatch centers consider it noneconomic to include small hydro plants below 10 MW capacity in the grid operator's dispatch regime. For small isolated (diesel) grids, this capacity limit may be lower, and the small hydro plant may have to assume grid stability and deliver firm capacity against proper reimbursement.[88]

[88] *Indonesia's first small private power program in 1997 provided for firm-capacity payments, but developers voiced concerns over complex definitions. With regard to small isolated diesel grids, the question was who would be allowed to provide the base load (i.e., the small hydro or grid operator).*

In Himachal Pradesh and Nepal (to a certain extent), provision is made for so-called "deemed generation." If the grid operator cannot take power from the small hydro generator for more than 20 days per year, s/he pays for an estimated amount of energy not taken off (estimates are based on actual generation in previous years).

In many developing countries, the financial standing of utilities and grid operators is relatively poor, and small hydro developers fear that payment for energy supplied might be endlessly delayed. Himachal Pradesh provides for government guarantees in the event of a default by the public grid operator.

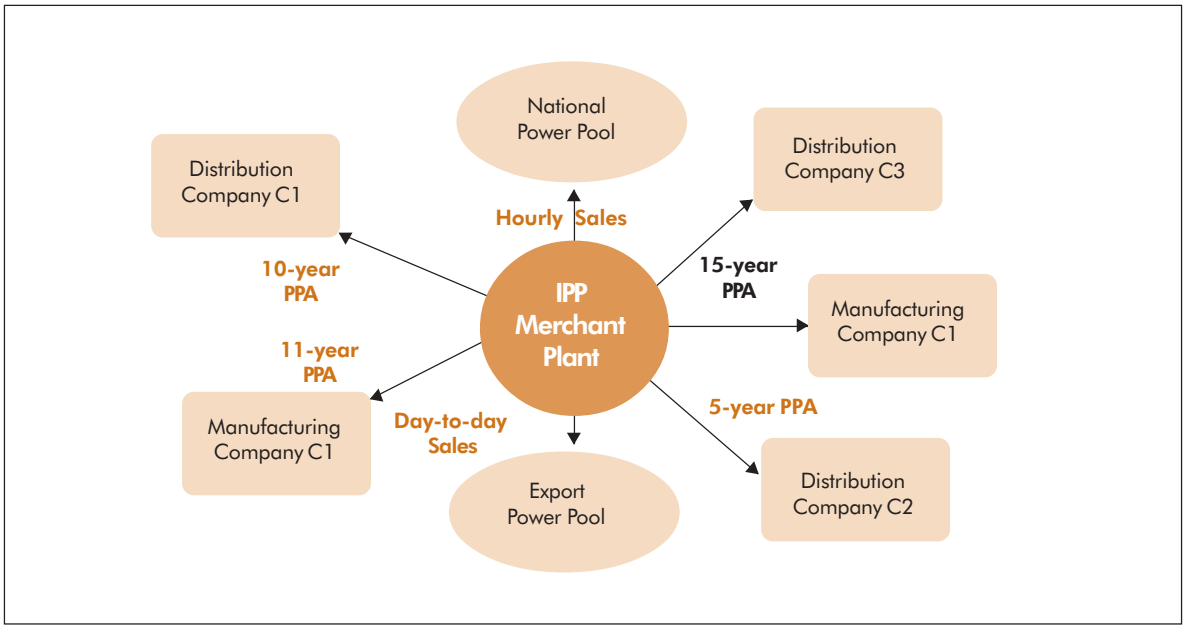
For private investors, identification of small-hydro project sites is a lengthy process with high upfront costs associated with the risk that a feasible and attractive project would not be found. In certain countries, a master plan with preidentified small-hydro sites has been published and promoted among private developers and investors. The master plan serves two purposes: 1) It specifies those sites not earmarked for other water development projects (large-hydro, irrigation and water supply); and 2) It gives a first possible layout of a small-hydro project, including heat, flow, power output, distance to roads, and interconnection points or load centers.

Large-scale Hydropower for the Regional Market

For Nicaragua, establishment of power pools at the regional level – the medium-term vision for Central America – would also, in theory, facilitate establishment of larger-scale hydropower plants in-country. The ideal investor would not insist on selling all output via a long-term PPA before construction; rather, s/he would sell portions to distribution companies and final industrial consumers and into the power pools (using long-, medium-, and short-term contracts and daily and hourly pool bidding) (Figure A3.1).

Merchant plants generally have fallen out of favor with investors. In addition, the free power market disfavors investments in capital-intensive plants, as the risks for default on loans caused by temporarily low power prices (in times of overcapacity, pool prices drop to the marginal short-run cost of production) are higher for plants

Figure A3.1: Organization of IPP Merchant Plant



with high fixed costs of production. It is difficult to secure financial closure for hydropower plants without a long-term PPA. In Southeast Asia, Laos has succeeded in attracting foreign investment to larger-scale hydropower plants, mainly for production export to Thailand; the State benefits via payment of a water-use royalty per kWh of output. In Laos, the ability to sign long-term PPAs for most plant output with the Electricity Generating Authority of Thailand (EGAT) made the project possible. In Uganda, the 250 MW Bujagali, under development by AES Corporation, was never implemented, even though a PPA had been signed and the International Finance Corporation (IFC) was cofinancing the project and providing a partial risk guarantee. Beyond corruption scandals, which had already marred the project, the State-owned national transmission company in the PPA was to accept a take-or-pay for the large output increment, although demand in Uganda was growing by less than 20 MW per year. AES never tried to obtain part of the output sold to Kenya.

The positive lesson from international experience with private investment in large-scale hydropower is that it is possible to find willing investors – even for difficult country environments – as long as a long-term PPA can be signed.

RE Policies in Central America

In 2000, the six countries of Central America – Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama – had a total population of 36 million.[89] In 2002, the Gross Domestic Product average (GDP) per capita was US$1,900 in current dollars. Costa Rica had the highest electrification rate (95 percent), while Nicaragua had the lowest (47 percent).

Share in Regional Power Supply

At the end of 2003, RE share in total annual power generation for the six countries was 59 percent, representing a 32 percent decline from 1990 (Table A3.1). Costa Rica topped the list at 98 percent, while Nicaragua was at the bottom with 23 percent. Conversely, in terms of share of petroleum consumption used for power generation, Nicaragua was first (36 percent), while Costa Rica was last (2 percent). Costa Rica had the highest share of commercial energy in final energy consumption ss(92 percent), while Nicaragua had the lowest (40 percent). Foreign private investment in generation went into oil-fired power plants and a single coal-fired plant (Box 4.1).[90]

Table A3.1: Percentage of RE in Central American Electricity Production, 1980-2002

Year	*Region*	*Costa Rica*	*El Salvador*	*Guatemala*	*Honduras*	*Nicaragua*	*Panama*
1980	71.1	98.8	98.7	20	91.6	53.7	55.0
1990	91.1	98.7	93.6	92.3	100.2	61.2	84.0
1998	60.4	92.4	53.0	55.4	54.3	21.8	51.3
2000	67.0	99.1	57.6	54.2	60.5	16.9	70.5
2002	59.1	98.4	50.6	40.6	38.7	23.4	64.7

Source: Economic Commission for Latin America and the Caribbean (ECLAC).

[89] *In 2000, country populations were 3.6 million (Costa Rica), 6.1 million (El Salvador), 11.4 million (Guatemala), 6.5 million (Honduras), 5.5 million (Nicaragua), and 2.8 million (Panama).*
[90] *Information in this section is largely drawn from Economic Commission for Latin America and the Caribbean (ECLAC) (2004).*

Decline in RE share occurred despite Central America's enormously identified potential for hydropower (24,000 MW) and geothermal (2,100 MW), as well as high-quality wind farm potential in Costa Rica (600 MW), and Nicaragua (200 MW) (Table A3.2).

Regional Policy Initiatives

Although RE share fell in all Central American countries except Costa Rica, all six had signed high-profile, regional policy declarations in favor of RE. Major declarations include the Latin American and Caribbean Sustainable Development Initiative (ILAC), 2002 (approved during the Environment Ministers Meeting in Johannesburg, which committed the region to having 10 percent of its power supplied by RE by 2010 and making better use of its comparative advantage in RE resources); Brazilian Renewable Energy Platform, 2003 (part of a regional RE conference held in Brazil); and Central American Sustainable Development Alliance (ALIDES), 1994. Major regional organizations include the Central American Electrification Council (CEAC), Central America Coordinated Association of Electricity Regulatory Bodies (ACERCA) and the Regional Commission on Water Resources (CRRH).

Country Policy Summaries

Costa Rica

In 2002, Costa Rica had an installed capacity of 1,796 MW, the largest in Central America. Renewable generators, which accounted for 98

Table A3.2: Electricity Industry Variables for Central America, 2002

Year	*Region*	*Costa Rica*	*El Salvador*	*Guatemala*	*Honduras*	*Nicaragua*	*Panama*
Installed Capacity (MW)*	7,898	1,796	1,136	1,703	1,073	659	1,533
Electricity Demand (Production, plus Net Imports, GWh)**	29,730	7,035	4,658	5,806	4,577	2,410	5,243
Maximum Potential Demand (MW)***	5,170	1,221	752	1,119	798	422	857
Net Energy Production, by Source (%)							
Total (GWh)	29,724	7,439	4,274	6,191	4,162	2,402	5,257
RE Source (%)	59.1	98.4	50.6	43.7	38.8	23.4	64.7
Hydro	48.7	80.2	27.6	32.5	38.7	12.5	64.6
Geothermal	7.9	14.6	21.9	2.1	0.0	8.0	0.0
Cogeneration	1.7	0.1	1.1	9.0	0.1	3.0	0.1
Wind Energy	0.9	3.5	0.0	0.0	0.0	0.0	0.0

Source: Economic Commission for Latin America and the Caribbean (ECLAC).
* *Installed capacity only includes national interconnected systems.*
** *Domestic consumption at wholesale or high-voltage levels.*
*** *Maximum regional potential is not coincident.*

percent of generation, consisted of hydropower (80 percent), geothermal (15 percent) and wind energy (4 percent).

Costa Rica's power sector policy has four distinguishing characteristics:

- The State-owned, vertically integrated power utility plays a dominant role;
- Private Independent Power Producers (IPPs) can invest only in RE generation projects;
- Long-term PPAs (of up to 20 years) can be signed with plants whose capacity is larger than 20 MW (a public tender is required); and
- The law actively promotes participation of the Costa Rican citizenry in private power projects (national investors must provide a minimum of 30 percent ownership in an IPP project).[91]

The Costa Rican Electricity Institute (ICE), the State-owned, vertically integrated utility, generates more than 90 percent of the country's electricity through National Power and Light Company, S.A. CNFL, a subsidiary distributor in the capital city of San Jose; this is the largest market (75 percent), which acts as single buyer for IPPs. Two integrated municipal utilities and four Rural Electric Cooperatives (RECs) provide distribution service in areas beyond San Jose.

Since 1990, a handful of small independent generators selling power to ICE under long-term PPAs have entered the market. These include three wind farms and one geothermal power plant (to which ICE sells steam).[92]

The Ministry of Environment and Energy (MINAE) performs policy functions. The Regulatory Authority for Public Services (ARESEP) – a multisector agency responsible for regulating power, telecommunications, hydrocarbon, irrigation, public transportation, maritime and air services, rail cargo transport and waste disposal – is in charge of setting tariffs, sector oversight and organizing public auctions to award independent generation projects.

Regulations strongly favor RE power generation; major ones have included:

- The 1949 law creating ICE, which directly entrusts it with development of the country's physical resources, especially hydropower;
- Organic Environment Law, which states that Costa Rica's RE resources have an essential role to play in sustainable development, which the State is responsible for promoting;
- MINAE-issued decrees, providing RE-resource incentives;
- Parallel Autonomous Generation Law, which authorizes ICE to purchase up to 30 percent of the national required power capacity and energy from IPPs, provided they use RE (this law has driven development of private investment in RE generation); and
- Rural Electric Cooperatives and Municipalities Participation Law, which regulates how entities created by these bodies obtain concessions for hydropower plant investment.

All power projects must be compatible with the National Energy Plan, one of whose objectives is to continue development of alternative energy resources. This includes meeting the target to increase RE share (other than hydropower) in generation to 15 percent of the national power production.

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[91] *This condition is difficult to implement in practice. Foreign investors can easily circumvent restrictions on percentage of foreign ownership by finding a local "straw man" with little or no capital; they lend the straw man the required national equity capital under a shareholder agreement that limits his voting rights and allows him to access dividends first when the loan has been repaid.*

[92] *A cap on the country's debt (imposed by the IMF in the mid-90s) had created a situation in which public utilities raised tariffs but could not reinvest the resulting revenues in the respective sector.*

As a result of the Costa Rican government's policies and regulations – the long-term PPA being the primary tool – plants using fossil fuels have been unable to penetrate the country's market. The PPA structure, with its seasonal- and time-of-day differentiated tariffs, merits replication in Nicaragua.

El Salvador

In 2002, El Salvador had an installed capacity of 1,136 MW; that year, RE generated 51 percent of total power, 28 percent of which was provided by hydropower and 22 percent by geothermal energy.[93] The country is Central America's largest consumer of geothermal energy. Its two main geothermal facilities are Ahuachapan (Ahuachapan Province), with a 95 MW generating capacity, and Berlin (Usulutan Province), with a 66 MW generating capacity.

A geothermal law supports private development. MARENA, responsible for water management policy and legislation, has prepared a bill for a General Water Law. Concurrently, the Superintendent of Electricity and Telecommunications (SIGET), the power sector regulator, has issued regulations to facilitate administrative processes for obtaining geothermal and water concessions for smaller-scale projects.

The first RE law, adopted in 1986, was replaced in 2003 by the Renewable Energy Development Incentives Law, which instructs the Ministry of Energy and Mines (MEM) to conduct resource surveys and provide investment incentives (for example, exemption from import duty and VAT and 10-year tax holiday on income and property taxes).

The government of El Salvador is considering a major policy initiative, known as the Renewable Energy System Development (SIFER). It would establish :1) the Guarantee and Stabilization Fund (FOGES) for RE projects; 2) guides for making maximum use of "green electricity funds" (including the Clean Development Mechanism, CDM) and 3) tools for comparative cost-analysis of options; and 4) a proposal for a wholesale power broker, who, inter alia, would sign long-term PPAs.

Guatemala

In 2002, Guatemala had an installed power capacity of 1,703 MW; that year, RE provided 44 percent of the power generated, comprised of 33 percent hydropower, 9 percent biomass-based cogeneration, and 2 percent geothermal energy. Demand growth calls for an additional 90 MW capacity per year.[94]

The government of Guatemala took a strategic approach to power sector reform. It privatized all State-owned assets, with the exception of hydroelectric and transmission assets, which remained under the National Electrification Institute (INDE).

The privatization process aimed to rapidly develop private investment in generation and rural electrification. Two thermal-fired generating units, owned by the Guatemala Electric Power Company (EEGSA), were sold for US$30 million to the Guatemala Generating Group (GGG) (controlled by Constellation Power), securing a 18-year PPA that allowed the winning bidder to construct up to 150 MW of new capacity on a Build-Own-Operate (BOO) basis.[95] In 1998, EEGSA's urban

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[93] *El Salvador has the second-highest credit rating of all countries in Latin America.*
[94] *Guatemala, Central America's only oil-producing country, is the region's largest economy, with a GDP of US$18 billion.*
[95] *The GGG's 18-year PPA allowed the group to construct up to 150 MW of new capacity, with free choice of site, fuel and technology. During the first three-year phase of the PPA, GGG sold EEGSA 80 MW of output from existing units they recently acquired, providing part of the cash needed to build the plant that would sell power on a dispatchable basis over the next 15 years. Follow-up investment was in the 120 MW San Jose coal plant and the Orzunil geothermal project.*

distribution assets were privatized when 80 percent was bought by the Central America Energy Distributor, SA (DECASA), a consortium of Teco Power Corporation of the United States, Iberdrola Energy, SA of Spain and Portugal Electricity, SA INDE's rural distribution assets were privatized; proceeds remained in a rural electrification fund, which the rural concession holder (Union Fenosa won the tender for both concessions) could draw on to finance 100 percent of the cost of rural electrification investment.[96]

The investment framework for generation is clear. At the wholesale level, companies compete in two markets: 1) deregulated contracts market; and 2) spot market. The wholesale market administrator is a private, nonprofit company. Electricity generation is open to any entity, and projects under 5 MW do not require specific government authorization other than what the constitution and related laws stipulate. Distributors include one large urban company, one large rural company, and 14 smaller Municipal Companies (EEMs), which account for 5 percent of demand. Electricity Law regulations classify clients with power demand above 100 kW as large users; they are not subject to regulation and can freely negotiate power supply conditions with distributors or other suppliers, including generators and dealers. Independent power retailers or wholesale brokers are free to operate in the market without a license; but they must buy and sell a minimum of 10 MW. In 2004, there were 11 retailers. Marketers, distribution companies and large consumers are required to hold contracts that cover their capacity and energy requirements for both the current and subsequent year. This restriction puts most generation under the contracts market.

The National Electricity Commission (CNE), created in 1996 as an independent agency under the MEM, is responsible for market oversight. It sets market rules and procedures and oversees market-agent behavior. It also regulates electricity law and defines transmission and distribution tariffs. The General Energy Administration (DGE), responsible for sector policymaking and planning, may, in certain extreme cases, require transmission and distribution companies to undertake targeted system expansion projects in return for government payments and guarantees.

Demand-side conditions, apart from the overhang of long-term PPAs with EEGSA and INDE,[97] are conducive to investments in new generation as demand grows 80 MW per year and there are several off-takers.

Guatemala has a long history of promoting private sector investment in RE. The first RE law, adopted in 1986, was in force until 2003 when it was replaced by the Incentives for the Development of Renewable Energy Projects Law (Decree 52-2003). In 1993, INDE signed its first PPA with a private developer for a 12 MW hydropower plant. In 1996-97, a private developer's PPA application for a proposed 20 MW wind farm was put on hold, pending sector reform. But no new renewable generation plants have come up since privatization, in part, because Parliament has not passed the Water Resource Law. However, the main reason is the inability to sign long-term PPAs with INDE.

Decree 52-2003 instructs MEM to undertake resource surveys and provide a range of economic and fiscal incentives (e.g., tax exemptions on imports of relevant RE equipment and for companies implementing such projects,

[96] *The subsidy of US$600 per connected consumer was more than enough to cover the cost of the rural investment program. However, the subsidy only covered new consumers located more than 200 meters from the distribution grid of the concession holder (i.e., outside the concession area). The concession holder charged consumers beyond the 200 meters a low connection fee, and those within the concession area a high fee, thereby discouraging low income households from connecting.*

[97] *INDE resells this power to distribution entities.*

elimination of the VAT and a 10-year tax holiday on RE investments). MEM's recent activities include creation of the Center for Renewable Energy Information and Promotion and introduction of a Bill for a biofuel law.

Honduras

In 2002, Honduras had an installed generation capacity of 1,073 MW; that year, hydropower generators accounted for 39 percent of power. The country has five State-owned and three private Small Hydropower (SHP) Plants in operation; 15 new SHP projects, totaling 105 MW, are under development by private developers.

The government of Honduras intends to change the existing legal framework to privatize the distribution system. Currently, the National Electric Power Company (ENEE), the vertically integrated, State-owned public company, runs the system. But the new law proposing an open generation market has not yet been approved.

Reform of the Honduras power sector began in 1994, with the Electricity Subsector Framework Law and its subsequent regulations in 1998. The law established that the PPA price for electricity between an IPP and ENEE had to equal ENEE's short-term marginal power cost.

From 1998 to 2004, additional RE generation-investment incentives were introduced. Renewable generating plants below 5 MW and hydropower plants contributing to flood control (and thereby contributing to watershed management) were paid 10 percent on top of the short-term marginal cost of power. Investors were exempted from paying sales tax on equipment, materials and accessories during construction and import duties on equipment and accessories during study and construction (under Decrees 95-1998 and 267-1998). Investors were also exempted from net income tax for five years after starting commercial operations. Electricity generated in hydropower plants below 50 MW had a dispatch guarantee (under Decree 9-2001). ENEE was required to purchase from private producers (this requirement will change once the new electricity law comes into force, under which ENEE will be sold to a private owner). The limit for small hydropower plants with special incentives was 20 MW. A special decree allowed private wind farm investment. Administrative approval procedures were rationalized, and the issue of municipal tax payment was resolved (under Decree 103-2003).

The Natural Resources and Environment Secretariat (SERNA) is responsible for the development, coordination, evaluation, and implementation of projects related to the protection and use of water and RE resources. SERNA issues licenses to hydropower and wind energy projects and implemented micro-hydro and PV projects to electrify isolated communities.

One success factor for private hydropower development was development of the Canadian International Development Agency (CIDA)-supported Power System Master Plan in the early 90s. Before that time, the energy sector was fragmented by studies and site inventories. Currently, all private hydropower developers select their sites in accordance with the Master Plan.

In October 2003, the Central American Bank for Economic Integration (BCIE) announced that it will cofinance a new hydropower plant with a 12.2 MW capacity. Electricity will be sold to ENEE over a 15-year period. The project includes management of the 115 square kilometer (km^2) Río Cuyamapa watershed. At the same time, lack of progress in attracting private capital to hydropower led the government to develop the Special Executive Commission for Hydropower Development Projects that same year. Under the European Union-financed Autonomous Generation and Rational Use of Energy Power in Honduras

(GAUREE) project, ENEE identified potential project sites for which it had prepared prefeasibility and feasibility studies. One of these, the 100 MW Piedras Amarillas Project, was to be put up for tender in 2004.

Panama

In 2002, Panama's installed power capacity was 1,533 MW. That year, RE accounted for 65 percent of the national generation, of which all but 0.1 percent (biomass-based cogeneration) was derived from hydropower.

The 1997 Regulatory and Institutional Framework for Public Electricity Service Law (No. 6-1997) created the Energy Policy Commission (COPE) as the power sector's key policymaking institution (including RE promotion). Article 55 mentions specifically that it is in the State's interest to promote RE in order to diversify energy supply, reduce environmental harm and lessen dependency on imported sources. To this end, the law's implementing regulations give RE generation sources a 5 percent price preference when distribution companies make their tender calls for capacity and energy. Calls for tender rules and regulations contain other provisions that favor RE, the most important of which is the potential to engage in long-term PPAs (10 years, with a four-year waiting period to allow for construction).

The Environment Law reconfirms that natural resources are State property. It assigns the National Environment Authority (ANAM) responsibility for setting tariffs on natural resource use, based on the justification provided by economic and financial studies.

COPE has implemented a series of RE studies in hydropower (supported by the Electric Power Transmission Company, SA [ETESA]), geothermal energy (assisted by ETESA and the International Atomic Energy Agency [IAEA]), and wind energy (in cooperation with the Global Environment Facility [GEF]). In addition, COPE has set up the National Energy Information and Documentation System (SNIDE); prepared a perspective study for future power supply, including RE; and developed the National Rural Electrification Plan (PLANER), financed by the Inter-American Development Bank (IDB), which aims to increase national electrification from 81 to 95 percent within 10 years.

In 2004, COPE issued its policy and criteria for expanding the interconnected power system. It concluded that the most financially viable hydropower projects should be included in investment plans to reduce the effect of fluctuating oil prices. Specific policy guidelines were issued for hydropower and wind energy (Resolutions Nos. 001-2004 and 002-2004). A major change was introduction of a postage-stamp transmission charge.

Country Lessons for Nicaragua

Like Nicaragua, the other four Central American countries that implemented power sector reform – El Salvador, Guatemala, Honduras and Panama – have experienced similar problems. All five countries have witnessed the reality that liberalization favors power sector investments with short payback periods, while such capital-intensive investments as hydropower and geothermal energy are stymied. In their generation portfolios, all five have clearly expressed their preference for RE for reasons related to the environment, foreign exchange and long-term price stability. All have lamented that private sector RE investments have been delayed, yet none have imposed a moratorium on conventional thermal power investment. All have had difficulty obtaining parliamentary approval of their respective water laws. Their RE-promotion strategies have included State-financed resource surveys and easing of administrative procedures and economic investment incentives (for example, exoneration of VAT and import duties, long-term tax holidays

and reduced municipal taxes). None have royalty payment policies for use of water or geothermal resources.

Some countries are attempting to tilt the tender process in favor of RE, for example, by offering renewable generators a 5 percent price premium. Special offers are being developed for investments in plants below 5 MW, and special regulations are being adopted for wind farm implementation. All five countries are struggling to introduce long-term PPAs into their competitive power environment. One is considering setting up a specialized retailer for this purpose.

Obviously, Costa Rica's experience stands apart from that of its Central American neighbors. Although Costa Rica actively encourages IPP investments, it maintains, through its ownership of ICE, State control over the entire vertical chain, from generation to distribution. On the demand-side, the advantage is that IPPs can obtain long-term PPAs. On the supply-side, when private IPPs are unwilling to invest in hydropower plants, ICE can take on such investments, as long as the companies are sufficiently creditworthy.

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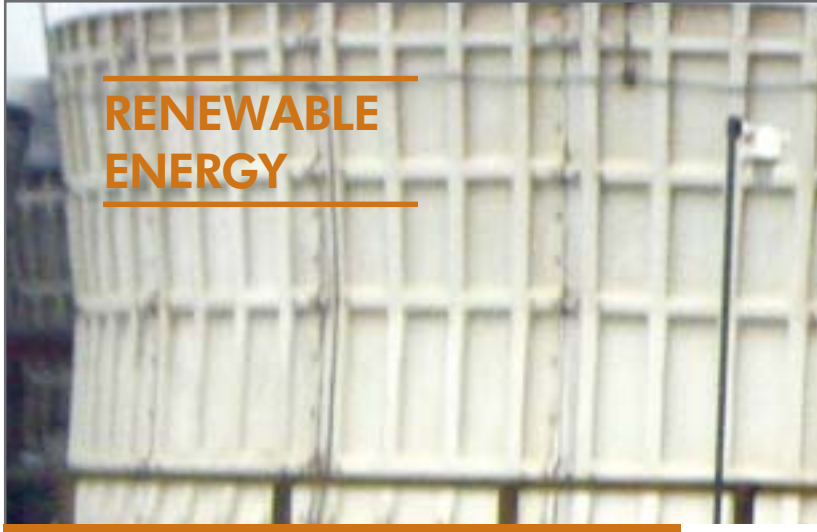

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