

Easing Investment Barriers: Nicaragua's Renewable Energy Potential

by Wolfgang Mostert

Today Nicaragua's economy faces a triple squeeze: high power prices, power shortages, and increased costs for imported fuels. Despite the country's economically-viable renewable energy (RE) potential, risk-averse private investors prefer diesel power plants, with their low upfront costs. This note highlights lessons from the country's failed power-sector reform of 1998–99 and recent measures to ease barriers to RE investment.¹



El Bote, a 930-kW hydropower project located in Nicaragua's central highlands, delivers power to 2,700 rural residents.

Renewable Energy: Untapped Potential
Nicaragua, Central America's largest country (129,500 sq km), is endowed with abundant, high-quality renewable energy (RE) resources. In 2004, the country's economically-viable RE potential was 3,000 megawatts (MW)—five times its national power capacity—composed of hydropower (1,700 MW), geothermal (1,000 MW), wind farm (200 MW), and biomass (200 MW). Generation at potential RE project sites, spread throughout the country, is highly price-competitive compared to conventional thermal power.²

New geothermal and hydropower plants and wind farms offer an array of potential advantages:

- Supplying additional power at a lower risk-adjusted cost per kilowatt hour than conventional thermal plants,
- Saving foreign exchange,
- Generating employment,
- Increasing national value added, and
- Providing price stability.

In addition, the capital requirements for RE investments offer an opportunity to accelerate the development of a national capital market.

Despite RE's rich potential and price competitiveness, available RE capacity in 2006 amounted to only 243 MW: biomass (108 MW), hydropower (98 MW), and geothermal (37 MW). From 1980 to 2005, RE's share in national power production fell 25 percent (60 to 35 percent), while investment in diesel-fired power continued to rise. Political issues, along with low per capita income, acted as constraints.³ Investment in infrastructure stagnated; by 2005, 1.7 million residents were still without electricity. Today's daily power outages are a reminder that power-sector reform failed to bring sufficient private capital into generation to achieve a more rational portfolio of power projects.

Why Reform Failed

The objectives of Nicaragua's 1998–99 power-sector reform were threefold:

- Develop the country's economic RE potential for generation,
- Reduce high system losses in distribution, and
- Increase the national rate of electrification.

Like other Central American countries that underwent power-sector reform in the late 1990s—El Salvador, Guatemala, Honduras, and Panama—Nicaragua implemented a vertical breakup of its power sector, privatizing its generation and distribution assets. At

¹ This note is based on the 2007 ESMAP report, *Unlocking Potential, Reducing Risk: Renewable Energy Policies for Nicaragua*. Building on the findings of studies supported by Nicaragua's National Energy Commission and ESMAP, the author proposes a comprehensive strategy for promoting RE investment in Nicaragua.

² To be financially viable, Nicaragua's geothermal power projects require US\$65–70 per megawatt hour (MWh) (GPS 2006). The financial production costs of several potential hydropower plants are estimated at less than US\$60 per MWh (Scheutzlich 2004). Wind energy at the better sites requires US\$60–66 per MWh (Jiménez and Povedano 2003). In 2005, the average price for bulk thermal power was US\$88 per MWh.

³ About 70 percent of Nicaragua's population of 5.5 million—77 percent of dispersed rural residents and 64 percent of urban dwellers—live in conditions of poverty.

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that time, the cost of investment capital was high, while international prices of oil and coal were low. None of the five countries imposed restrictions on private investment in generation; in each case, market liberalization led risk-averse private investors to avoid capital-intensive RE technologies, preferring conventional thermal power plants. As a result, RE share declined.⁴

Lack of facilitating rules. Rather than establishing enabling conditions for developing the country's RE potential, the designers of Nicaragua's market scheme focused on creating a competitive power pool in a market characterized by an oligopolistic structure on the supply side and a monopsony on the demand side. But with no specific facilitating rules, power pools have been biased against investment in RE generation. Short-term selling into a market with fluctuating power prices has increased revenue uncertainty, driving up the cost of capital and undermining the cost-competitiveness of investing in capital-intensive RE power plants.

Bulk-power market rules have not favored concluding long-term power purchase agreements (PPAs). In addition, the price evaluation method for PPA tenders, implemented by Union Fenosa, the Spanish distribution company, has offered no premium for price-risk differences between fixed-price offers from RE generators and tariff bids from diesel power plants, which have automatic adjustments for changes in imported fuel prices. Furthermore, market rules have undermined the financial viability of intermittent sources of power supply (box 1).

Poor policy sequencing. Market liberalization was introduced before key legislation allowing developers to access potential RE project sites had been adopted. At the time of power-sector restructuring, a critical water rights law had not been passed, leading to the failed privatization of HIDROGESA, the state-owned hydropower holding company and, more importantly, the inability to develop larger plants. Also, development of geothermal power generation was blocked by legislation that converted resource-rich areas into national parks (GPS 2006).

Distributor Union Fenosa, which won the two tendered concessions, was unable to reduce inherited system losses—more than 35 percent—to the lower levels prescribed in its regulatory contract. Tolerance regarding electricity theft proved difficult to

Box 1. Market Rules Bias

Before Nicaragua adopted the 2005 Renewable Energy Promotion Law, wind farms and run-of-the-river hydropower plants were not entitled to a capacity payment on the contracts market or the short-term capacity market, which is settled daily. The price difference is substantial. Between November 2000 and June 2003, energy prices were US\$34–59 per MWh versus US\$60–71 per MWh for the monomial price,* which includes the cost of capacity payments. Generators' obligation to provide a capacity reserve equal to 5 percent of installed capacity imposed a greater financial burden on wind farms, which have a lower capacity factor than thermal power plants; that is, per sold kilowatt hour, the cost of that obligation is higher. Thus, although Nicaragua has some of the world's best wind-farm sites, market rules have rendered the commercial viability of wind-farm projects virtually impossible.

* Average price of PPA contracts and spot markets, which yields the bulk power market's kilowatt price that the distributor, Union Fenosa, is allowed to pass on to final consumers via its tariffs.

eliminate. The Nicaraguan government did not establish a facilitating framework that would have made theft a criminal offense and would have put in place a small-courts procedure. [The electricity law criminalizing electricity theft was finally passed in 2008.] Prevented by the regulator from including full coverage of system losses in its tariffs, Union Fenosa slid into a precarious financial position; in turn, investors ready to sign long-term PPAs with the distributor found it difficult to secure project finance. In short, Union Fenosa was not a creditworthy off-taker of power (Barnes and Waddle 2004).

Blocked legislation. Political divisiveness and a regulatory setup of competing institutions with overlap-



In Nicaragua's remote Atlantic Zone, 350 families benefit from 2-kW capacity, solar battery charging stations installed by the Offgrid Rural Electrification Project (PERZA).

⁴ Costa Rica, which did not undergo reform, required independent power producers to invest solely in RE generation projects; by 2003, RE share had reached 98 percent.



Photovoltaics workshop sponsored by the Offgrid Rural Electrification Project (PERZA).

ping responsibilities blocked legislation promoting RE investment. The power-sector reform process divided governance functions between the National Energy Commission and the National Energy Institute. The National Energy Commission was made responsible for energy planning, laws, and regulations; preparation of national and rural expansion; and implementation of rural electrification projects. The National Energy Institute was to handle sector regulation. From the outset, disagreement between the two institutions on critical issues hindered development of a coherent approach to rural electrification and RE policy. By 2006, with the supporting institutional and financial framework for accelerating rural electrification still undecided, the National Energy Commission adopted a project-by-project approach.

In 2005, a political power struggle between the executive and legislative branches of government climaxed when, by act of parliament, the National Energy Institute was replaced by the Superintendency of Public Services, a multisector regulator, and the president declared the nomination of regulators an unconstitutional encroachment on executive powers. Paralysis of the regulatory agencies' work ensued, creating further uncertainty for potential RE investors.

Lessons in Power Market Design

To achieve financial closure, geothermal, hydropower, and wind energy projects usually require one of the following:

- A long-term PPA with a credible off-taker;
- Guaranteed market access through a fixed, feed-in tariff for a specified number of years; or

A long-term “green bonus” imposed by an RE portfolio scheme, paid on top of the pool market price.

Easing Barriers to Investment

International experience shows that two factors are critical to the success of any national RE policy:

A comprehensive regulatory framework tailored to the needs of RE power generation and

Adoption of published, quantified targets by specified years for RE power-market penetration.

Nicaragua's 1998–99 reform process failed on both counts; by the end of 2002, RE share in total power generation had fallen to 23 percent, the lowest in Central America. The post-reform years of 2000–04 witnessed the issuance of various presidential decrees that provided generous incentives for RE investment and guaranteed market access for wind-farm and hydropower projects up to 5 MW. Yet general market and political uncertainties rendered these incentives ineffectual. By late 2005, the high prices of imported fuels revealed the macroeconomic and social costs of inadequate RE policies.

In response, the national assembly adopted three laws built on earlier policy efforts by the National Energy Commission (box 2). Adoption of these laws reflects a lessening of the political divisions that have long

Box 2. Toward a Virtuous Cycle of RE Investment: Laws Adopted in 2005

Energy Service Stability Act (No. 554-05):

Introduced a series of short-term emergency measures and made electricity theft illegal.

Amendment to the Hydropower Promotion Law (No. 531-05):

Authorized the Ministry of Development, Industry, and Commerce to grant run-of-the-river hydropower plants water rights of up to 30 MW after consultation with pertinent local authorities.

Renewable Energy Promotion Law (No. 532-05):

Exonerated projects from paying import duties and value-added tax on equipment, income tax for 7 years from project start-up, municipal turnover and property taxes for 10 years, and natural resource taxes for 5 years.

Introduced grid feed-in tariffs for wind-farm and run-of-the-river hydropower projects up to 5 MW (valid for 12 years in a range of US\$55–65 per MWh, based on a reference rate of US\$39 per barrel of crude oil).

characterized Nicaragua's business and regulatory environment and, in turn, damaged investor confidence.⁵

The Energy Service Stability Act can help Union Fenosa to reduce non-technical system losses if supplemented by a small-courts procedure and political pressure on the police force to prioritize the prosecution of cases. The Amendment to the Hydropower Promotion Law will enable investors to develop small run-of-the-river hydropower plants. The first plants may become operational within four years. The feed-in-law for mini-hydropower and wind-farm projects ought to get the first power plants into operation within three years, despite the tight international supply situation for small wind farms. The economic incentives offered by the Renewable Energy Promotion Law will have a limited effect. RE investments are already least cost, and perceptions regarding the long-term price of hydrocarbon fuels has shifted sharply upward over the last several years. As a risk premium for investing in capital-intensive technologies, the tax incentives are skewed in the sharing of risks: The first 10 years of operation are not counterbalanced by increased public benefits after that period.

Weaknesses in the institutional and regulatory framework are being addressed. In 2006, the National Energy Commission was elevated to ministry status. Elections brought a new parliament and president, which have helped to resolve the constitutional deadlock over the Superintendency of Public Services.

⁵ ESMAP-financed studies played a significant role in facilitating an understanding of Nicaragua's institutional limitations and potential sources of energy, which contributed to national policymakers' formulation of energy legislation promoting the use of renewables.

Conclusion

Although the legal, regulatory, financing, and institutional framework has much room for improvement, the current environment for RE investment is more positive. Still missing are three major policy initiatives: (i) mixed-use rules that permit the establishment of geothermal power plants in areas now designated national parks, (ii) adoption of the water rights law, and (iii) quantitative targets for RE penetration.

The Nicaraguan case shows that halfway implemented reforms carry a high economic cost. While competitive market schemes offer cost savings, they are never technology neutral in a world of uncertainty. When fuel prices are on the rise, low-investment technologies with high fuel costs hit the economy, not their investors. In a competitive pool, their generators are the marginal price-setting unit. The market design challenge is to identify the portfolio mix that provides the least-cost supply options for the country and develop instruments and market rules that guide private investments toward it.

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About the author: Wolfgang Mostert, an economist and renewable energy specialist, is a World Bank consultant based in Denmark.

Douglas F. Barnes, Technical Editor • Norma Adams, Editor • Marjorie K. Araya, Production

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