

# A Review of Energy Development Needs and the Hydropower Industry in Central America

Prepared by Colleen Ward, student intern  
Submitted August 18, 2005

## Introduction:

This report explains Central America's energy needs, the role of hydropower within this system, and the challenges of providing electricity across the region. Through this examination, this report also addresses the comprehensive effects of energy development on the area's ecosystems, natives living near dams, and foreign investment. The report was prepared for The Nature Conservancy's Sustainable Waters Program.

The Sustainable Waters Program (SWP) was formed in 2004 for the purpose of helping The Nature Conservancy (TNC) address a leading global threat to freshwater biodiversity: hydrologic alteration from dams, diversions, and groundwater pumping. SWP recognizes that dams, diversions, and groundwater pumping serve a variety of human needs for water, food, and for energy. A central tenet of this program is that opportunities exist to improve current management practices pertaining to these waters for the benefit of ecosystem health.

The Sustainable Water Program is interested in gaining a deeper understanding of the hydropower industry, infrastructure numerous markets, and institutional forces that contribute to the current pattern of hydroelectric generation. Ultimately, it is interested in discovering and pursuing opportunities for collaboration with the energy industry to create a more sustainable future in these markets. This report is part of this overall effort with specific focus on Central America.

## Central America's Current Energy Demand and Supply:

Central America is home to some of the poorest nations of the world. According to United States Agency for International Development (USAID), two-thirds of the population lives on less than \$2 a day. Access to electricity is also limited. Over half of the region's population lives in rural areas where there are frequent energy shortages (United States Energy Information Administration). Overall, in 1999, the countries of Central America consumed 0.2% of the world's total of energy (0.70 quadrillion BTU). This energy demand is supplied by oil (74%), hydropower (21%), other renewable energy sources (5%), and coal (less than 1%). However, considerable variation exists across each country regarding their dependence on each of these sources. For example, Costa Rica utilizes the greatest proportion of renewable energy sources, including hydropower, while Panama, Nicaragua, Honduras, and El Salvador depend upon renewable energy sources for between 15% and 25% of their energy needs (Energy Information Administration). These national differences are described in greater detail below. Significant variation also exists with respect to whether energy producers that fulfill the needs in each country are public or private entities and these variations also tend to reflect the reliability of the

electricity delivered. Where electricity is largely provided by public entities, delivery appears more reliable and consistent. These national differences are also explained in greater detail below.

- **Costa Rica** - Instituto Costarricense de Electricidad (ICE), a state owned electricity company, provides 97% of the country's electricity. Electric energy is relatively reliable and consistent across Costa Rica and provided across both urban and rural areas. Hydropower contributes 90% of the energy to fulfill the country's current demand. ICE estimates that Costa Rica's electricity demand will grow by 5.7% annually through 2020. Many other hydropower plants are being developed including the Pirris plant (128 MW) on the Pirris River and the Brasil II (39 MW) plant on the Virilla River (Energy Information Administration).
- **Guatemala** – Most of Guatemala's energy production and delivery is owned and operated by private entities. As with most countries in Central America, less than half of Guatemala's population has access to electricity. These effects are most extreme in rural areas outside of Guatemala City where many have virtually no access to electricity. Hydropower accounts for approximately 35%, fossil fuels for thermal plants account for another 52%, and natural gas and renewable energy sources for approximately 13% of Guatemala's energy needs. Guatemala relied on hydropower to fulfill 90% of its energy needs 15 years ago. Although Guatemala is the only oil producer in Central America, its production has been hampered by civil war for 36 years. The country is interested in developing its oil production potential, it currently is a net importer of oil. Guatemala also has some natural gas reserves (United States Energy Information Administration).
- **El Salvador** – Both public and private companies serve El Salvador's energy needs (El Salvador also began significantly expanding privatization within this industry in 1996). As in other countries in Central America, rural electrification is limited and about half of the country's population has access to consistent energy sources. El Salvador's energy needs are met by hydropower (31%), fossil fuels for thermal plants (44%), and renewable energy sources (25%). These renewable energy sources include geothermal facilities which met approximately 20% of El Salvador's total energy needs in 2000 (Energy Information Administration).
- **Nicaragua** – Significant private investment exists across Nicaragua's energy industry. Nicaragua's energy needs are met by hydropower (8%), fossil fuels for thermal plants (84%), and renewable energy sources (8%). Private ownership of Nicaragua's production and delivery system has increased significantly since the early 1990s as has its reliance on fossil fuels for thermal plant energy production. For example, in 2000, Coastal Power (a U.S. corporation) bought four of the six electricity production facilities in Nicaragua (Energy Information Administration).
- **Panama** - Significant private investment exists across Nicaragua's energy industry. Panama's energy needs are met by hydropower (61%), fossil fuels for thermal plants (37%), and renewable energy sources (2%). Panama is also the largest energy consumer in Central America. Panama has no known natural gas, coal, or oil reserves (United States Energy Information Administration). Panama is strategic to the energy market in Central America

since it provides a transporting zone for petroleum products and crude oil along with the Trans-Panamanian pipeline. Given Panama's proximity to Columbia, and Columbia's natural gas reserves, interconnecting the Colombia and the Panamanian markets could expand Panama's reliance on natural gas and diminish its dependency on fossil fuels (Energy Information Administration).

- **Honduras** - Significant private investment exists within Honduras's energy industry. Honduras's energy needs are met by hydropower (50%) and fossil fuels for thermal plants (50%). As with other countries in Central America, Honduras relied on hydropower to fulfill 90% of its energy needs as recently as 15 years ago. Private companies own the majority of thermal plants (94%) while most hydroelectric plants are public, except one. The government is not able to invest in new projects, and therefore private investors have been able to build generation plants (Midence 2003).
- **Belize** - Significant private investment exists within Belize's energy industry. Belize's energy needs are met by hydropower (40%) and fossil fuels for thermal plants (60%). However, biomass investment has recently increased. With no evidence of petroleum deposits large enough for commercialization, 100% of fossil fuels are imported and 50% of electricity produced is imported from Mexico (Azurdia-Bravo 2003). This import of electricity has been cited for 13% of the 567 recorded outages in 2002. Belize's energy demands are growing at 10-15% each year significantly outpacing the global annual growth rate of 2 – 3% (*Outside* May, 2003). See <http://www.puc.bz/publications/energy%20sector%20diagnostic%20report%20final.pdf> for more information about Belize's potential for a sustainable energy future.

The preceding country-specific analysis reveals the affects of electricity sector reforms during the past 15 years. The general reform model applied consisted of the vertical unbundling of the electricity industry, the total or partial privatization of energy companies, the introduction of competition in generation, and the creation of regulatory bodies for distribution. What may also be apparent is that global organizations and private investors are becoming increasingly involved in the energy industry across Central American countries. This is most pronounced in the countries that are most needy financially.

#### Environmental Consequences of Hydropower:

As stated above, extensive privatization of the energy sector has occurred across Central America during the past 15 years. Although privatization allows for these countries to gain needed infrastructure investment for their energy sector, private business interests are often less sensitive to national interests in biodiversity protection and sustainable resource management. The region has limited laws requiring consideration and mitigation for ecological effects or lacks capacity to enforce such regulations. Further complicating this situation are the linkages between staff of governmental agencies and the multilateral organizations and transnational corporations that provide funding for development projects (such as the World Bank, U.S. Agency for International Development (USAID), International Monetary Fund (IMF), and the Inter-American Development Bank (Solo 2003). Privatization also does not always result in a

positive economic situation either. Here are two examples that show how such schemes can result in financial hardship as well as local harm:

- ***Chixoy Dam in Guatemala:*** The Chixoy hydroelectric program began in 1975 and was run by German, Swiss, and U.S. companies. Four hundred native Maya Achi people were killed by the Guatemalan army after protesting the dam's construction in fear of their villages being flooded. The Chixoy also proved to be extremely costly - it exceeded five times the projection of U.S. \$270 million. In the 1990's, 45% of the national debt in Guatemala was from the Chixoy Dam project (Solo 2003).
- ***El Cajon Dam in Honduras:*** Construction of the El Cajon Dam began in 1985 with U.S. \$700 million funded by the Inter American Development Bank and the World Bank. For five years the dam provided 75% of Honduras's electricity, then engineering problems with water filtration and environmental damage occurred. Already in debt millions of dollars from the original loans for this project, the government had no choice but to ask for additional financing from international lenders to finish the project.

#### Regional Expansion to Meet Central America's Energy Future:

Efforts to connect Central America's energy production and distribution systems have been underway for some time. These efforts occur between individual countries, across the region, and between Central America and its northern and southern neighbors.

- ***Country-to-country connectivity:*** Individual countries across Central America have developed partnerships with their neighbors to link their energy systems and provide more reliable energy delivery. For example, Guatemala has been involved with neighboring countries in several projects to increase reliability of power supplies and to alleviate frequent power shortages and Panama and Colombia have partially linked power grids ( United States Energy Information Administration).
- ***Regional connectivity:*** The Central American Electrical Interconnection System (SIEPAC) is a U.S. \$320 million project to create Central America's first regional power and transmission grid. SIEPAC calls for 1,125 miles of transmission line with a capacity of 300 MW between Guatemala and Panama as well as improvements to existing systems. SIEPAC is financed by the Spanish government through the agency Endesa and Inter-American Development Bank (IDB) who have already committed U.S. \$240 million in financing (Luna 2002). Its goal is to provide connectivity across Central American's energy producers and distributors, promote energy sector privatization, and encourage expanded energy projects including 72 hydropower dams.
- ***Mexico – Central America Connectivity:*** Plan-Puebla Panama (PPP) is a 25-year, \$20-billion dollar, project that interconnects Mexico to Panama. Proposed by former Coca-Cola executive and current Mexican President Vicente Fox and the Inter-American Development Bank (IDB) in 2000, the project includes the region of nine southern states of Mexico and all Central American countries. The infrastructure projects include: building highways, new electrical lines that distribute power from gas and dams, and

development zones for processing plants (Pickard 2002). It would create the infrastructure required for Free Trade Area of the Americas (FTAA) and trade with the U.S. Central America Free Trade Agreement (CAFTA). Connectivity with South American energy grids may be facilitated through Panama's existing connections with Columbia (United States Energy Information Administration).

Little public involvement has been associated with these plans for regional connectivity and little to no consideration of the ecological effects of such plans has occurred (Ross 2003).

Opposition to plans for energy grid connectivity, and particularly hydropower expansion, across Central America extends from several in-country and international governmental and non-governmental organizations. Discussion has been most heavily focused on the PPP during the last three years. In July 2004, the 2<sup>nd</sup> Meso-American Forum against Dams "For the Peoples' Water and Life" was held in Honduras (Solo 2003). 150 delegates from across the region discussed the region's 500 hydropower projects and proposals for new projects. In a statement issued citing the Puebla Plan and the Colombia plan: "the proliferation of hydroelectric projects in our countries is not due to the energy needs of our peoples but responds to the need to set up the necessary infrastructure to develop the neo-liberal economic model through the Free Trade Area of the Americas, and the various Free Trade agreements on a continental level" (Solo 2003).

International organizations argue that alternative energy sources, such as solar, wind, and biomass, should be considered. Developing alternative sources has also been supported by the United Nation's Framework Convention on Climate Change as part of U.S. Initiative on Joint Implementation. An example of such alternative energy development is the Bel/Maya Biomass Power Generation Project in Belize. The project uses smashed orange waste, sugarcane, and wood to fuel the steam power plant which generates 18MW. The United Nations Environmental Program mapped solar and wind resources called the Solar and Wind Energy Survey Assessment (SWERA) in El Salvador, Nicaragua, Honduras, and Guatemala. The UN program's goal was to motivate potential investors with accurate renewable energy resources information (Energy Information Agency).

In-country opposition also exists. One such group is a grassroots program in the Americas supported by the International Relations Center (IRC), which provided a critical analysis of the PPP's faults and recommendations for improvement in September 2002 (Call 2002). According to the organization's website, the Mexican's government budget priorities allow 82% for transportation projects, while only 2.0% is for health or social development projects (Call 2002). Few of the projects call for environmental impact statements. There have been some plans to study ecological effects where dams will be built, but none have been recorded yet. Public information is confusing, incomplete, sporadic, and websites contain general information about natural resources. Citizens' critiques and suggestions stated that the PPP responds to U.S. interests, not regional communities. The lack of public input "violates international agreements, including Convention 169 of the International Labor Organization on indigenous rights." More importantly, the citizens were outraged at the disregard for the destruction of endangered species and habitats only found in Central America. Additionally, the group concluded that:

The PPP should be canceled and replaced with a regional development plan that: supports rural development and enhances food security; does not rely on assembly plant maquiladoras or agro exports; respects the diverse cultures and customs of the region; protects biodiversity; provides local communities with electrical power not based on large-scale dams; and involves affected communities in both planning and implementation phases (Call 2002).

Conclusion:

Opposition to PPP exemplifies the growing public interest in being part of the dialogue about the region's future energy development. Opposition also reflects the growing societal recognition of the environmental costs of hydropower development to meet the region's growing energy demands. The full environmental costs of these projects should be considered before moving forward with development that involves acceptance of financial risk and privatizing national resources. At minimum, The Nature Conservancy will likely need to pursue additional research to ascertain how to affect such regional development plans so that they are more responsive to environmental concerns so that the region's unique biodiversity can be conserved for future generations to enjoy.