

**Title:** Pico-Hydropower Franchising: A Test Bed in Rural Honduras

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**Abstract**

Hydropower is considered a significant natural resource<sup>1</sup> in countries such as Honduras, Peru, Chile, Kenya, Tanzania, Nepal, Vietnam, and others, because of their mountainous landscapes and adequate levels of rain and/or snow. Despite this resource, many of the poor of in these countries live in isolated mountainous communities without access to grid-based electric power because large-scale production plants primarily serve urban areas. The decentralized nature of the populations of these regions makes it economically prohibitive to connect them to their national grids.

The international development organization Practical Action emphasizes the role of electricity in development:

“It is widely recognized that electricity is a central element for social and economic development. It contributes to economic growth and underpins a range of basic welfare services, such as clean water, health, communications, and education.

“Research on rural electrification suggest that rural people without access to electricity only need small amounts of energy to improve their quality of life and their income. In most cases, electricity is necessary for the provision of lighting and community services such as education and health.”<sup>2</sup>

One of the primary uses of electricity by the remote, rural poor is for lighting. “For those without access to electricity, lighting is derived from a diversity of sources, including kerosene, diesel, propane, biomass, candles, and yak butter.”<sup>3</sup> Fuel-burning lanterns, perhaps the most common alternative to electric lights, have been shown to: be a source of respiratory disease<sup>4</sup>, contribute to environmental problems associated with fossil fuels and deforestation, and put a

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<sup>1</sup> CIA - The World Factbook, <https://www.cia.gov/cia/publications/factbook/geos/xx.html>

<sup>2</sup> Sanchez, Teodoro, “Electricity Services in Remote Rural Communities, The Small Enterprise Model”, Intermediate Technology Publications Ltd., UK, 2006

<sup>3</sup> Mills, Evan, “The Specter of Fuel-Based Lighting,” Science, Vol. 308, Issue 5726, May 27, 2005

<sup>4</sup> Sikolia, DN, “The Prevalence of acute respiratory infections and the associated risk factors: A Study of children under five years of age in Kibera Lindi Village, Nairobi, Kenya,” Japanese National Institute of Public Health, 51 (1): 2002

significant financial strain on the impoverished<sup>5</sup>. Evan Mills, an expert on rural lighting in developing countries, states in his 2005 *Science* article, “The Specter of Fuel Based Lighting”<sup>6</sup>:

“Fuel-based lighting embodies enormous economic and human inequities. The cost per useful lighting energy services... for fuel-based lighting is up to ~150 times that for premium-efficiency fluorescent lighting...

“By virtue of its inefficiency and poor quality, fuel-based light is hard to work and read by, poses fire and burn hazards, and compromises indoor air quality. Women and children typically have the burden of obtaining fuel. Availability of [electric] lighting is linked to improved security, literacy, and income-producing activities in the home. Fuel prices can be highly volatile, and fuels are often rationed, which leads to political and social unrest, hoarding, and scarcity.”

This paper describes the efforts of the authors to create village-level “pico-hydro” systems (smaller than 5000 Watts output power) that harness small mountain streams to produce electricity services in remote communities. The energy produced by these methods can be sold to consumers through a variety of methods thereby making possible both electric lighting and income-generating opportunities simultaneously.

A small number of technologically appropriate, environmentally benign pico-hydro systems have been developed and installed in Honduran villages as prototypes. Village-level franchises have been created to maintain the systems, collect fees, and repay the franchiser, which is a for-profit business established, registered, and operated in an urban center of Honduras. Business plans have been created for both the franchiser and franchise businesses. These plans should be adaptable to other types of village-level electricity producing companies that use different energy sources, such as wind power, biogas, or solar photovoltaic sources.

At the successful completion of this project, franchised pico-hydropower will be sufficiently developed that researchers may pursue the next stage of funding from sources such as socially minded private investors, The World Bank, the National Science Foundation, or other sources.

The research has significant and probable potential to reduce poverty globally by improving the health, education, and economic burden of rural people while simultaneously generating scalable entrepreneurial opportunities.

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<sup>5</sup> Residents of the Nairobi slum known as Kibera, for example, told the author in 2006 that they were spending \$0.28 per day on kerosene for less than three hours of light. With average incomes near \$1.00 a day, this expense is significant.

<sup>6</sup> Mills, Evan, “The Specter of Fuel-Based Lighting,” *Science*, Vol. 308, Issue 5726, May 27, 2005