Microhydro-Generation of Electricity:
Providing Physical and Spiritual Light in Honduras

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Introduction

• Short-term missions projects popular
  – Church youth groups, college students
  – Service + Evangelism
  – Participants profoundly effected

• Often projects are to improve quality of life
  – Construction of homes or churches
  – Water purification

• Local people are left to maintain it
  – Unless sustainability is made a goal, impact can be short term when the mission group goes home
Why Energy Projects?

• Energy has the ability to help people in many ways:
  – Monetarily
  – Environmentally
  – Socially
Earlier Attempts at Energy Projects

- 2006: installed wind power/solar panels in impoverished area Nairobi, Kenya
  - Community owned = nobody owned
  - Solution somewhat socialist
- 2007: installed a micro-hydroelectric system in a poor mountainous village to:
  - Generate electricity for a village church
  - Battery recharging station
  - Business operations underdefined
Transition from Traditional Charity to Development Business

• Influential Book by C.K. Prahalad
• Begin to see the impoverished as customers
Other Examples of Technology-enabled, Entrepreneurship-based Development

- Grameen phone by Muhammad Yunus
- IDE and D-Rev by Paul Polak
- KickStart by Martin Fisher
Unmet Demand

1.6 billion people have no access to electricity (about 1 person in 4, globally)
Why is it Demand Unmet?

• Centralized production / decentralized population makes it financially prohibitive for national utilities to:
  – deliver power,
  – read meters,
  – collect payments,
  – prevent theft

• Modest energy consumption does not justify expense (rarely > 30-50 kWh/month/user)
Solution: Form Village Energy Inc.

Village Energy

Franchise

Support

Franchise Income & Fees

Utility Payments

Electricity

Village Homes and Small Businesses

Carbon Markets

Investor

Lender
Customer Profile

• Agricultural Worker
  – Village of 50-500 people
  – Grows own food
  – Works fields of land-owners for $4-5 per day
  – Energy Costs $7.44/month

Pueblo Nuevo, Honduras, 2008
The Hydropower System

- 63 liters/second
- 10 ft of head
- 770 Watts at 48 VDC
The Powerhouse

- Battery bank, 48 VDC, 235 Ah
- Two, 20 Amp Breakers
- 3 kW Inverter Additional Breakers
- Dump Load Controller
- Color Branding and Logo Design Culturally Appropriate

Battery bank, 48 VDC, 235 Ah
Distribution

Electronically resetting circuit breaker at each home

Madreado Trees
Business Model: BOOT Franchises

- Build, Own, Operate, Transfer
  - Micro Franchise + “Rent to Own”
- Employee-Owners living in village perform:
  - Maintenance
  - Billing
  - Collection
  - Theft prevention
Employee-Owner Profile

• Agricultural Worker
  – Literate and intelligent
  – Problem solver
  – Peace maker
  – Willing to disconnect for non-payment!

Danta Uno, Honduras, 2008
Employee-Owner Training

- Technical Training
- Operations Training
- Entrepreneurial Training for the generation of new businesses
- Opportunities for discipleship

Blaine McCromick teaching business and entrepreneurship, 2009
Competitive Providers

- One dollar buys how much light? (1000· lux-hours/$):

  - US Utility 19.23
  - Village Energy 2.31
  - Kerosene Lanterns 0.09
  - Batteries and Flashlights 0.02
Results in the Village

- Village 1, 25 connections (100%)
- Village 2, 40 connections and counting (80%)
Support of the Church

- Half price electric bills for churches
- Bible and literature distribution in homes with electricity
- Coordinating radio-based theological training with village pastors
Results with Student Volunteers

• My experiences... in Honduras have had a huge impact on my life... In a way it was thrilling to know that something was going to be built based on calculations I performed. As an added bonus, I had the satisfaction of knowing that our project would change the lives of people that I met while I was there. I discovered that using the same engineering skills I had gotten so tired of at the library could be incredibly rewarding!

• Lisa, Baylor mechanical engineering senior
Summary

• A for-profit model is superior to a community owned model in our experience
• Formed Village Energy Inc. to franchise village-level electricity companies
• Company is triple-bottom-line:
  – People
  – Profit
  – Planet

Danta Uno, Honduras, 2009