

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



ASA Annual Meeting, 2009

Authors

- Brian Thomas
 - Electrical & Computer Engineering



- Blaine McCormick
 - Management and Entrepreneurship



- Ryan McGhee
 - Former graduate student, ME/MBA



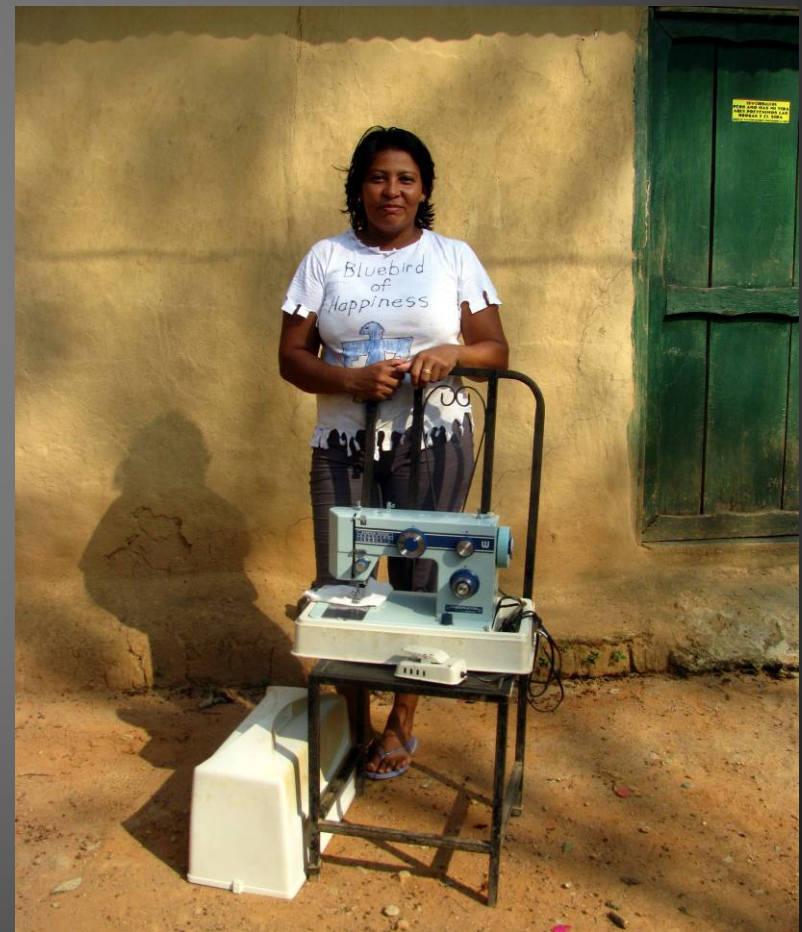
Introduction

- 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

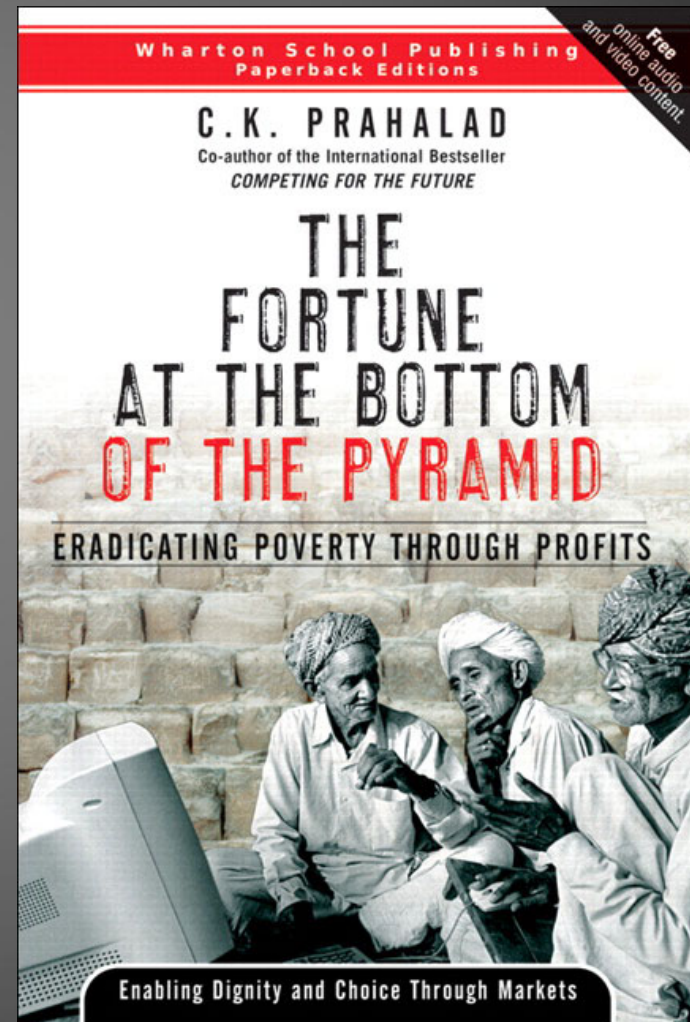


Earlier Attempts at Energy Projects

- 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



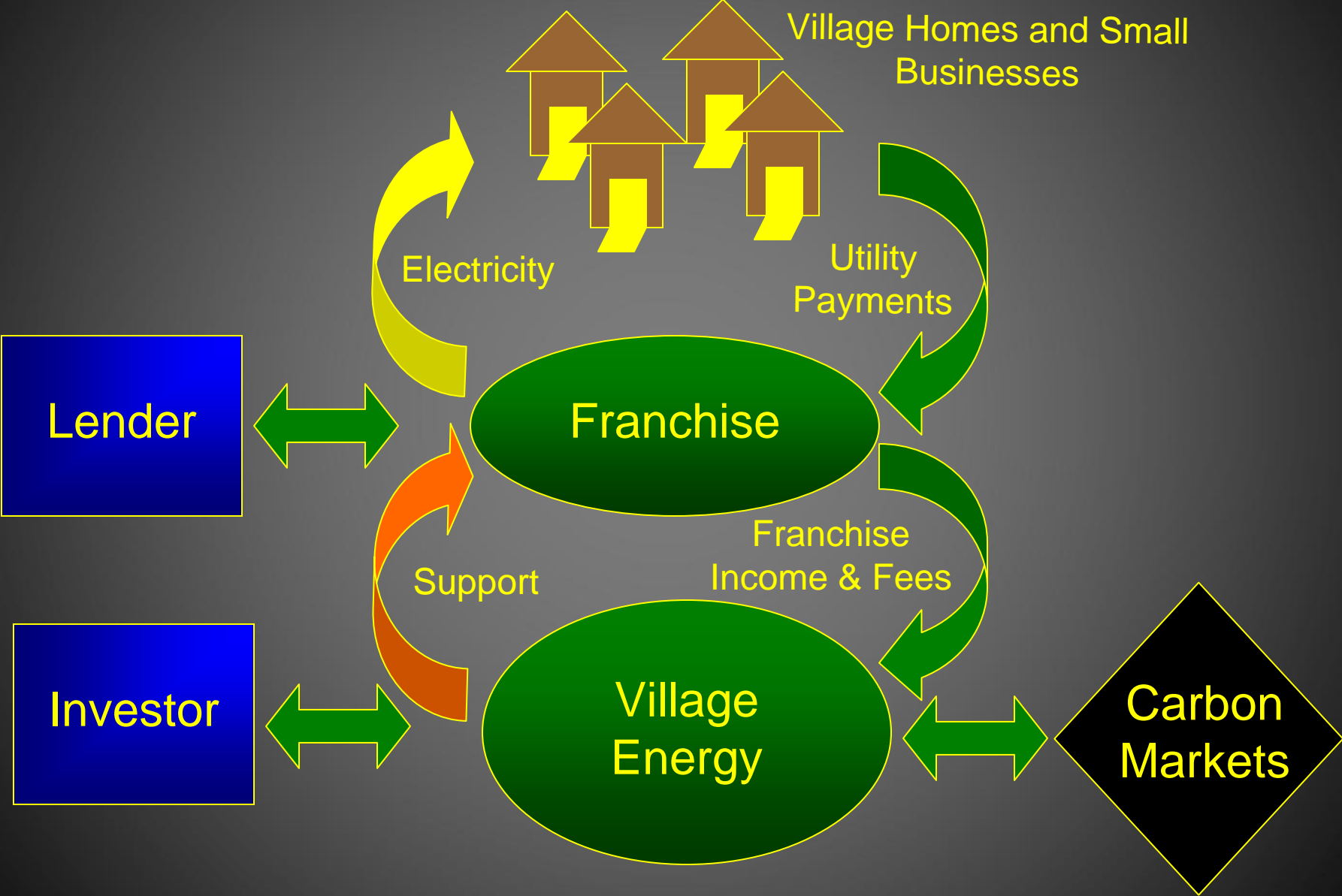
1.6 billion people have no access to electricity (about 1 person in 4, globally)

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.



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



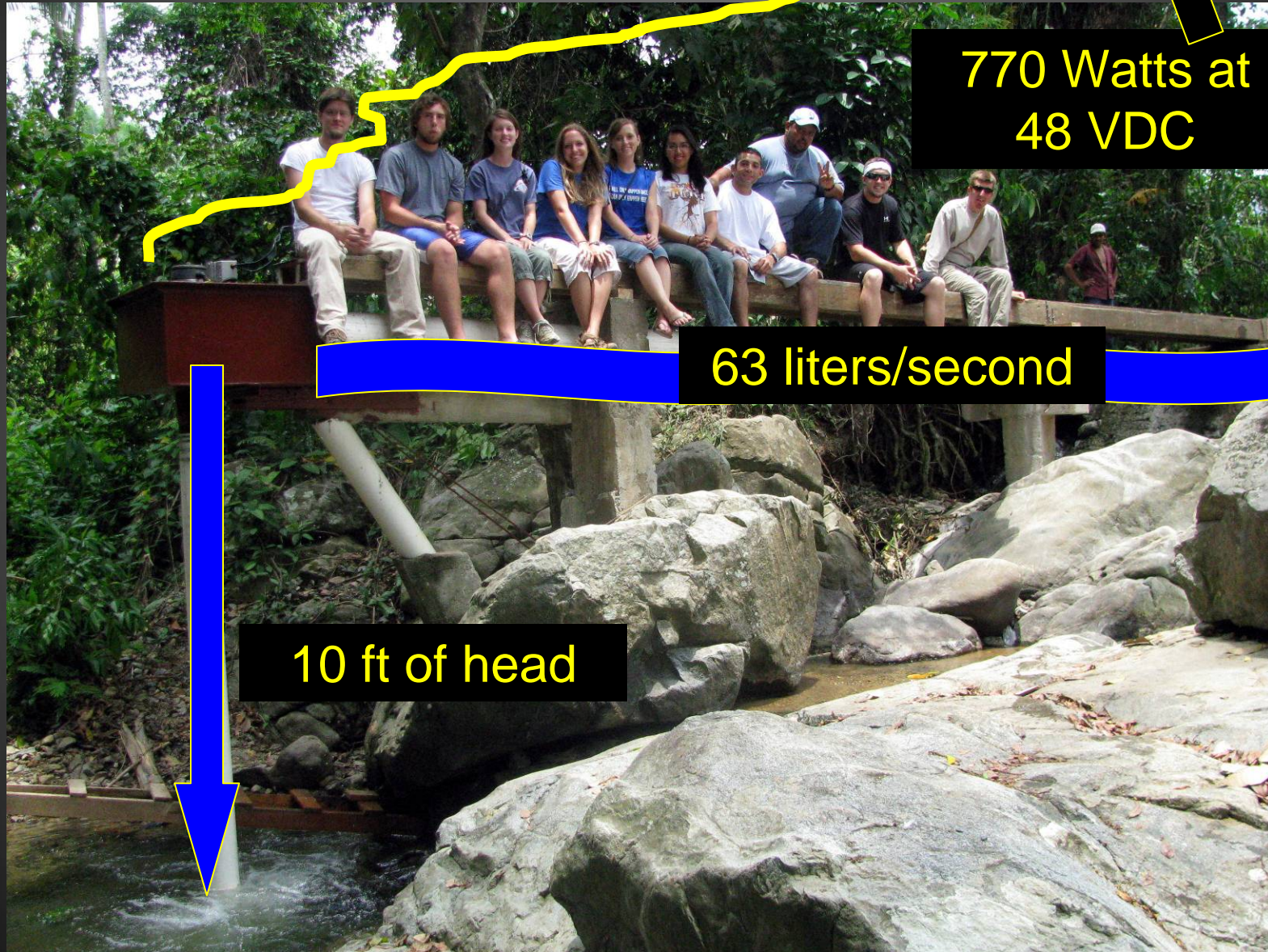
Pueblo Nuevo, Honduras, 2008

The Hydropower System

770 Watts at
48 VDC

63 liters/second

10 ft of head



The Powerhouse



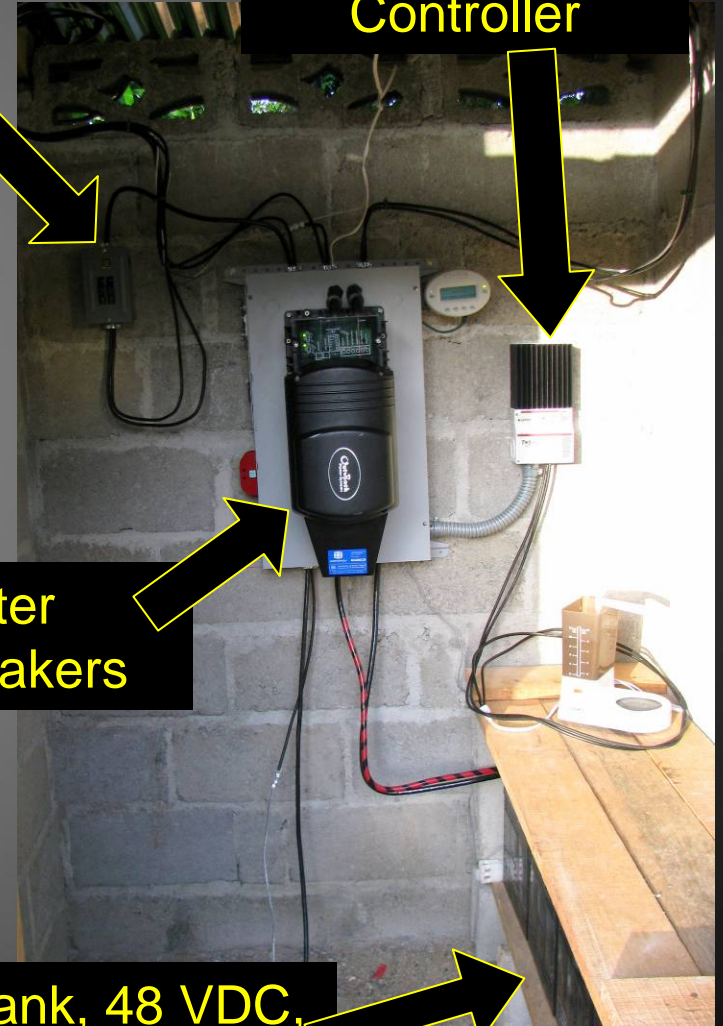
Color Branding
and Logo Design
Culturally
Appropriate

Two, 20 Amp
Breakers

3 kW Inverter
Additional Breakers

Battery bank, 48 VDC,
235 Ah

Dump Load
Controller



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%)



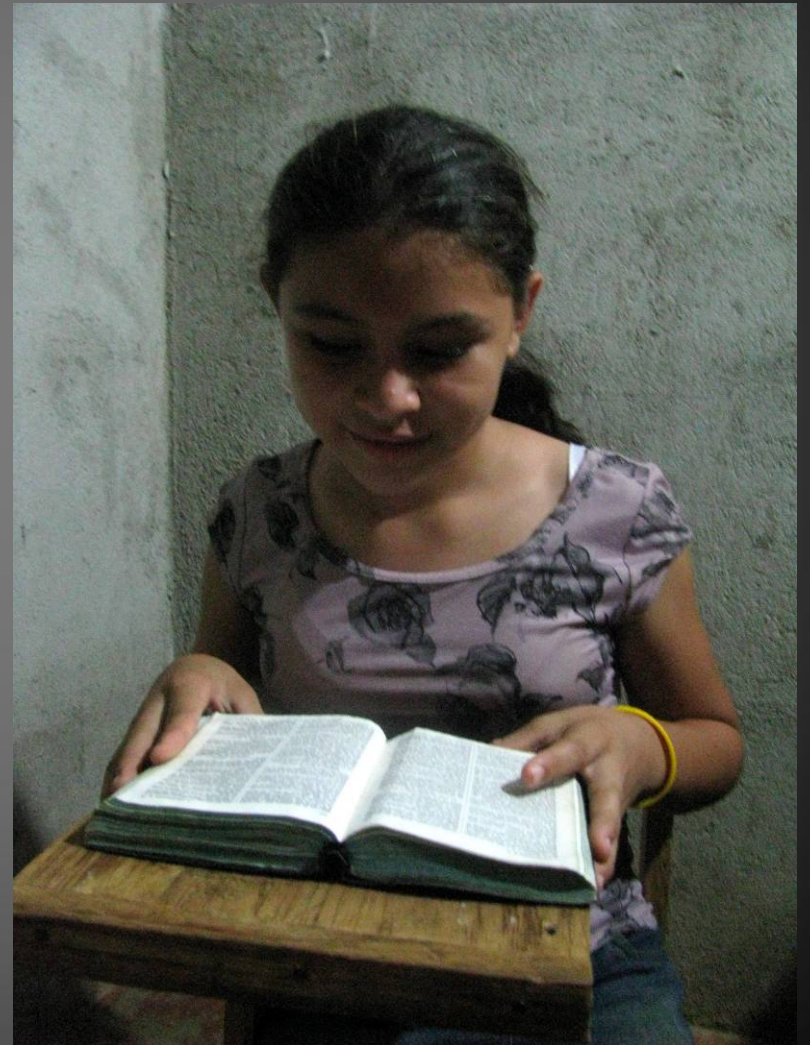
Waldina, 2008



Waldina, 2009

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