

HOUSEHOLD ENERGY
BEST PRACTICES FOR CLEANER COOKING OPTIONS

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INTRODUCTION

Today, a quarter of humanity lives without access to any electricity and almost one-half still depend on solid fuels such as unprocessed biomass, coal, or charcoal. Without change to the status quo for this substantial portion of the world's population, the elimination of poverty in our century will remain only a dream. Electrification is a key part to solving this problem, but equally important is addressing household energy options for the 2.4 billion people cooking with dirty and dangerous fuels.

It is well known that the smoke from burning solid fuels in households is damaging to one's health and can even cause death. It is estimated that 1.6 million people die each year in the world's poorest countries from cooking with low quality stoves in poorly ventilated kitchens. Since women do most of the cooking indoors with their children in tow, it is not surprising that women and children are most at risk to deaths caused by indoor air pollution. In fact almost 1 million children under five die every year from diseases directly related to smoke in the kitchen.

The inefficient and unhealthy use of these solid fuels in the home is putting millions of the world's poorest families at risk. Particles from burning wood and charcoal make lungs vulnerable to acute lower respiratory infections, such as pneumonia and chronic obstructive pulmonary disease, and there is evidence linking indoor air pollution to asthma, tuberculosis, cataracts, low birth weight and infant mortality. Lack of access to clean and reliable cooking fuels further impacts the lives of women and children by constraining time for income generation or study due to long hours spent collecting fuel and the increased risk of burns. In addition, rural women and their families pay a high economic price for keeping the fire burning.

There are many options to improve the household energy situation that center on the expansion of markets and programs for improved cookstoves. There are immediate benefits that are quickly realized for people who need access to cleaner cooking options. The benefits are many, but the primary ones include:

- **Reduced usage of firewood and charcoal:** Expenditure on firewood ranges US\$20-80 per month (depending on family size and location). Moreover, if people are gathering wood, then they have to typically spend 4-6 hours in the day collecting fuel. Improved cookstoves are up to 50% more efficient leading to dramatic savings in fuel.
- **Improved cooking:** Three stone fires and traditional cookstoves do not use firewood efficiently or cook food in the most resourceful manner. The selling point for improved cookstoves is that food can be cooked more quickly because they provide more concentrated heat and they can be built to accommodate multiple pots.
- **Improved health and wellbeing:** Soot left over from burning firewood is a hindrance to users. While cooking, people experience extreme irritation and burning sensation for their eyes and nose as well as experiencing long-term illnesses. Improved cookstoves with proper ventilation or a chimney can eliminate close to 100% of the toxic emissions and lead to dramatic health improvements for the entire family

There are now locally available options for clean, efficient and affordable cooking fuels and stoves that can become the center of a thriving energy enterprise or a national public sector program. Cookstove enterprises and programs can involve many different approaches and methodologies including manufacturing of the stoves, distribution and marketing, end-user finance, or entry into carbon markets. The bottom line is that customers are seeking products that are available, affordable, and appropriate for them; and local enterprises and national programs need to stay focused on facilitating their availability.

The purpose of this report and powerpoint presentation is to highlight a set of distinctive and diverse energy enterprises, programs and projects in Asia, Africa and Latin America that are creating and sustaining markets for improved cookstoves. The overall aim is to contribute to the knowledge base on energy access and household energy by reviewing and documenting good practices based on the growing body of experience in the public and private sector. There are seven case studies presented here that summarize and highlight the approach, business model, financing, impacts, and key lessons for each enterprise and program. A detailed rubric was used to collect and analyze the information to ensure consistency and allow for comparison of the different examples. This small subset of case studies for what is happening across the world, illustrates how different organizations and individuals are working hard to achieve wider distribution and adoption of cleaner cooking options, and to demonstrate the challenge in front of us all.

HOUSEHOLD ENERGY
IMPROVED COOKSTOVE ENTERPRISES

GHANA: TOYOLA ENERGY LTD.

Toyola Energy Ltd. is a private Ghanaian company that makes and sells charcoal stoves (known locally as “coal pots”). Toyola was formerly registered in Ghana in 2006, though its two co-owners, Suraj Wahab and Ernest Kyei, had been involved in the stove business since 2002. As of 2012, Toyola has sold over 150,000 stoves, realized revenues from carbon monetization, been recognized at the Clinton Global Initiative, won an Ashden Award, and begun a process of internationalization.



Country and Household Energy Overview:

Ghana is a West African country often lauded for its stable, democratic governance and favorable business climate. Real GDP growth in the last decade has been consistently near or above 5%. Ghana, however, has one of the highest rates of deforestation in Sub-Saharan Africa, losing 2% of its forest cover per year. Much of this decline can be attributed to cooking needs, in particular charcoal production. For the half of Ghana’s 25 million residents that live in urban centers, charcoal is the preferred cooking fuel, more convenient to transport than wood, cheaper than electricity, and easier to find than LPG (the country faces chronic shortages of LPG). Annually, ~700,000 tons of charcoal are consumed and it takes anywhere from three to eight tons of wood to produce a ton of charcoal due to the use of inefficient technologies.

Policy:

The Ghanaian Ministry of Energy places priority on the development and pricing of its petroleum resources over the development of improved biomass stoves. For over 20 years, the government has promoted the use of LPG as the cure for its unsustainable harvesting of wood fuels, though with limited success. Without significant government intervention of any sort, though, Toyola has been able to flourish. The company was, however, helped undoubtedly by the international policy framework that established carbon trading regimes. Even without carbon though, Toyola would still have a viable, albeit more slow growing, business based solely on product margins; the customers’ internal rate of return on an improved stove purchase remains compelling.

Technology:

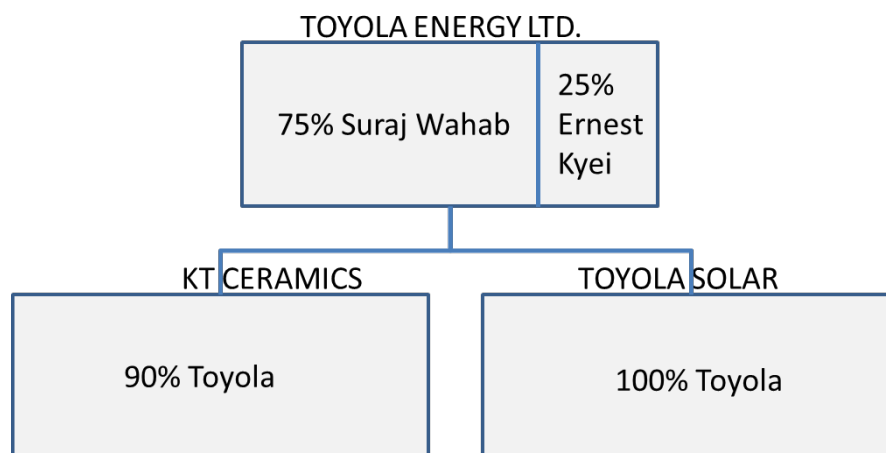
Toyola stoves are based off the design of the Kenyan Ceramic Jiko, created in the early 1980s, itself adapted from the Thai Bucket Stove. Toyola stoves consist of an hourglass-shaped cladding made of sheet metal and an inner ceramic liner with holes to allow the ash to fall through. The ceramic liner, when made of the right type of clay and properly fired, retains heat from the lit charcoal. In fact, some cooks extinguish the charcoal part way through the cooking task and use only the hot liner to finish cooking their meal. Toyola stoves also have a door in the bottom chamber (where vegetables can be roasted while stews are cooked up top) which

can be open or closed to better control air flow and achieve more efficient combustion. Lab testing shows that Toyola stoves are anywhere from 30-40% more efficient than traditional coal pots, but experienced users in the field report that with the right techniques, their stoves can be 60-70% more efficient (as judged by fuel savings). Each stove can reduce the equivalent of approximately one ton of carbon dioxide emissions per year.

Overview of Structure and Ownership:

Toyola Energy Ltd is a private company with annual revenue of \$550,000. Headquartered in Ghana, it also began selling to customers in neighboring Togo and Burkina Faso and is currently involved in expansion plans to Sierra Leone, Nigeria and Benin. Toyola has two subsidiaries (pictured below), one for the production of ceramic liners and one for the sale of PV lanterns, notably under the joint GoG/ World Bank GEDAP Program.

Figure 1: Toyola Ownership Structure



Business model:

There are several aspects to Toyola's business model worth mentioning, in particular, the way management promoted division of labor, incentivized the work force, sought control over the full value chain, utilized carbon revenues, and extended credit to others.

1. *Division of labor* – Toyola's founders, sometimes referred to as the Henry Fords of Ghanaian coal pots, moved quickly away from the craft production techniques that characterized many small and medium stove enterprises, not just in Ghana but much of Sub Saharan Africa. They established interchangeable parts and associated prices for every step of manufacture and assembly. This raised average output per artisan dramatically by allowing for specialization.
2. *Incentivizing the workforce* – Toyola employs half a dozen full time staff. The other 300 or so associates are all compensated based on performance. Artisans are paid per piece manufactured or assembled. Sales agents receive commissions on the product sold. Even truck drivers are responsible for vehicle maintenance and gas, incentivizing them to take

good care of the fleet. In this system, the most effective individuals rise quickly to the top through their ability to work with larger volumes of product, usually by creating their own franchise-like structures, and are transparently rewarded with higher incomes.

3. *Control over the supply chain* – Since demand for stoves has consistently outstripped supply, Toyola is very sensitive to business risks from supply disruptions and seeks to mitigate these to the utmost. Dissatisfied in upstream bottle necks that were choking their growth, Toyola’s entrepreneurs acquired a ceramics company to bring liner production in-house. Toyola has also been more than occasionally hampered by the ability to source scrap metal, especially in the face of increasingly stiff Chinese competition for the same resources. To this extent, it has enlisted a network of scrap dealers and agents who fan out to search for scrap metal deals and report back to the company.
4. *Carbon monetization* – In 2009, Toyola registered the second ever voluntary Gold Standard project for stoves. This was key in helping drive the company’s growth and allowing them to remain competitive. Carbon monies are used to lower sales prices to customers and increase margins for those selling stoves. Toyola has implemented special SMS-based sales tracking systems to aid in monitoring and verification.
5. *Credit policy* – Toyola understands the importance of credit for all of its stakeholders because prior to 2006, it was exactly in the same position – unable to expand due to a lack of capital. Once Toyola received its first loan, it was able to supply local artisans with tools and raw materials as a form of credit. Toyola then began providing stoves on consignment to distributors and retailers and letting customers pay over a month or two using the fuel savings created by their new stove. Important to Toyola’s practice of extending credit is the accompanying training provided. Artisans and sales agents are trained by Toyola to be successful before being provided with tools, materials or inventory. Customers are given a piggy bank (“Toyola box”) and taught how to save from their reduced fuel expenditures. Toyola’s ability to empower its artisans, sales agents and customers through generous credit policies has greatly expanded the market and generated company loyalty.

Finance:

From 2002, when entrepreneurs Wahab and Kyei were first trained in stove building, to 2006 when Toyola was formally registered and received its first loan, there was practically no growth. From 2007 – 2009, Toyola received US\$ 360,000 of debt capital in three stages and in 2009, it registered a Voluntary Gold Standard project. The debt capital it received laid the foundation to transform Toyola into the company it is today. Until present, the company has been exceeding forecasts and has managed to arrange significant amounts of follow-on financing, though arguably not enough to fully meet its needs. Nevertheless, Toyola is a fully financially self-sustainable, scalable and replicable enterprise.

In particular, the use of fixed term debt for such a company may not have been an appropriate financing instrument. The uncertainty of when carbon revenues would materialize coupled with the pressure the company faced to sell a maximum number of stoves early in the project (so

they would generate offsets in subsequent years) made making quarterly loan repayments problematic and ultimately not in the best interest of the company.

Table 1: Annual Sources of Finance for Toyola

	Pre- 2006	2006	2007	2008	2009	2010	2011	2012
Shell Foundation (grant)	~\$5,000							
E+Co (debt)		\$70K		\$100K	\$100K		Refinance	
E+Carbon (debt)				\$40K	\$50K			\$100K
USAID (direct payment of business expenses)						~\$30K		
Ashden (award)							£40K	

Impacts:

Toyola has sold over 150,000 stoves since 2006. Four significant impacts that stand above the rest – Fuel saved, cost savings, emissions reductions and job creation.

1. *Fuel savings* – Each stove saves an average of 0.5 kg of charcoal a day, or 180 kg annually. This translates into between 0.5 and 1.5 tons of wood per year given the typical conversion ratios.
2. *Cost savings* – Each stove saves a typical family around \$30 per year, or a third of their fuel expenditures. This means a stove, lasting about five years, pays for itself in roughly three months.
3. *Emissions reductions* – Each stove results in reductions of 1 ton of CO₂e per year. 80% of this reduction is from carbon dioxide not released from the charcoal as it burns, and 20% is from the avoided methane emissions during the charcoal's production.
4. *Job creation* –Toyola's activities support livelihoods for 300 individuals.

Critical Challenges:

Toyola's first two challenges were (1) accessing working capital to front materials and buy in bulk, and (2) possessing vehicles to aggressively distribute products. The 2006 loan was critical in overcoming these barriers. Next, while sales significantly surpassed projections between 2006 and 2008, Toyola was constrained by the availability of ceramic liners supplied by another company. The entrepreneurs thus decided to vertically integrate to control their supply chain and used a loan to purchase a controlling stake in the ceramics company, bringing them know-

how in liner production and thereby allowing them to invest in expanding production to meet demand.

Between 2006 and 2007 only a limited number of carbon developers were focusing on small cookstove projects, providing a challenge to access carbon markets as information and financial resources were scarce. Fortunately, through its networks Toyola was able to connect with a developer and secured favorable ERPA terms. However, gaining access to carbon finance came with its own challenges. Toyola sought to use carbon revenues to grow sales rapidly, however a lag in waiting for revenue to flow meant that it began expanding at an often cash negative status (due to price discounting). It would have needed larger and more flexible loan/ credit packages to offset the longer than anticipated waiting period for carbon revenues to flow.

Finally, while Toyola's system of providing informal credit and piggy banks to customers has been an effective sales technique, its informal nature hampered the company's ability to raise capital since most lenders viewed it as a risk. Toyola would benefit from creating and formalizing a credit scheme that meets both the needs of its customers and financial backers.

Lessons Learned:

From the perspective of investors, the chance of picking a Toyola out of the many early stage stove companies in their portfolio may only be 1-in-5 or 1-in-10. When the company started out, as two individuals with scarce financial resources literally sitting under a tree making stoves one at a time, it wasn't at all clear that Toyola would emerge to be the dynamic company that it is today. It is clear that financing Toyola in 2006 required a flexible "missing middle" financier. The investor needed the flexibility, risk appetite, and the autonomy to make the investment decision, not just for Toyola, but also for the four, or nine, other early stage portfolio companies that didn't grow to the same size.

Finally, one can never underestimate the power of a champion. Suraj and Ernest were prepared to put their lives on the line to ensure their businesses were successful. Their persistent and visionary outlook on what a "coal pot maker" could become, despite skepticism from friends, family, and local banks, was the most important driver behind their success.

KENYA: PARADIGM, LLC

Paradigm is a US-headquartered, low profit limited liability company (L3C) founded in 2009 to sell improved cook stoves in low income countries. Its founders have strong backgrounds in the private sector, but created the company primarily to achieve social objectives. The first country office was established in Kenya where it has registered a voluntary Gold Standard project and sold over 50,000 stoves. The company is now engaged in expanding internationally.

Country and household energy overview:

Kenya has a population of 43 million of which 40% live on less than US\$ per day. GDP per capita is estimated at US\$1,700 and GDP real growth at 4.3%. The country is heavily reliant on biomass with an estimated 70% of households using firewood (or a combination of firewood and non-woody biomass). 68% of total energy needs and 90% of household energy needs are met through biomass. Kenya also has a long established tradition of promoting improved biomass cook stoves. This effort dates back to the late 1970s and



encompasses stove models for both firewood (notably the Jiko Kisasa) and charcoal (notably the Kenyan Ceramic Jiko). Firewood stoves are typically made from mud and clay and installed in users' homes. Women's groups and cooperatives, with support from donors, have played a large role making and selling these stoves. Combined metal and ceramic charcoal stoves are mostly manufactured in the informal sector by small ceramicists and Jua Kali artisans in clusters of stalls in markets. By some estimates, there are around 3 million improved stoves in use in Kenya (accounting for breakage), but the true thermal efficiency of many of these stoves is suspect.

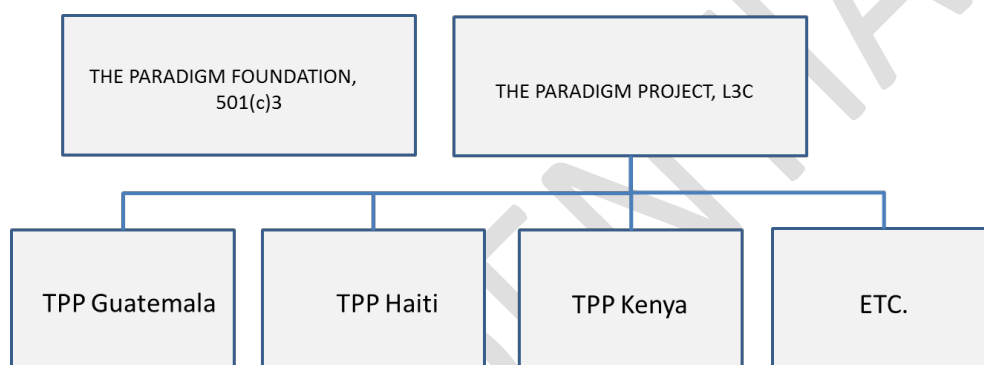
Technology: Paradigm does not manufacture stoves; rather it works with designers and manufacturers to bring their stoves to market. In 2011, Paradigm offered two stove models, both wood burning stoves utilizing the rocket principle, to its customers. One stove, the Jiko Poa, designed by Burn Design Labs, has its manufacture contracted out to local factories. The other stove, an Envirofit model that is slightly more expensive than the Jiko Poa, must be imported. In the coming months, a third stove will be offered as well. Paradigm's objective is to find high quality products that respond to the cooking preferences and economic realities of its customers.

Overview of Structure and Operations:

Paradigm has established a fairly unique structure that allows it to fully take advantage of characteristics of both private sector and charitable organizations.

1. *Legal structure and capital raises* – Paradigm the L3C has in-country subsidiaries established in accordance with local regulations. Paradigm can raise equity capital for the corporate entity and also for the subsidiaries, but there is also a US-based 501(c)3 in order to receive donations. The Paradigm Foundation can take donations and then make program related investments into the subsidiaries, so in this way the Paradigm country offices can effectively blend public and private capital.

Figure 2: Paradigm Ownership Structure



2. *Initial community-based sales approach tending more toward the private sector* – Paradigm began building out its distribution model in a way that relied heavily on NGOs and community-based organizations to sell stoves. Quickly, however, it revised its thinking to exploit relationships with more commercially oriented entities, establishing five vertical distribution channels that range from doorstep, last mile entrepreneurs to large nationwide retail chains.
3. *Carbon monetization* – Paradigm has recently (2012) verified offsets from its voluntary Gold Standard project. The carbon benefit is partly used to discount stove prices to customers and increase dealer margins. It is also key in providing Paradigm’s investors a reasonable return on their investment and plausible exit strategy. With the uncertainty surrounding carbon markets at present, the company has decided to diversify its activity into the compliance markets as well.

Finance:

Paradigm is not legally permitted to disclose the identities of its investors but it can say that it has raised about \$3.5 million for its operations, mostly from individual impact investors and one low interest loan from a foundation. Investors are said to have acquired 10-year equity positions with an anticipated 10-15% return. Donations form a relatively small contribution to the overall capital structure. Paradigm argues that being an L3C has allowed it to raise larger sums of money than if it were simply a 501(c)3.

Impact:

To date, Paradigm has sold 50,000 stoves in Kenya, touching the lives of over 200,000 individuals. Over the estimated five year life of each stove, Paradigm calculates that a family will save \$283 in fuel purchases, 1,300 productive hours (valued at \$101), that 5-10 tons of CO₂e will be avoided, and that 34 trees will be saved.

Critical Challenges:

Paradigm must overcome two critical supply chain challenges to achieve even greater growth; these are relieving supply constraints and securing working capital for a number of their distributor partners.

1. *Supply constraints* – Paradigm’s supply constraints exist both for the locally manufactured stove and the imported stove. Part of the issue is that internal sales forecasts at the company underestimated demand and suppliers didn’t have adequate lead times to increase their output. Another consideration is that manufacturers need additional resources to ramp up production. For the local stove, Paradigm itself assisted the manufacturers in upgrading their equipment and processes.
2. *Access to working capital for distributors* – Most of the small and medium distributors with whom Paradigm works lack sufficient financial resources to keep sufficient inventories of product and they cannot easily access small business loans from local banks. Business opportunities are missed when stocks are low or they must wait to be resupplied. Also the distributors, themselves lacking working capital, are largely unable to offer credit to those buying from them, smaller retailers or customers.

Lessons Learned:

Paradigm’s mission is primarily social – to bring clean cooking to households and reduce negative impacts on the environment – but its ability to achieve those objectives hinges in no small part on the degree to which it is able to achieve traditional commercial objectives. The company has hired staff and recruited channel partners aggressively from the private sector and brought strong management and processes into its operation, one of the contributing factors to its success. At the same time, Paradigm constantly struggles to balance the return expectations of its many partners and shareholders with its ultimate mission. So far, there doesn’t seem to have been any significant conflicts because of the effort Paradigm has

expended in finding and screening like-minded individuals and organizations; however this remains a worry for its founders.

Three main takeaways from the Paradigm example exist: (1) While market-oriented approaches are preferable, they must also be closely monitored; (2) Most stakeholders underestimate the capital requirements to set up a carbon stove project; and (3) Stove customers can be very sensitive to aesthetic considerations, thus stoves must be redesigned accordingly.

CONFIDENTIAL

CHINA: KUNMING RONGXIA

Kunming Rongxia is a designer and manufacturer of highly efficient biomass stoves in Kunming, Yunnan. Compared to competitors' stoves, "Juhong" brand stoves are recognized as an efficient, high-quality practical product with a relatively longer product life expectancy. The enterprise is led by Juhong Zeng, who has strong professional and political connections as well as a professional background in aero-thermal dynamics.

Country and Household Energy Overview:

China has a population of 1.3 billion and GDP real growth of 9.2%. Despite the country's impressive economic growth during the past two decades, more than 100 million rural Chinese still live in acute poverty and the disparity between urban and rural areas is significant. Virtually all of China's rural households, representing about 770 million of the country's population rely on biomass and coal to meet their daily cooking and heating needs. Rural poor, who strongly rely on biomass and low-grade coal, face immense difficulty in absorbing soaring costs for household energy. The continuous increase in demand for and reliance on fuel wood has increased deforestation and open fire cooking. Moreover, cooking on old poorly designed wood and coal stoves contributes to in-door air pollution, which has had negative health effects in rural populations.



Policy

The stove market in China, estimated at approximately US\$40 million, is largely influenced by the national and provincial government's policies, specifically its 5 year plans. In the early 1980s, the Ministry of Agriculture launched the National Improved Stove Program (NISP) to provide rural households with more efficient biomass stoves and improved cook stoves for cooking and heating. By 2006, the program claims that 189 million of China's rural households had improved biomass or coal stoves. However, only 22%-30% of households in western provinces were covered by the program. Many of the stoves distributed have deteriorated over time and no longer reach the efficiency levels originally envisaged by NISP.

The 11th Five Year Plan (2006 to 2010) of Yunnan Provincial Government fuel-efficient stove program targeted directly 500,000 rural households in highland areas (altitude greater than 2900 meters). The Provincial government subsidized CNY 200 (US\$26.7) to each targeted household to buy fuel-efficient stoves or provide a free combustion chamber for households to install in existing built-in stove. The current 12th Five Year Plan (2011 to 2015) retains its previous commitment to supply stoves and reduce usage of firewood and coal.

In the southwestern province of Yunnan (population: 46 mln), there are approximately 10-15 stove manufacturers supplying government programs with biomass and coal stoves. Most of

these enterprises are completely government subsidized and are temporary machining workshops that operate seasonally when government funding arrives. There are a few small, private manufacturers doing well, one of which is Kunming Rongxia.

Technology:

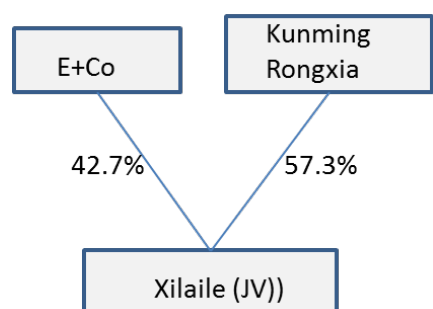
Kunming Rongxia' "Juhong" brand stoves have won several competitions for design and efficiency and burn biomass 65-85% more efficiently than other stoves on the market in China. Some of its stoves have been specially designed for use in high altitude, mountainous locations. The stoves are designed to burn wood, agricultural refuse, and dried dung.

Overview of Structure and Ownership:

The owner, Mr Zeng, was introduced to E+Co, a US-based social investor (henceforth referred to as "the investor") that invests services and capital in small and growing clean energy businesses in developing countries. Their investment philosophy employs a triple bottom line approach to investing. This particular investment achieved that through: decreased fuelwood consumption and improved in-door air quality for rural households through the introduction of high efficiency biomass stoves; increased employment and trained skilled workers; and expansion of a successful manufacturer of high efficiency biomass stoves in Western China.

To receive financing from a foreign entity, Rongxia and the investor needed to enter a joint venture since this is the only way that foreign funds are allowed to flow in this sector. The investor is a 42.7% minority stakeholder of the JV. With a five year-put option on both rounds of equity financing, each investment generates a 12% annual return for the investor. The JV gave the investor a board seat, which allows them to play an important business and management advisor to the operation.

Figure 3: Joint Venture Structure



Business Model:

There are three elements of Kunming Rongxia's business model worth mentioning. The first two, "Superior Product and Brand Recognition" and "Customer Service" have set apart the company brand. The third element, government contract- driven sales also appears as a challenge to the company's sustainability.

1. *Superior Product and Brand Recognition:* These elements set Kunming Rongxia's stoves and brand apart from its competitors. Due to the stoves' long life expectancy and ability to efficiently burn a variety of agricultural residues, its stoves have gained popularity and wide adoption across the region. The company's "Juhong" brand stove was also awarded one of the top ten "superior environmentally friendly" products by the China Association of Rural Energy industry, thus boosting customer confidence.
2. *Customer Service:* Kunming Rongxia also offers after-sales service, which includes a one-year guarantee for stove replacement, a 2-year guarantee for fixing or repairing the accessories and equipment, and on site-training and instructions for end-users.
3. *Government contract-driven sales:* Over 90% of Kunming Rongxia's revenue is derived from government contracts that are primarily aimed at poverty alleviation and supply fuel efficient stoves to decrease the demand for coal and firewood. The company currently aims to diversify sales away from local government agencies to dealers in other provinces as well as internationally in Southeast Asia and Africa.

Finance:

In order to expand production, Kunming Rongxia needed financing options, but small businesses in China virtually have no access to loan financing because they cannot provide sufficient fixed assets as guarantee and generally face a restrictive environment to obtain foreign-backed loans.

Kunming Rongxia needed capital to scale up its production capacity and expand its marketing and sales deeper into Southwest China as well as Southeast Asia. The investor's two rounds of US \$100,000 equity financing (first round in 2008 and the second round in 2010) allowed the company to scale up, diversify the sales of its products and purchase equipments to improve the productivity. In addition to the seed capital, the investor has assisted the company in developing its growth plan to move beyond selling largely to government subsidized poverty alleviation programs to include more private, un-subsidized sales to local governments, NGOs, and retailers.

The investment enabled Kunming Rongxia to increase production from 8,000 combustion chambers and 3,000 stoves in 2007 to 20,000 combustion chambers and 8,000 stoves in 2008. Annual sales more than doubled from 2007 CNY 1.69 million (equivalent to US\$ 248,385

(US\$1=CNY6.83)) to CNY 3.62 million (US\$ 530,056) by 2008. Kunming Rongxia's Mr. Zeng was named one of the top 10 standout energy enterprises by the Ministry of Agriculture in 2008.

Critical Challenges:

E+Co's seed funding and enterprise development services for Kunming Rongxia have successfully turned the company from a small scale, hand-made appliance producer to a medium sized, high-efficiency stove manufacturer. Still, there are important continued risks that Kunming Rongxia, and most other private stove manufacturers in China, will be challenged with. First, Kunming Rongxia is too dependent on government sales. More than 95% of Rongxia's sales are through government purchases and government sponsored programs. If government policy shifted or if a different government agency was responsible for implementing the stove program, this could be a setback for Kunming Rongxia. Efforts have been made to diversify sales away from government channels. Another key risk is that of intellectual property infringement. Even though patents have been obtained for Rongxia's products, there is a risk of another company copying the cook stove, manufacturing it and undercutting them on price. The market has low barriers to entry as evidenced by the fact that there are over 700 stove manufacturers in China. Juhong Zeng, the owner, is a key part of this enterprise's operations and his continued involvement is vital to its success. A succession plan, just like for many small and medium-sized enterprises, would be wise.

Impacts:

Investing into Kunming Rongxia not only successfully expanded the business but also generates benefits for the environment, the health of rural households and the community. From 2007 - 2009, Kunming Rongxia supplied around 30,000-40,000 stoves per year. From an environmental perspective, there is a reduction of in-house air pollution (also known as IAP). Each household can reduce its consumption of fuel-wood by 60-80%, which equates to about 3.65 tons per year of fuel-wood and coal consumption per rural household. This means successful mitigation of approximately 5 tons of CO₂ emission annually per rural household through the replacement of open fire to a highly efficient stove. From a community, health and social point of view, the use of biomass stoves leads to health improvement for rural families and reduction of rural pulmonary disease occurrence. Rural women can save almost 2/3 of the time they used to spend on fuel wood collection. Furthermore, the enterprise has created 30 new full time jobs for the local community.

Lessons Learned:

1. *The weight of government policy leaves little room for entrepreneurs:* The stove market in China, approximately US \$40 million, is largely influenced by the national and provincial government's 5 year plans. The combination of strong Chinese government policies on renewable energy development and large subsidies provided to state-owned enterprises for poverty alleviation purposes leaves little room for growth of small, private cook stove manufacturers in China.

2. *Small enterprises in China have difficulty finding access to financing:* This is because 1) the companies don't have any fixed assets to serve as guarantees and 2) these entrepreneurs typically do not have good accounting systems and controls, thus making it hard to even be considered for a loan. Small enterprises in China cannot receive financing from foreign sources easily. In order to obtain financing from a foreign company, a joint venture must be set up.
3. *High dependency on government-backed sales adds risk:* The major risk to an enterprise like Kunming Rongxia is that more than 90% of its sales come from the government. A shift in government policy or even a change in the government agency coordinating a stove program would be a set back.

Further background

Originally, the investor's investment into Kunming Rongxia was part of a larger UNEP managed project called the China Rural Energy Enterprise Development (CREED). The Nature Conservancy and E+Co both initially signed up with UNEP with a shared goal of providing remote rural ethnic minority populations in Yunnan with access to cleaner energy technologies. However, the supporting partners decided to part ways at the beginning of the project and pursue their activities independently. There was no collaboration between the two implementing partners. Even so, despite the institutional constraints faced, both organizations did not give up on their respective goals and were able to prove the merits of the CREED model.

Through GreenVillage Credit, the Nature Conservancy's China office provided local villagers in the remote mountainous communities of Yunnan province with household credit to purchase higher quality sustainable energy systems, and additionally, a loan for activities that can generate income using the new and improved energy services.

Through Clean Energy Services Initiative (CESI) – the investor coupled Enterprise Development Services (EDS) with startup financing ("seed capital") for entrepreneurs. The investor set up a local entity in Yunnan, China to facilitate EDS and capital.

HOUSEHOLD ENERGY
IMPROVED COOKSTOVES INSTITUTIONAL PROGRAMS

BANGLADESH: IMPROVED COOKSTOVE PROGRAM BY GIZ

Country and Household Energy Overview:

Bangladesh, with a total surface area of about 147,570 km², is one of the most densely populated countries in the world (1,142.29 people per km² of land area). It has a population of 160 million of which 28% reside in urban areas and 72% in rural countryside. Poverty declined from 57% of the population in 1990 to 31.5% in 2010. Despite this good track record, still 56 million (>40%) people live below the poverty line (World Bank 2010, UN 2010). Household demand for energy primarily involves cooking, lighting, heating, productive uses, and other end uses¹. Fuel wood accounts for 44 % of total household energy use and 38 % of expenditures in rural Bangladesh. Biomass fuels, collected mainly from the local environment only two decades ago, are fast becoming a marketed commodity. In rural Bangladesh, some 95 % of Bangladeshi households collect or purchase biomass energy with which to cook all or part of their meals, mainly using fixed clay stoves (ESMAP 2009).

Program Objectives:

GIZ's² support with the Sustainable Energy for Development (SED) program was set up in 2007 and lasted three years and eight months. This was the second phase, acting as an extension of a previous project, Promotion of the Use of Renewable Energies (PURE)³, that lasted from 2004 to 2006. The Improved Cookstove (ICS) Program was one of the components of SED to promote a commercial, sustainable approach by identifying locally acceptable and reliable technology and design, and developing systems for marketing and maintenance. It was designed to follow a multi-level approach that draws support from government institutions to develop a favorable policy framework and to promote market development in the energy sector (GIZ report 2009).



¹ However for the purposed of this case study only cooking will be considered.

² Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) is a federal enterprise that supports the German Government in achieving its objectives in the field of international cooperation for sustainable development.

³ While there are two phases to the GIZ program in Bangladesh, -PURE and SED, both are often referred to as SED program from 2004-2011 on Govt. of Bangladesh websites

Current Status

Program	Details
Duration	2004-2011
Location	Rural/urban Bangladesh
Stove Model	1, 2 and 3 pot stoves. <i>Bondhu Chulha</i> is a modification of clay stove models-a fixed cement stove with a chimney which may be 1 pot, 2 pot, or 3 pot. This model was found to be 26–27 % efficient (compared to 5–15 % for traditional stoves) and saved 50–60 % fuel. (ESMAP 2010)
Reported Achievements	250,000 stoves disseminated, 10,000 people trained (domestic and commercial) such as stove technicians/NGO workers/private entrepreneurs, 1,000 people are earning their livelihoods by installing and maintaining improved stoves, detailed training manuals for training of stove manufacturers and training of trainers, over 160-200 partners (includes small NGO and SMEs that represent 80% of business players competing in the ICS sector)
Sources of finance	From 2004 to 2011 primarily 2 sources of funding: <ul style="list-style-type: none"> • German government: EUR 6 million • The Netherlands Directorate General for International Cooperation (DGIS): EUR 4 million
Financial and operational sustainability	The program provided an impetus to commercialize the improved cook stove market, however some sustainability issues must be noted: <ul style="list-style-type: none"> - Half of the systems from a sample of 20 partner organizations (PO) were not in use (GTZ Report 2009) -10% of 10,000 stove builders and manufacturers trained continue operations but it remains unclear how long they can sustain their businesses if incentives provided by GIZ cease. -Funding supplementation coincides with onset of carbon finance; forward payments from sales of carbon offsets from POs to feed ongoing activities. Long-term sustainability of this source is questionable, particularly because its implications for developing a robust process remains unclear. Careful attention will need to be paid on the accuracy of the information to avoid an overestimation of emission reductions.

Key Stakeholders and Framework:

1. *Partner Organizations* identify and support stove manufacturers (financial/business development, technical training), consumer financing, awareness, monitoring.
2. *Stove Builders* are commission based and are responsible for installation, maintenance and repair.
3. *Users* receive training on how to use stoves at time of installation, and are engaged in participatory feedback. Strong linkages with partner organizations make consumer financing a reality, while linkages with stove builders provide access to technical support.
4. *Government* provides R&D⁴ for stove designs and policy support to ensure training and cooperation of The Ministry of Power, Energy and Mineral Resources, local government agencies in training.
5. *Carbon Financing* is enabled by a relationship between various stakeholders. SZ consulting bundles sales from partner organizations, and sells to ClimateCare who in turn resells certified emission reductions. The goal is to create standardized frameworks for monitoring and verification under CDM.

Figure 4: Institutional Arrangement with Role of Carbon Financing, GTZ Report 2009



Impacts:

Four types of impacts have been observed in (1) Health, (2) fuel savings, (3) time savings, and (4) capacity building.

1. Reductions in smoke, less respiratory/eye irritations, and improved safety from closed fire create positive health impacts.
2. Significant fuel savings have been reported, ranging from 33 to 50%.

⁴ Bangladesh Council of Scientific and Industrial Research (BCSIR) R&D wing, Institute for Fuel Research and Development

3. Stove design, in particular closed combustion and easier cleaning of vessels, saves an average of 7 hours per week so that users can dedicate this time to other leisure or economic activities.
4. Training was provided to more than 10,000 people (domestic and commercial installations), including stove technicians, NGO workers and private entrepreneurs. Furthermore, 1,000 people are earning their livelihoods by installing and maintaining improved stoves.

Critical Challenges:

1. *Structure of contracts:* Rewards number of installations during a short timeframe (six months) without offering incentives for after sales support, thus favoring quantity over quality.
2. *Weak after sales support:* Onus on stove builders exists for maintenance, but without adequate compensation to support this activity.
3. *Multiple partners:* Creates difficulty to assess accurate performance can lead to continued financial support to underperforming rather than more sustainable organizations.
4. *User-Technology Interface:* Training was imparted only at the time of installation on usage, but little effort was dedicated to behavioral changes and IAP awareness.
5. *Enterprise Support:* Other than financial aid to PO and capital cost to set up manufacturing facilities for stove builders, there was minimal business development support to enhance capacity of local actors.
6. *Minimal profit margins:* Made it difficult for PO and stove builders to sustain without external support for additional activities such as marketing and after sales support.
7. *Price differentiations among PO:* Stoves were sold at different prices to customers even within same geographic area due to conflicting direct discounts on stoves to increase sales (GTZ Report 2009).
8. *Redirection to lucrative portfolios within PO:* Sales agents that were tasked with selling cook stoves in addition to other products chose to sell products with higher commission and less hardship (Aziz et al.)
9. *Quality Control:* Little provision was made for technical tests on-site in order to compare performances with laboratory tests, and an absence of regular participatory feedback meant that stove design was not modified optimally. The stove design models were limited to 2-3 fixed models.

Lessons Learned:

1. *Local participation must be built into all stages of the program:* There is a need for participatory feedback from end users, especially women. In addition, working with technical local R&D facilities that can closely monitor performance and make modifications to cookstove design can help ensure that variations of stove models are well suited different regions and affordability.

2. *Creation of a sustainable financial ecosystem is imperative:* Efforts to tap into local financial institutions and plug in incentives targeted at financial managers to lend to enterprises and consumers can enhance success.
3. *Enterprise support is key:* In order to sustain local capacity, the program should provide financial/business development support that targets all round development of the supply chain.
4. *Policy environment must favor market development:* A set of policies that targets the engagement of different stakeholders at various levels (national, district, village) must be laid out to influence government interventions and support towards cook stove market development.

NEPAL: NATIONAL IMPROVED COOKSTOVE PROGRAM

BY THE CENTRE FOR RURAL TECHNOLOGY

Country and Household Energy Overview:

Nepal is a small, landlocked, mountainous country, located between the world's two most populous countries, China and India. It has a population of 29 million, with about 30 % of the population living below the national poverty line. Real GDP growth is estimated to increase to almost 5% for 2011/2012. Nepal is among the poorest countries in the world and currently ranks 157 out of 187 countries on the Human Development Index. However, the proportion of poor people was halved in only seven years (World Bank, Country Review 2012). The Ministry of Population in Nepal separates the nation into three topographic regions: mountains, hills, and terai, or plains. 80% of Nepal's population uses fuel wood for energy, while 16.6% use agricultural byproducts (Winrock 2004) and only about 40% of the rural population has access to electricity. Acute Respiratory Infection (ARI), a consequence of indoor air pollution, is the third leading cause of death in the nation.

Program Objectives :

The National Planning Commission/Government of Nepal launched the National Improved Cookstove Program in the 1980s and due to its unsuccessful attempts at disseminating stoves merged, into a new approach spearheaded by The Centre for Rural Technology (CRT/N)⁵ in 1998.

Its objectives were to:

1. Promote an efficient, cost-effective and appropriate technology
2. Build capacity of local organizations and promote entrepreneurship
3. Address gender, health, environment and socio-economic issues
4. Expand the program by gradually decentralizing tasks of training, monitoring, and supervision.



⁵ A non-governmental organization dedicated to developing and promoting appropriate / rural and renewable energy technologies effective in improving livelihood of the rural mass.

Current Status:

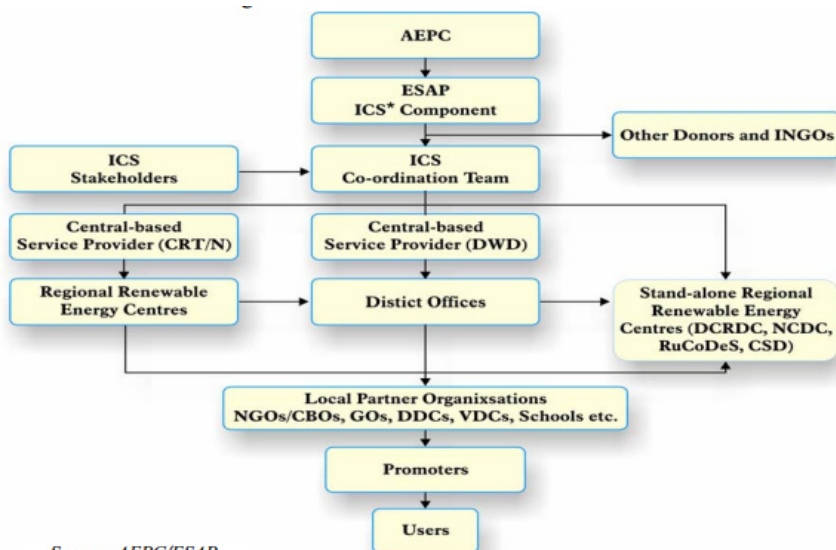
Program	Details
Duration	2000-Ongoing
Location	Rural Nepal
Stove Model	1, 2 and 3 pot stoves. The fixed type mud stoves are constructed out of mud bricks, mud, a chimney outlet and a few iron rods. Efficiency of mud-brick ICS varies from 12 to 20%. Low construction cost (NRs. 150 to 250)
Reported Achievements	196,540 ICS reaching nearly 995,500 beneficiaries. Trained over 850 promoters and covered 35 districts in total. Product improvement, product diversification and adaptive research. First agency to develop and implement a clean development mechanism (CDM) project on ICS in Nepal.
Sources of finance	Initiated in 1999 and implemented in two phases from 1999-2006 and 2006-ongoing. In its first phase it was supported financially by Denmark (>US\$ 30 million) and in the second phase by Denmark (US\$ 25million), Norway (US\$ 18 million) and Government of Nepal (US\$ 7.5 million) (www.aepc.gov.np). In total government funding accounted for 27%, private sources for 38% and public donor funds like grants for 35% (UNDP 2010).
Financial and operational sustainability	Key elements ⁶ of the program are that it was participatory and demand driven, provided no end-user subsidy, utilized effective and appropriate technology, and focused on women as the key managers of household energy use and cooking. Additionally, the use of local materials and skills to design and construct the stoves were key to the adoption of ICS. Furthermore networking activities among practitioners encouraged knowledge transfer; crucial to sustaining CRT/N's approach over the years. However, a few sustainability issues were visible: <ol style="list-style-type: none"> 1. Profitability from stove sales for both PO and stove builders were too minimal to sustain program without external funds needed to cover marketing, capacity building, enterprise development. 2. Nature of product as fixed and scope for improvement still does not make it an ideal product in the market. 3. Supply of skilled labour of stove promoters and ceramic and iron components is mostly project driven. 4. Onset of private finance through carbon financing might supplement some of the funding required but will not build processes necessary for commercialization.

⁶ UNDP/AEPC 2010

Key Stakeholders and Framework:

While CRT/N1998 is the main implementing agency, Figure 5 below demonstrates how multiple stakeholders were mobilized to coordinate activities and facilitate programmatic success.

Figure 5: Institutional Framework for Dissemination of Cookstoves (Dhakal 2007)



Impacts

Initially, 196,540 improved cook stoves were targeted at 995,000 beneficiaries. This required training over 850 promoters over 35 districts. The improved cook stoves are resulted in:

1. Reduced health issues related to chronic coughs, nose running, chest pain or itchy throats observed by women
2. Safety from open fire hazards
3. Vessels appeared to be less charred and easier to clean
4. Reduced smoke environment more inviting for other members of the household to assist in kitchen activities
5. Limited information on quantifiable impacts from this particular program. AGEPP 2008.

Critical Challenges:

1. *Saturation of markets for promoters:* The number of trained stove promoters is confined to certain geographical locations. Once the market is saturated in the project area, the promoters get little or no demand.
2. *Stove Design:* The dominant stove design is fixed and requires on-site construction therefore limiting production and consequently availability at market outlets
3. *Mixed market:* The project is sustained from three main financial sources-government, donor, private or community. This has elements of both a free and regulated market.

4. *Short Training Period:* The eight day training period was considered too short to learn critical practical aspects of ICS.
5. *Limited Profitability:*
 - a. Profitability from stove sales for both PO and stove builders too small to sustain Program without external funds: marketing, capacity building, enterprise development
 - b. Promoters appeared to leave their jobs due to lack of regular income, job guarantees, related expenses not covered by program, social issues (marriages, long distance travel).

Lessons Learned

1. *Proactive Government role:* Establishment of a dedicated agency to lead and coordinate rural energy programs (AEPC), made scaling up a reality.
2. *Importance of Capacity Building:* Evidence suggests that capacity development costs represent a significant portion of the overall costs of decentralized energy access programs especially in the initial stages, and must be fully taken into account in planning program budgets.
3. *Demand Driven:* An approach that takes into consideration the needs of end users, integrating traditional practices, community mobilization and rural development is likely to gain momentum.
4. *Multi-stakeholders:* The ICS program is characterized by networking and collaboration among various key actors at an international, national, district and village level.
5. *Absence of direct subsidies:* While the need for this subsidy might vary depending on affordability and type of stove, decisions on subsidies need to be carefully discussed depending on contexts and preferably redirected towards market development rather than price reductions.
6. *Evidence Based Policy Influencing:* CRT/N has lead efforts to collaborate with partners and present findings, results and insights from the cook stove program and presented this to high level policy makers at various platforms.
7. *Monitoring:* Consistent monitoring by CRT/N, field technicians from partner organizations and participatory feedback have assured some degree of a performance review of systems.

Additional Insights

1. *Absence of consumer financing:* There appeared to be a lack of consumer financing. It is not clear for the basis of this conspicuous absence but other programs have demonstrated that by offering financing to users solutions can reach deeper into poorer sections and also enables people to purchase higher priced models that might normally be out of reach of a onetime cash purchase.
2. *An Enterprise Approach:* Key actors in the supply chain of ICS, promoters and local potters work on a commission basis or as demand arises. There is little evidence to suggest that beyond this model any other approach has been tested.
3. *Caution over Carbon Finance:* While it offers a different route of funds and perhaps brings in a rigorous monitoring method it is also driven by quantities rather than process or strategy. This could drive organizations to neglect the most important aspect of such programs-

building sustainable processes and instead focus on installations to generate carbon revenue.

4. *Technical Research:* At present, only 3-4 popular models are being promoted with minor modifications. Simultaneous effort needs to set up research facilities that can constantly improve existing models and offer up gradations suited to local needs. This also urges efforts to find modern solutions that steer away from old fuel pattern habits that have proven unhealthy.

HONDURAS: CENTRAL AMERICAN MICRO-ENTERPRISE STOVE PROGRAM BY TREES, WATER & PEOPLE AND AHDESA

Country and Household Energy Overview:

Honduras is a republic in Central America with an estimated population of approximately 8 million. Its surface area covers just over 112,492 Km². GDP per capita is estimated at US\$ \$1,930 and 65% of the population lives under the poverty line (2010 est.) In Honduras, an estimated 100,000 households in the capital city Tegucigalpa as well as 50,000 families in Honduras' second largest city San Pedro Sula still use traditional firewood stoves for cooking – that translates to 90% of rural families and 50% of urban



families. Urban households spend more money on modern energy services such as electricity, gas and kerosene, while rural households spend more money on traditional fuel wood. For the latter, they spend close to 7.2% of their income in fuel. In Honduras two types of subsidies are intended to benefit the poor; one for domestic consumers that use less than 300kWh per month and another which subsidize new connections of the rural electrification program.

Program Objectives:

In May 2004, with support from the U.S. Environmental Protection Agency (USEPA), Trees, Water & People (TWP) launched a two year pilot program to increase the use of clean, affordable, and efficient cooking technology among low-income families living in and around Tegucigalpa, Honduras. TWP, in collaboration with the Honduran Association for Development (AHDESA), implemented the improved cook stove training and construction program in Tegucigalpa. Program Objectives were to:

- Raise awareness about the health risks of indoor air pollution among 200,000 people
- Provide training and technical assistance to local entrepreneurs to reach 720 families
- Aid in the creation of 30 new small businesses that produced the improved technologies and reduce exposure of indoor smoke by 3,600 people
- Produce improved cookstoves that meet standards for high fuel efficiency and low emissions, and are socially acceptable, affordable and safe
- Decrease the risk of acute respiratory infections by reducing indoor air pollution in homes with improved stoves by 50-90%

Current Status:

Program	Details
Duration	2004 - Ongoing
Location	Tegucigalpa, Honduras
Stove Model	Self-developed 5 stove models: <ol style="list-style-type: none"> 1. EcoLenca 2. EcoStove 3. EcoHorno 4. EcoTortillero 5. Justa
Reported Achievements	<ol style="list-style-type: none"> 1. 5 Stove Models developed 2. 15 Stove vendors trained 3. Signed contracts and government agencies for set number of stove orders per month 4. 200,000 people educated about the impacts of indoor air pollution through development of marketing materials and campaigns via radio, newspaper and television 5. More than 23,000 cook stoves built in Honduras (2012)
Sources of finance	<ol style="list-style-type: none"> 1. US\$ 132,000 United States Environmental Protection Agency grant for implementation and development of safe, affordable cooking and heating source (administered by the Partnership for Clean Indoor Air). 2. Additional to USEPA, the program received funding from: <ol style="list-style-type: none"> a. Weyerhaeuser Family Fund b. Rotary Clubs and Rotary International c. Award funding from Ashden award 2005
Financial and operational sustainability	<p>TWP's core philosophy of participatory community involvement in program design and implementation was a key tenet to its financial and operational sustainability.</p> <ol style="list-style-type: none"> 1. JUSTA stoves cost US\$ 60 but end users can contribute 30% towards its cost by providing labor and materials 2. Additional Funding from partners and awards allowed TWP to add a micro-credit fund to enable end-user finance. This was important in making the stoves affordable to communities. 3. Stoves were designed with community needs in mind as witnessed in the diversity of products offered that were demanded by community members 4. Locally-enabled mass production was deemed necessary to reach demand 5. Training, awareness raising and marketing activities were central to the program's operations

Key Stakeholders:

1. *AHDESA* was constituted as a private, non-profit organization in 1992. It targets its efforts to lower income communities via training, technical assistance and socio-economic, environmental and agricultural projects that promote community development. Key to its model is woman/men active participation.
2. *TWB* was founded in the United States in 1998, and since has worked in several developing countries to improve people's lives by helping communities protect, conserve, and manage the natural resources upon which their long-term well-being depends. Their model is based on the philosophy that the best way to help those most in need is to involve them directly in the design and implementation of local environmental and economic development initiatives. This creates ownership, involvement, and financial sustainability well into the future.
3. *Funders:*
 - a. USEPA provided a US\$ 132,000 grant to kick off the project.
 - b. Ashden Awards receipt helped set up TWP first factory in Honduras
 - c. Private foundations, individual donors, Rotary International, Rotary clubs, Weyerhaeuser Family Foundation and Climate Care helped to sustain capacity building, marketing and microcredit activities.
4. *Community Members* were encouraged to participate in the design and implementation of the project so that they would have a stake in its success. This includes stove producers, vendors and community leaders.

Impacts:

In 2009 TWP reported that it had selected and trained 4 stove producers and developed 5 Stove Models: EcoLenca, EcoStove, EcoHorno, EcoTortillero and Justa. It had also trained 15 Stove vendors, developed marketing materials and campaigns via radio, newspaper and television, and signed contracts with NGOs and government agencies for a set number of stoves per month. By 2010 Ashden reported that TWP had built its first factory in Honduras. By early 2010, AHDESA had produced and sold 5,000 stoves. Furthermore, by 2010 AHDESA had also trained 156 community leaders out of which 1/3 could now construct and install the stoves. As of 2012, it is reported that they had built 23,650 cookstoves in Honduras.



Critical Challenges to Implementation:

1. *Adapting the program to local conditions:* Technology validation is regularly required to adapt to customer needs. While the program did diversify its product line, major challenges for stove design are issues of overheating and catering to diverse customer preference. Additionally, end-user finance needs to be made more available to low-income families. While a micro-credit fund has enabled this to a certain extent, it needs to be strengthened to meet demand.
2. *Meeting increasing demand requires mass production:* Stove production methods need to be improved in order to reach larger populations. Additionally, controlling quality and cost among many producers poses an operational challenge.
3. *Marketing and awareness raising efforts creates added cost:* In order to enhance these activities, linkages between public health agencies need to be strengthened.

Lessons Learned:

First and foremost, the role of community involvement as a success factor was evident throughout the program, particularly with regards to product distribution and adoption. Another lesson learned by TWP is that recognition awards such as Ashden (2005 winner) are extremely valuable towards program sustainability. Not only did Ashden place the program in the public eye, but TWP was also awarded the “Best in America” Seal of Excellence from Independent Charities of America (ICA) in 2008 and the Rio Tinto Prize for Sustainability in that same year, and the UNEP Sasakawa prize in 2010. This kind of attention can help bring in additional funding to sustain capacity building and marketing activities. In addition, it was learned that in order to reach all the families in need, the program required to undertake mass production of stoves, diversity in products and availability of micro-credit for end-user finance. Finally, awareness raising and marketing activities are integral to the program in that they garner the support of multiple stakeholders—crucial to a program’s sustainability.

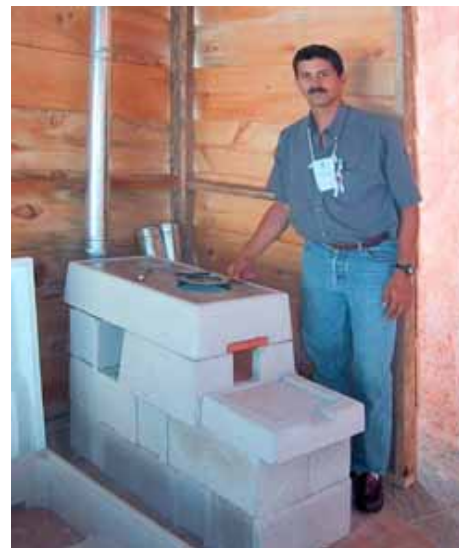
HOUSEHOLD ENERGY
IMPROVED COOKSTOVES HYBRID INSTITUTIONAL & ENTERPRISE PROGRAM

GUATEMALA: ONIL STOVES BY HELPS INTERNATIONAL

HELPS International is the creator and manager of the ONIL stoves as well as the additional ONIL product line, and has been working in Guatemala since the 1980s. It was founded in 1984 as a 501(c)(3) charitable foundation in the tradition of service to others. HELPS works together with other non-governmental organizations (NGOs), private enterprise, and cooperates with local and national governments to promote sustainability of its programs. HELPS ONIL is an ongoing project in which ONIL is run as a commercial venture by HELPS International, promoting and selling its product line.

Country and Household Energy Overview:

Guatemala is bordered by Mexico, the Pacific Ocean, Belize, the Caribbean and Honduras and El Salvador. It covers a surface area of 108,890 km² and has a population of 14 million. Its GDP per capita is estimated at US\$ 2,660 and 56.2% of its population remains below the poverty line. Guatemala's household energy sector is fueled primarily by wood. According to a Partnership for Clean Indoor Air (PCIA) report from 2004, fuel wood use has increased 29% in urban areas, in contrast to 86% for rural areas. Even with LPG users, they still use fuel wood for heating, lighting or for drying clothes. PCIA estimates that Guatemala loses an approximate equivalent of 2,460 hectares of biomass annually due to firewood consumption, out of an overall annual deforestation rate of approximately 90,000 hectares per year, the major causes of which are shifting agriculture and new pasture land.



Objectives:

The overall mission for the ONIL Products Program is to design, produce and provide on a large-scale, best quality products at the lowest price to improve the quality of life of families that lack adequate and acceptable conditions.

Its objectives are to:

1. Improve low-income family economies
2. Improve health and safety (air quality and burns)
3. Promote a commercial and sustainable improved cook stove market via mass production
4. Raise awareness among community and households
5. Engage the community in environmental conservation

Technology:

In the late 1980's HELPS International's medical teams reported an alarming number of children being treated for burns and numerous respiratory problems in Guatemala. Don O'Neal, an engineer with HELPS, investigated and found that the problem was the method of cooking that the indigenous Mayan women used in their homes, a centuries old tradition: cooking meals using an open fire pit on the dirt floor of their one room homes. This led to burn accidents, respiratory problems and increased deforestation. HELPS then set out to solve the problem by designing the ONIL Stove. It is a method of cooking that is compatible with traditional methods, yet safer. The fire is contained in a clay-fired firebox in an insulated, durable stove that sits off the floor, thus minimizing the risk of burns to small children. Vented by a galvanized steel chimney, the stove uses an efficient burning technology, and virtually eliminates smoke and deadly carbon monoxide in the home.

Model:

As previously mentioned, HELPS ONIL is an ongoing project in which **ONIL is run as a commercial venture by HELPS International**, promoting and selling its product line.

1. *Community involvement:* The HELPS methodology is based on 4 main activities: demonstration and awareness creation directly with the communities, training the community leaders, delivering the product once the training has concluded, and monitoring of the installments. These steps guarantee community involvement, understanding and implementation of the project. As of 2012 HELPS International has been able to create a community microcredit corporation, through which it sells the stove.
2. *Marketing and distribution through networks:* ONIL Stoves and products are marketed as well through other NGO's, local associations, farm owners, socially responsible businesses, municipal and federal government programs, community distributors or direct sales. By 2008, HELPS had a network of over 140 implementing groups. One distribution approach is that the extension agency promoting the ONIL stove in a particular area nominates five women from the community to be trained by HELPS in stove assembly and use, and routine maintenance. A stove technician assists these women to assemble the stoves in their own homes, and they then pass on their skills to others. Each community will have at least three follow-up visits from a stove technician, to ensure that the stoves are working well.
3. *Local manufacturing:* By 2009 HELPS had two manufacturing facilities in Guatemala, in which the main concrete body parts of the stoves are made. The ceramic and steel parts are produced by local enterprises.



4. *Stove pricing and products offering:* HELPS offers a diverse product line including different types of stoves and water purifiers. It will make different product offerings based on the client. For instance, purifiers can be sold individually or as part of the “ONIL Health Combo”, which includes both the purifier and the plancha stove. This Health Combo is targeted at the community programs which include the participatory process and training. The project has also delivered two other types of stoves: the institutional stove to serve the needs of preparing greater volumes of food such as in schools and the Nixtamalera stove designed to avoid the use of open fires when using significantly bigger pots. Pricing of the stoves is designed to allow for a sensible price point where the end-user invests in the product at a price he/she can afford. For instance, stoves cost approximately US\$100, but with some of HELPS’ community development programs, consumers can pay US\$30.

Finance:

Limited information is available on financing for HELPS Onil. As a 501(c)(3) charitable foundation, HELPS is able to receive funding from grants and awards programs. Its program was a recipient of the International Ashden Award 2004 prize and the Monja Blanca Award 2004. As a commercial venture, HELPS has made substantial sales and revenue to sustain and grow its operations. Between 2005 and 2008, it sold 10,000 stoves each year. HELPS International projected 45,000 stove sales in 2009 and 90,000 in 2010. In 2012, HELPS staff stated that they had delivered 81,056 plancha ONIL stoves, 21,299 Nixtamal stoves, 415 institutional stoves, 62,546 water filters/purifiers in Guatemala. Internationally (as they also operate in Haiti and Mexico), they estimate to have delivered a total of 135,000 of the plancha stoves.

Impacts:

1. *Cost savings:* In Guatemala, stoves cost an estimated US\$ 80 - 100. Through HELPS community development programs they cost around US\$ 30. By 2012, HELPS has delivered more than 80,000 plancha ONIL stoves and more than 21,000 Nixtamal stoves. Additionally, 62,500 water filters/ purifiers have been delivered.
2. *Safety and wellbeing:* Efficient burning technology virtually eliminates smoke and deadly carbon monoxide in the home. The ONIL stove reduces wood consumption by 70% thus, women who use the ONIL stove gained the equivalent of two days a week in time saved from gathering wood, allowing them time for social and economic activities like cultivating a vegetable garden.
3. *Environmental benefits:* Each ONIL stove uses only 15% of the equivalent of one tree per month per family, and, since there are over 40,000 stoves in use, Guatemalans are saving over 300,000 trees per year
4. *Job creation:* As of 2009, HELPS employed 86 people in Guatemala and 17 in Mexico / Two manufacturing plants in Guatemala and in Mexico
5. *Institutional creation:* HELPS has also set up a community microcredit corporation, through which it sells the stoves.

Critical Challenges:

1. *Satisfying domestic heat requirements:* Household heat requirements vary according to geographic location of the rural households so that the stoves don't always satisfy the needs of warming up a home.
2. *Proven reductions of IAP (Indoor Air Pollution):* Not all cook stove programs have adequate IAP monitoring, HELPS however has been evaluated by Aprovecho Center and meets allowed standards
3. *Keeping quality control and stable:* HELPS has been able to address this by linking local enterprises to the manufacturing process, as well as establishing two manufacturing plants themselves. This guarantees quality control and mass production lowers prices.

Lessons learned:

HELPS' Onil Stove in Guatemala provides an example of how a non-profit organization can create a sustainable social enterprise by managing a commercial venture. As a non-profit organization, HELPS can receive funding to support its high amount of engagement with community members. These activities include awareness raising and follow-up. Instead of giving away products for free as a traditional non-profit model might follow, HELPS set up community distributor programs that enable microcredit and end user finance. In order to satisfy a high need for these cook stoves, HELPS had to undertake mass production and handle quality control and distribution logistics. It was able to tackle these feats by facilitation coordination between multiple organizations. Finally, HELPS demonstrates that community participation is important to a program and/or enterprise's success because customers have varying demands that require a diverse product offering.

CONCLUSION

Commonalities among successful interventions:

Despite the wide variety of case studies presented in this report, there are several discernable commonalities that signal a higher probability of success:

- (1) Mutually beneficial interaction of the private and philanthropic/public sectors as they pursue overlapping objectives;
- (2) Mastery of the full value web of stove production and final delivery to the user, including services and finance; and
- (3) Participatory processes and demand responsiveness.

First, all cases presented a synergy between multiple stakeholders (donor, government support and private enterprise), although the timing, sequencing and quality of interaction varies from case to case. Some enterprises are heavily reliant on governments and/or donors as their single largest clients. Meanwhile, other enterprises sustain sales growth without government or donor contracts, but still did capitalize on decades of publicly funded awareness creation. The combination of program support and private enterprise appears to be optimal, achieving more impacts than any one approach alone.

Second, it is evident that every company or program struggles with its own bottlenecks, either internally or more widely in the sector. The most successful entities have been able to identify these, address them, and maintain a growth trajectory. The variety of bottlenecks and challenges is impressive -- from manufacturing to marketing, or enterprise finance to customer finance-- but the hallmark of a successful company or program is that it witnesses an ever-changing critical bottleneck. This is proof that the company is addressing its challenges, innovating, and continually evolving. Often, this ultimately entrepreneurial mindset leads a program or company to extend its influence over greater parts of the value chain, either by design, direct acquisition or through partnerships.

Third, all successful cases, whether private or public, have been responsive to demand by allowing user preferences and purchasing power drive the agenda. Programs that “measure twice, cut once,” or do adequate market research before developing or introducing stove models are simply more successful. Furthermore, programs that remain alert towards changing consumer preferences over time and reevaluate their assumptions when expanding into new geographic areas or customer segments, have been rewarded for doing so.

What next?

A typical, successful cook stove program or enterprise, as documented in this survey, can expect to achieve sales of between 100,000 and 500,000 units over, say, five years. This level of activity corresponds to concerted government/donor, multi-million dollar effort, or an enterprise that has been able to benefit from participation in carbon markets. In contemplating

broad new initiatives for stove dissemination (ie not one-off projects focused on unique communities), this level of activity should represent a minimum benchmark achievable by any well-designed program. Such a program would likely blend technical training, capacity building, awareness-raising, and access to finance with a strong private sector component. The recipe exists. The real question is: “After this, what next?”

One route would be to focus on doing the same types of activities, but reaching for sales targets of several million over the same timeframe. Another route would be to focus first on improving the *quality* of the activity (through improved stove design for instance). Both are crucial to enhancing and scaling the success of improved cook stove programs and entrepreneurial ventures and can be met by different forms of collaboration between actors.

Impacts on health outcomes, the contribution of black carbon to climate change, and the contribution of cooking to deforestation exist, but they can be difficult and costly to quantify. Much more research is needed on actual dose-response curves for indoor air pollution followed by product development directed towards achieving meaningful and quantifiable reductions in morbidity and mortality. Investigations surrounding the true effects of black carbon from stoves need time to come to fruition. And perhaps other means of controlling or reversing deforestation need more attention.

Finally, it is important to call attention to the primary reasons that improved cook stoves have seen success in the market. This is because they provide (1) time and cost savings to the customer, (2) increased ease of cooking, and (3) aspirations related to owning a durable, attractive stove (and a cleaner kitchen if applicable). These are selling points that are most relevant to customers, and until more clarity is gained on quantifying health and environmental impacts of cook stoves, these important benefits should be the primary drivers for scaling up cook stove programs and entrepreneurial ventures.

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ANNEX 1: DATA COLLECTION TEMPLATE

The following template was used to collect the data and compile the findings for each of the case studies presented in this report.

1. Project Title and Country a. <i>Include contact information of key person if you have it</i>
2. Household Energy Sector
3. Rural, Urban or Peri-Urban
4. Project Objectives a. Who, what, where, when, how?
5. Current Project Status
6. Relevant Policy Frameworks a. What policies are in place related to this project b. What is the status of the related policies (approved or in process)?
7. Institutional Framework a. What organization is managing the project or is the champion of the project? Include a brief description. b. Who are the key sponsors/funders and their roles? What other organizations are key to project success? c. Use bullets for each of organizations
8. Delivery Mechanism a. <i>Is it an NGO/private sector/government program delivering the project?</i> b. <i>How did they implement the project?</i> c. <i>What was their approach in reaching communities?</i>
9. Sources of Finance a. Project Source and financial contribution over course of project, to include in kind support by communities/others. Do this in a table where possible (source, amount, by year). Funding (US\$) Organization Year 1 Year 2 ... Source 1 Source 2 ...

<p>10.Outputs, outcomes and results of project</p> <ul style="list-style-type: none"> a. What specific things have been achieved by this project? b. Who are the primary beneficiaries and how many beneficiaries are there?
<p>11. Financial and Operational Sustainability and Scale-UP</p> <ul style="list-style-type: none"> a. <i>Demonstrated organizational capacity and financial viability of the project</i> b. <i>Capacity to grow and continue operations into the future (e.g., beyond donor funding)</i> c. <i>Extent to which project could grow and be scaled up to reach additional beneficiaries or replicated elsewhere. In particular, the potential for the idea to be applied at a large scale.</i>
<p>12. Critical Challenges to Project Implementation</p> <ul style="list-style-type: none"> a. List the key barriers and for each identify the actions taken to remove these. Do in bullet form, maximum 1 paragraph per barrier. b. How were challenges addressed? c. Were their cost implications for the project
<p>13. Key Interventions and their Impacts</p> <ul style="list-style-type: none"> a. <i>What were the project impacts (as measurable as possible)? For example, number of households or individuals using improved cookstoves; income impacts; health impacts; impacts on women/children, etc. Use bullets to identify and briefly describe each impacts</i> b. Based on above, what actions/interventions worked and what didn't ? c. What were the lessons learned? Use specific stories if you have them.
<p>14.Recommendations and replicable lessons for other countries</p>
<p>15.Other key findings about the project</p> <ul style="list-style-type: none"> a. Include other information that might be useful in understanding the project or interesting insights gained from the project