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International Guidebook of Environmental Finance Tools: A Sectoral Approach

Protected Areas, Sustainable Forests, Sustainable Agriculture, and Pro-poor Energy

CHAPTER 3: ENERGY ACCESS FOR THE POOR

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ENVIRONMENT AND ENERGY



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CHAPTER 3: ENERGY ACCESS FOR THE POOR

“There is simply no way to effectively describe the impact giving electricity to someone has on their life. What does it mean to you to be able to wake up at night and turn on a light to see your children in the dark, to read at night, to charge your mobile phone (your only means of communicating), to listen to a radio, to have your children be able to study after dark, to visit with your friends or spouse in the evening after the sun goes down? One woman cried when we installed the light in her home while her husband literally danced. Many of the customers have never had electric light in their home.”

Paul Lacourciere, Sirona Cares Foundation, 2011

Introduction

According to UNDP an estimated 79 percent of the people in the developing world -- the 50 poorest nations -- have no access to electricity. The total number of individuals without electric power is put at about 1.4 billion, or a quarter of the world's population, concentrated mostly in Africa and southern Asia. This is especially dire for isolated and impoverished rural populations that tend to live too far from the national electrical grid. As a result, biomass (mostly firewood and charcoal), is the primary source of fuel, which contributes to wide scale deforestation and produces greenhouse gases and air pollution in the home and outdoors. In response, this chapter focuses on tools that support energy delivery to poor rural communities.

Because grid extension is usually not cost effective, rural communities must rely on alternative and mostly renewable forms of energy to provide a sustainable source of electricity. According to the OECD/OIA 2010 report on energy poverty: “small stand-alone renewable energy technologies can often meet the electricity needs of rural communities more cheaply and have the potential to displace costly diesel-based power generation options.” By and large, the most common renewable technology adapted to rural areas is solar, which comes with high upfront costs but is affordable over the long term since energy delivery is not reliant on an ongoing provision of costly fuel, such as diesel. Other renewable energy technologies (RETs) in common use include run-of-river micro-hydro systems, biofuels, biogas and wind. In addition to these RETs, efficient cookstoves also contribute to energy conservation, environmental protection and human health by reducing dependency on biomass for fuel.

Chapter Focus

This chapter explores pro-poor electrification and fuel efficiency programs in multiple countries with an emphasis on lower cost projects in isolated rural areas, such as solar homes in Bangladesh or efficient cookstoves in Ghana. As the most common RET in developing countries is solar, the majority of case studies look at various way of financing solar home systems. Other technologies reviewed in this chapter include micro-hydro, biofuel, biogas and efficient cookstoves. While the technologies may differ, the finance tools are largely the same:

When financing energy in rural poor communities most projects succeed through loans, subsidies or a combination of both.

Financial Tools

FINANCIAL TOOL CHOICE

As discussed in Chapter 1 above, this Guidebook focuses only on financial tools most commonly implemented in and most applicable to developing countries.

In addition, because climate change is an overarching concern in all four sectors, the efficacy of financial tools that addressed carbon emission reductions was also analyzed. Thus, this chapter did not attempt to assess financial tools that have been predominantly implemented in developed countries, such as tax incentives, or tools with limited application in a developing country context, such as government bonds. Instead, the energy analysis includes:

- Tools in most common use to finance pro-poor energy throughout the developing world: loans and subsidies,
- Tools that hold the most promise for increased distribution of pro-poor energy: loans and subsidies, and
- Tools that directly address climate change: clean development mechanisms (CDM) and voluntary emissions reduction (VER).

The following discussion and case studies largely focus on the predominant tools used in developing countries to finance pro-poor energy: loans and subsidies. An analysis of VERs and CDM is also included because they relate directly to reducing greenhouse gases and climate change. In general, loans can come in a variety of forms including credit, payment installments, microfinance, patient loans (long term repayment agreements), and rent. Subsidies can come in the form of government funding, grants, carbon credits or sliding scale fees. Carbon-based mechanisms (carbon credits) can be either voluntary (VERs) or serve to support compliance with quantified emission limitation and reduction commitments under the Kyoto Protocol (CDMs).

LOANS

Overview

Environmental finance loans can range from multi-million dollar World Bank investments in national energy projects to micro-finance programs that offer small loans to individuals. Loans may also take the form of credit, in which a buyer receives a product up front (such as a solar home system) and pays back the cost, plus interest and/or fees, over time. Patient loan programs have proven successful, allowing borrowers to take several years to pay back relatively small amounts. Some of the challenges with implementing a loan include the following.

Setting loan amounts and terms: Loans are a financial investment and thus require sophisticated contractual agreements that must be appropriate to the potential borrower and attractive to the lender. It must be determined in advance how much a borrower can and is willing to accept in debt, and how long they can/will take to pay it back. Lenders must determine the level of risk they are willing to assume, the interest loan rate or fee, and what return on investment they need in order to maintain a sustainable program.

Defining collateral: Loan programs normally require collateral to help guarantee repayment and reduce risk. Collateral is a borrower's pledge of specific property against which a loan is made. The property could be a home, tractor, or any other item that has equal or greater resale value than the original loan. In developing countries, many borrowers have no collateral to offer, which raises the level of risk to the lender.

Community lending: In order to overcome the lack of collateral, some lenders promote community lending options in which several village members purchase energy systems together and all share the responsibility for repayment. This pooled risk strategy, pioneered by the Grameen Bank, has proven successful, however it requires the development of rural financial institutions in order to be effective.

Delinquent payments: Delinquency is always a concern for a lender and terms need to be established for when a borrower is delinquent and what the penalties may be before a loan program is implemented. Lenders must also develop protocols for repossession of products when buyers become delinquent.

Developing financial infrastructures: Because so many developing countries lack local banks to provide credit and accept payment, grassroots financial infrastructures frequently need to be developed before loan programs can be launched.

Loan Case Studies

With the exception of Brazil, all of the case studies below rely on variations of loans. In many instances, willingness and ability to pay were determined through extensive analyses that based loan repayments on how much customers would save if they switched from biomass to renewable energy sources (for example, Bangladesh and Haiti). Frequently payback periods are lengthy (Honduras), often several years to repay a loan that may be less than US \$200 (India-Solar Homes). However, even with long term payback periods, the very poor still have difficulty paying the upfront costs for solar or other renewable, clean energy (Kenya).

Access to credit has proven difficult for almost all of the case studies explored below. Those who were able to secure support from local banks emphasized how important that was to their success (Kenya, India-Solar Home). Unfortunately, in many developing countries there simply are no rural local banks to provide financial services (Ghana) or the banks that are available maintain terms that are too expensive (Honduras). Yet even when banks are engaged, it is not uncommon for them to remain wary of renewable energy products and under-collateralized customers.

Today banks in many developing countries have sufficient liquidity and in general are seeking to develop new loan products. However, it is the combination of the newness of renewable energy technologies and inconsistencies in the quality of products and services offered by the different vendors that can sometimes make lending difficult. (India-Biogas).

Overall, however, loans have proven successful in delivering energy to the rural poor. From the pooled risk sharing approach developed by the Grameen Bank and carried forward by the Grameen Shakti micro-utility financing program (Bangladesh), to long-term, patient payback periods (Honduras):

Innovations on loans may be the best path forward to financing pro-poor energy.

SUBSIDIES

Overview

Subsidies are direct transfers, usually from government to consumers or producers, to lower their costs or augment income. In environmental finance, subsidies often aim to encourage a particular behavior, e.g. avoiding deforestation or replacing diesel as a household energy source. Subsidies can be used to protect and support the growth of a young industry but they can also create reliance on below-market prices for products such as efficient cookstoves.

Some of the challenges with implementing subsidies include the following.

Unintended consequences: Subsidies artificially set prices that do not accord with the market. As a result they can have unintended consequences, such as overproduction, reducing innovation, protecting poor quality products and preventing competition.

Political difficulties: Politically, subsidies are very difficult to eliminate once they are put in place, yet they are costly for governments to maintain over time.

Market suppression: By introducing subsidies that support specific products, the market that may have developed otherwise may be suppressed because there is no incentive for competitive products, which typically bring down prices.

Vulnerability: While not often thought of as a subsidy, CDM and VERs are being incorporated by project developers to make unaffordable energy products like solar home systems or biogas domes affordable to poor customers. However this places a higher risk on the long-term viability of the program, which will be vulnerable to global carbon prices and the complicated carbon monitoring requirements. In some cases, grants have also been used to subsidize costs, however, relying on grants as a subsidy is also risky and likely to fail over time as funders develop new priorities.

Subsidy Case Studies

While subsidies can be problematic, some communities simply cannot afford access to energy at a price that provides an equitable return to the investor. In these cases subsidies that supplement the cost of a loan become necessary. Subsidies may also be required when a technology is new and unknown, and therefore distrusted (Haiti). In more highly developed countries that can generate revenue to support new industries (see India and Tunisia), subsidies can be internally funded through government programs.

Other subsidy programs are more social in their approach, demanding that those who have more pay for those who have less. Brazil's CRELUZ Cooperative requires larger wealthier users to pay more for their energy so poorer families are subsidized up to 64% while the poorest families receive free electricity. In some cases, energy programs are initiated with grants to help subsidize costs (Tunisia) with the hope that once the product is known and accepted, customers will be willing to pay more as the subsidy is reduced and eventually discontinued.

Subsidies, when used to launch a new energy program or lift a community to the point where they can eventually afford market prices, can be highly successful. However they are rarely sustainable over the long term and investors may find themselves in the position of lobbying governments to maintain a subsidy or seeking ongoing grants from international donors to subsidize their products. For a subsidy to be sustainable, it must be viable over time, such as the solar hot water system subsidy in Tunisia, where funds for the subsidy are provided through international LPG sales. Tunisian solar water heaters are also VAT free and customers can take up to five years to pay for them through patient loans.

CDM AND VERs

Overview

CDM and VERs can be valuable financial tools to help bring down the cost of an emissions reducing product or process (such as an efficient cookstove) thereby making the unaffordable, affordable. They are especially attractive tools for investors and businesses that may be incentivized to invest in new markets in developing countries that were traditionally considered too marginal or financially risky. However, accessing the carbon markets is not easy. In order for a project or product to qualify for CDM, a rigorous monitoring process must be implemented, strict rules and guidelines must be followed and complicated deals, including terms and prices, between buyers and sellers need to be negotiated. Indeed, as of 2010 most CDM projects have taken place in only four countries: China, India, Brazil and Mexico. (Ashden, 2010)

By definition, VERs do not have to follow the same requirements as CDM, however, to maximize revenue and the highest possible (premium) price per ton of CO₂, many project developers that generate VERs are following the same guidelines as CDM and using the same third party certifiers such as the Gold Standard. Gold Standard certification is an internationally recognized best practice methodology that provides a high quality carbon credit label for both Kyoto and voluntary markets. Thus the challenges of implementing both CDM and VERs are becoming virtually the same and include the following.

Proving additionality: CDM proponents must first show that their project could not or would not take place without the presence of carbon finance. Proving that a project will not happen without the expectation of carbon credits can be a formidable challenge. Proving additionality requires: 1) identifying alternatives (without which there cannot be additionality), 2) preparing an investment analysis to determine that the proposed activity is not the most economic or financially attractive, and 3) investigating barriers and common practices.

Baseline studies: In order to determine the amount of carbon emission reductions a project can offer, a baseline of existing emissions must first be quantified. For example, project developers will need to know how much wood a village uses on annual basis to cook meals, how much CO₂ is emitted as a result, and how much CO₂ emissions will be reduced by the introduction of more efficient cookstoves. Assessing the baseline will require rigorously tested products (to confirm

that they are capable of reducing emissions) and village surveys and monitoring to quantify wood use before and after the introduction of the stoves.

Monitoring over time: Following the baseline study, applicants must prove that they can monitor and verify carbon emission reductions from their projects over a period of many years.

Time: As shown above, proving additionality, preparing a baseline analysis and establishing a long-term monitoring program is a complicated and lengthy endeavor. Few projects are certified in less than two years and the process can be prohibitively expensive.

Third party certification: Projects must be verified, monitored and certified by a third party, which adds to the cost and the overall uncertainty of the effort, thus increasing risk.

Global vulnerability: Like MBMs and PES, CDM and VER revenue flows are vulnerable to global trends and price fluctuations and uncertainty over the path of the Kyoto agreement after 2012 makes CDM a risky option.

CDM and VERs Case Studies

Only a handful of developing countries have implemented CDM or VERs to finance or subsidize the cost of pro-poor energy rural communities (Brazil-Instituto Perene and Ghana). This relatively new approach to environmental finance focuses on reducing greenhouse gas emissions, however, registering a project so that it qualifies for either the voluntary or involuntary markets is an onerous process that can take years and cost tens of thousands of dollars. The certification and long-term monitoring process is intensive and only sizeable projects that guarantee large reductions in carbon emissions are likely to realize significant financial returns. In addition, even in cases where the entire cost of the product can be subsidized through VERs (Brazil-Instituto Perene), the project must still be attractive to carbon investors (e.g., corporations seeking offsets) who will demand strong management and significant auditing processes that frequently require costly international involvement.

Sector Specific Analysis

Because renewable energy is most often funded through various forms of loans, financing pro-poor energy in rural communities hinges on the customer's ability and willingness to pay. Unless a project is completely funded through subsidies (Instituto Perene in Brazil), and the energy is essentially free, bringing RETs to rural areas means developing a business strategy that can include everything from identifying, training and hiring entrepreneurs to establishing local financial institutions. Successful pro-poor energy efforts are often characterized by for-profit investors, government and/or nonprofit NGOs driving a project to create local industries through finance mechanisms that make renewable energy affordable. Most often the effort must be built from the ground up and there are a number of hurdles to be cleared before a successful energy program can take off. Some of those hurdles include the following.

Geographic Isolation

The UNEP experience (India-Solar Homes) has been that once solar portfolios get beyond 10,000 loans the sector is considered a strong commercial credit market and the banks will become willingly engaged. Thus, the isolation of rural communities creates a number of barriers beyond the fact that they are located far away from the national grid. Many of these communities are small, often less than 100 people, and they are miles apart from each other (see Ghana, Kenya, Laos and Honduras). This presents a significant challenge to setting up a program for energy delivery when there is no business infrastructure to sustain the effort.

Because most pro-poor energy projects rely on loans, a market must be attractive to investors (e.g., banks, impact investors, NGOs). That means there must be enough customers (e.g., a viable market) to support a supply chain that includes

manufacturers, retailers and maintenance. Servicing multiple small communities, across miles and miles of unpopulated land, over questionable roads is rarely cost effective and banks will normally view such a project as too risky to invest.

Access to Capital

As a result, in most cases, commercial financial institutions are not engaged in efforts to bring energy to the rural poor because they do not maintain branches outside of populated areas and they are skeptical of engaging with marginal communities (Ghana, Laos, Honduras, and Haiti). While some countries have developed their own microfinance institutions (Bangladesh and Kenya), commercial banks are rarely interested in promoting low-value credit and loan schemes that may cost more to operate than they return in investment for technologies (RETs) they do not understand.

In addition, RETs such as solar and micro-hydro carry high upfront costs that must be recovered from financially high-risk customers who have no collateral to offer. As a result, investors who set up pro-poor energy programs find it exceedingly difficult to access start-up capital and frequently have to finance their operations through grants and other support from international aid and development organizations (Ghana). Once the funding has been secured for the project, the lead organization or business will often find itself having to set up and be responsible for a finance structure that supports the various loan schemes such as credit, layaway, installments or long-term loans (see Ghana, Laos, Honduras, Brazil-Instituto Perene and Haiti). At the same time, they may be managing efforts to attract government support, international grants and carbon credits to subsidize costs.

Lack of Capacity

Assuming all the financial hurdles have been overcome, there are still many other issues to be confronted, the largest of which is the lack of capacity. When trying to get a product to market there is a sophisticated supply chain that must either exist or be built. Even when trying to develop and sell something as inexpensive and uncomplicated as a fuel efficient cookstove, investors frequently find that the basic elements they may be able to take for granted elsewhere – designers, manufacturers, suppliers, resellers and transport – must be developed at a local level before the project can move forward (for example, Toyola cookstoves in Ghana). Introducing sophisticated technologies like solar can be even more difficult, involving the additional effort and cost of importing supplies (India-Solar Home). In response, investors must often include a development focus within their projects to grow the expertise of the local labor workforce and build capacity to deliver their products to market (Laos and Ghana).

Lack of capacity also often extends to the market, which is frequently suspicious of, and must be educated on new RET products. Extensive marketing programs (Tunisia) that include door-to-door introductions and local representatives are often critical to engage the potential customers. In return, in order to make pro-poor energy products affordable, rural communities must often be willing to invest their own in-kind support (Brazil-Instituto Perene) in the effort by supplying space, contributing time and materials and providing security, especially for higher end products like solar. Thus, customer buy-in is critical to developing rural energy opportunities.

All Things to All People

As is evident from the discussion above, financing pro-poor energy is only one piece of the puzzle. Investors have often found that in order to be successful they must be many things at once: entrepreneur (Kenya), financial institution (Ghana), development worker (Laos) and possibly even environmental expert (Brazil-Instituto Perene). Bringing energy to poor rural populations is a complicated endeavor. However, many of the successful projects referenced in this chapter below are championed by organizations that have managed to map out blueprints tackling these developing country issues on their own unique roads to energy finance. All are replicable, and most are represented by an entrepreneurial spirit that is critical to developing renewable energy markets in the world's poorest communities.

Case Studies Included In this Chapter

Below is a list of case studies included in this chapter.

Tool	Country	Case Study Title
Loan – Microfinance	Bangladesh	500,000 Solar Homes and Counting (Grameen Shakti)
Loan – Credit	Honduras	Loans to Promote Small Scale Production and Local Use of Biofuels (GotaVerde)
Loan/Subsidy (VERs) – Credit	Ghana	Achieving the 4 “E”s: Energy, Efficiency, Employment and Environmental Protection (Toyola)
Loan – Credit/Installments/Layaway	Kenya	Business in a Box Thinks Out of the Box to Provide Solar to Rural Poor (ToughStuff)
Loan – Rent	Laos	Village Energy Committees Bring Light to Rural Communities (Sunlabob)
Loan/Subsidy – Loan	Tunisia	Subsidizing Solar Hot Water Heaters to Stimulate an Industry (PROSOL)
Loan/Subsidy – Grant/Franchise/Rent	Haiti	Entrepreneurs Bring Light to Rural Haiti (Sirona Cares)
Loan/ Subsidy – Government Subsidy	India	Indian Solar Home Program (UNEP)
Loan/Subsidy – Patient Loans	India	Biogas Domes Reduce Waste and Bring Light (Ministry of New and Renewable Energy)
Subsidy – Sliding Scale	Brazil	Hydro System Lets Users to Pay What they Can (CRELUZ)
Subsidy – Carbon Credits (VERs)	Brazil	Subsidizing Efficient Cookstoves with Carbon Credits (Instituto Perene)

Loan and/or Subsidy: What Determines the Best Financial Tool for an Energy Investment?

While there are numerous energy programs driven by grants to bring renewable energy (such as solar lanterns) to remote communities, the most sustainable efforts are those, which create a durable market for a renewable energy product. Thus, over the long term, grants are not the answer. In order to develop renewable energy markets, pro-poor energy access becomes viable in most cases either through loans or a combination of loans and subsidies.

While government or international donor-funded subsidies can effectively kick-start a program, that approach will be unsustainable over the long-term as customers grow accustomed to the artificially reduced prices and government programs grow deeper in debt. Ideally, subsidies are introduced as short-term solutions to develop and protect a new industry until it matures and establishes its market. Eventually, subsidies should be phased out - if possible - to make way for an industry that can effectively compete. Ultimately, the industry should stand on its own, offering an affordable product that satisfies customer demand. Thus, it is in a country's best interest to develop a strong foundation of energy policies, programs and regulations that foster industry growth and consumer demand without subsidized prices. But how does a federal, regional or

local government know if their communities can sustain a viable pro-poor renewable energy industry? While there are many decisions, which come into play when a government is determining the best approach to financing energy programs, there are certain criteria for attracting finance that can be used to help a government determine if it is ready to introduce a debt-based energy strategy, with or without subsidies.

When an industry relies heavily on loans (even if those loans are subsidized) to finance its growth and attract customers, then that industry must be well managed, financially stable and transparent in order to maintain sustained investment levels. Similarly, when a government wants to determine if a debt-based approach should be considered for pro-poor energy projects, the rules of investing should apply so that both the public and private sectors achieve long-term sustainable results. With that in mind, below is an overview of some of the criteria the financial community considers when choosing to invest in a product or project.

A conscientious investor looks at the complete business plan, not just the product. A good product with excellent management will overrule a great product with poor management at all times. When an investor reviews an opportunity, a successful business will have certain qualities that let it shine above others:

- Strong leadership/capable management team,
- Audited accounts available,
- Transparency and receptivity to governance and reporting standards, and
- Sound knowledge of the competition and available market.

In addition, investors will look for specific factors for success, which include:

- A large, accessible market and ability to command a large market share,
- Growth potential and the ability to achieve scale,
- Existing relationships with established or potential customers,
- Recurring revenue and the potential for financial sustainability,
- Strong rate of return,
- Immediate application (i.e., market sophistication - the market does not need to be educated, necessary regulations are already in place), and
- A competitive product that fills a need at a reasonable price.

In order for governments to make a decision promoting a debt-based pro-poor energy strategy, these basic rules of investing should be applied and have been laid out in the following Energy Investment Criteria Checklist below. The Checklist is designed to facilitate a 360-degree consideration of a potential pro-poor renewable energy project in a developing country. Many of the questions are borrowed from the framework that debt and equity investors use as due diligence in evaluating whether or not to proceed with an investment. Very few projects will have all “Yes” answers. However, a preponderance of “No” or “Unknown” responses may cause the prospective policymaker or investor to pause and re-examine the advisability, and alternatives, such as subsidies, to the project under examination.

Energy Investment Criteria Checklist

ENERGY INVESTMENT CRITERIA CHECKLIST		YES	NO
Management/Leadership			
National energy programs and policies are normally in place before a successful debt strategy can be implemented. Local and regional connections between leadership (government agencies, financial entities, etc.) and industry stakeholders should already exist. Links to target communities or a community outreach plan should be in place. If the majority of the answers in this section are “no” then the finance tool, subsidy or loan, is not ready to be introduced.			
Is there strong national government support and leadership?			
Describe national support/leadership (including energy agencies, policies, programs, etc.):			
Is there strong local/regional support and leadership?			
Describe local/regional support and leadership (including energy agencies, policies, programs, etc.):			
Is there a local/regional relationship with target market/stakeholders?			
Describe existing relationships between management/leadership and market/stakeholders in target communities:			
Are there strong project management skills and experience?			
Describe management team’s experience, qualifications and skills (attach CVs if applicable):			
Supply Chain			
The pre-existence of a supply chain is critical to a successful energy program and necessary to attract financial investment. If the majority of answers to this section are “no” then a subsidy should be considered to help nurture the development of an energy industry that can ultimately become self-sustaining.			
Is there an existing supply chain for the project?			
Describe the product supply chain including manufacturers, suppliers, importers, distribution centers, labor force, etc.:			
Is there a well managed, transparent supply chain?			

ENERGY INVESTMENT CRITERIA CHECKLIST		YES	NO
Explain transparent processes, such as regular auditing, quality assurance standards, etc.:			
Can the product be brought to market?			
Describe the transport infrastructure (roads, rivers, etc.) that supports the supply chain:			
Are there service and repair centers with market accessibility?			
Describe the existing service and repair centers that will support your project:			
Proof of Concept			
Introducing a product that has had no track record of prior success is a high-risk endeavor and unlikely to attract financial support. Because pro-poor energy projects will likely attract social and environmental impact investors (like E+Co) initiatives should employ approaches to energy production using established affordable and reliable technologies. If the majority of answers to this section are “no” then a subsidy should be considered in order to nurture an untested concept. However, if the subsidy option is chosen then it is recommended that the majority of answers in the other sections of this checklist be answered “yes”.			
Has this product/concept succeeded in similar countries?			
Describe where and how has it succeeded in other countries:			
Has this product/concept succeeded in the target country?			
Describe where and how has it succeeded in this country:			
Has the product/concept team shown prior success?			

ENERGY INVESTMENT CRITERIA CHECKLIST		YES	NO
Document the team's success:			
Product Support			
If the energy program requires regulatory support or faces regulatory barriers then these must be addressed before any financing option is chosen. For the remainder of the questions in this section, if the majority of answers are "no" then a subsidy may be the best option. However, it should be noted that if a subsidy is chosen to help attract an unwilling market, then a timeframe should be developed to phase out the financial assistance over time. In addition, an energy technology should be chosen that can ultimately be affordable to consumers with the support of debt finance.			
Are the necessary regulations in place?			
Describe what regulations, if any, are necessary for the success of the project:			
Have regulatory barriers been removed?			
Describe any regulatory barriers and measures that can be taken to remove or mitigate them:			
Is there low competition (including status quo)?			
What is the competition and status quo:			
Is the market open to changing the status quo (market inertia)?			
Describe how the market is open to changing including any resistance likely to be encountered:			
Is there a plan in place to address product competition and/or resistance?			
Explain how this project will overcome competition including status quo/market inertia and any resistance:			
Is there a system to ensure consistent product quality and performance?			

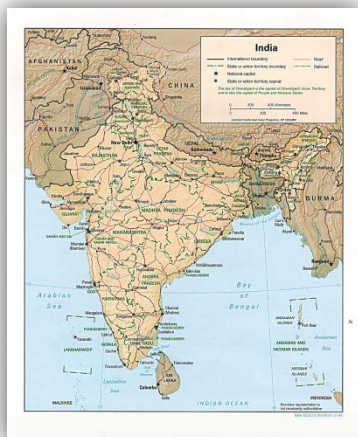
ENERGY INVESTMENT CRITERIA CHECKLIST		YES	NO
What are the established auditing/quality assurance systems:			
Market Maturity			
In this section, if the majority of answers are “no” then a subsidy may be the best option. However, it should be noted that if a subsidy is chosen to help develop a market, then a timeframe should be established to phase out the financial assistance over time. In addition, an energy technology should be chosen that can ultimately be affordable to consumers with the support of debt finance.			
Has the market been defined?			
Describe the target market by size, demographics, etc.:			
Has a communications plan been developed?			
Describe the marketing message and approach:			
Is there an existing relationship between the suppliers and consumers?			
Describe the current relationship between the product suppliers/field staff and the local consumers:			
Does the market perceive the value of the product?			
Explain how the market understands the value of the product:			
Can the market afford the product?			
Describe the price analysis that has been completed to determine product affordability (with or without subsidies):			
Does the market demand exist, or does it need to be developed?			

ENERGY INVESTMENT CRITERIA CHECKLIST		YES	NO
Describe the market research that has been completed to support the project:			
What is the timeline for implementation, and how will the development period be financed?			
Describe any education and/or training necessary to introduce the market to the project (including a timeline) and how it will be financed:			
Can the market grow?			
Describe the plan to expand your project and grow the market:			
Can the market reach financial sustainability?			
Describe how the project will achieve long term financial sustainability:			
Financing			
A healthy industry is one in which multiple financial options (loans, credit, equity, etc.) are available to support growth and success. A product that survives entirely on the support of a subsidy is not financially sustainable over the long-term. In addition, access to capital has been identified as one of the critical barriers of growth of the renewable energy industry in the developing world. In this section, if the majority of answers are “no” then a subsidy may be the best option. But again, it should be noted that if a subsidy is chosen to overcome lack of capital, then a timeframe should be established to phase out the financial assistance over time and a financial infrastructure should be developed to support access to capital.			
Are there multiple finance options?			
Describe the tools that will be used to finance the project now and in the future:			
Are there local financial systems in place?			
Describe local financial systems (banks, coops, etc.) are in place to support this project:			
Is there a transparent financial system in place?			

ENERGY INVESTMENT CRITERIA CHECKLIST		YES	NO
Describe the systems in place to guarantee financial transparency:			
Is there an auditing system in place?			
Describe the auditing systems in place:			
Sustainability			
Most renewable energy projects for poor communities will have a low rate of return. As a result, investors will often be including social and environmental impacts in their financial decisions. In this section, if the majority of answers are “no” then the initiative should be reconsidered as a viable project.			
Will the project become financially self-sustaining?			
Describe the plan for this project to become self-sustaining over time including any necessary subsidies:			
Will the project support pro-poor access to energy??			
Describe and quantify how impoverished populations will gain access to energy:			
Will the project be environmentally sustainable?			
Describe and quantify the environment benefits:			
Does the project contribute to community/national resilience?			
Describe and quantify how the project contributes to energy security, social equity, and/or political stability:			

Pro-Poor Energy: Loans

Grameen Shakti: 500,000 Solar Homes and Counting



Case Study: *Grameen Shakti*

Loan Type: *Microfinance*

Country: *Bangladesh*

About 70% of the population in Bangladesh does not have access to electricity. Grameen Shakti (GS) offers financing programs to individuals for solar home systems. Systems are primarily purchased with a 15% down payment and monthly payments for three years to cover the total cost of the system. Systems range in price from \$188 US to \$1,400 US depending on size and features. GS's solar program mainly targets those areas,

Financial Instrument

Grameen Shakti was created in 1996 as a non-profit organization under the Grameen Bank to establish renewable electricity throughout Bangladesh. Through 2010 the company has installed more than 500,000 solar systems at homes throughout the country. Shakti manages 1,159 offices staffed by 8,975 employees across the country to serve about 40,000 villages and 3.1 million people. While the total cost to manage their offices was not provided, according to Shakti, a break-even point was reached in 2002 and they now make a small profit. Their loan program is based on the finance structure of the Grameen Bank; however, energy systems (especially for electricity) are generally far more expensive than other rural products. The capital required is an order of magnitude more than normal Grameen microloans. GS started their credit program in 1996, subsidized by the Bangladesh Infrastructure Development Company (IDCOL). The subsidies are designed to diminish over time, starting at US \$90 and dropping to about US \$30 for each SHS installed. The project remains successful even as the size of subsidies has diminished.

Grameen Shakti (GS) offers financing programs to individuals for solar home systems (SHS), which can typically power 4-6 low energy lights, plus a socket for TV, radio and battery and cell phone recharging. Systems are primarily purchased with a 15% down payment and monthly payments for three years to cover the total cost of the system. Systems range in price from \$188 US to \$1,400 US depending on size and features. GS's solar program mainly targets those areas, which have no access to conventional electricity and little chance of getting connected to the grid within 5 to 10 years.

There are three financing options presented below.

- The user has to pay 15% of the total price as down payment. The remaining 85% of the total cost is to be repaid within 36 months with 6% (flat rate) service charges.
- The customer has to pay 25% of the total price as down payment. The remaining 75% of the cost is to be repaid within 24 months with 4% (flat rate) service charge.
- Micro-utility: The customer has to pay 10% of the total price as down payment. The remaining 90% of the loan amount is to be repaid by 42 checks. There is no service charge.

No collateral is required for any of the financing schemes and the recovery rate of credit is close to 90%. Grameen Shakti collects payments through their local branch offices that cover about 20 villages each.

Under the micro-utility system model, one entrepreneur installs the system at his own premise and shares the load with some of his neighbors. The owner of the system is responsible for making installment payments to GS, more than 50% of which is covered by the rents he collects from the users of his system. More than 1000 micro-utility systems are operating in the rural market places.

It took GS three years to develop a successful approach to the level of down payment and payback period. In 1996, GS started with 50% down payment and six months credit period. The penetration was low and GS determined that rural people could not afford such a high down payment. GS reduced the down payment to 25% and extended the credit period to 2 years. This increased sales but did not reach an acceptable rate of return. In 1999, GS further reduced the down payment to 15% and extended the crediting period to 3 years, which led to a breakthrough in sales.

According to Shakti, there is a strong internal audit team who audit their branch offices every six months. The auditors check everyday vouchers, clients' repayment books, bank transactions etc., and each audit activity takes about 5-7 days. The team physically visits the branch and cross checks the data. Audits have been decentralized at the divisional office level and supervised by two audit managers from the head office. About 75 officials are working with the audit department.

1996-Ongoing: Support to Develop Financial Instrument

A major expansion of solar power in Bangladesh has been underway since the late 90s, largely under the auspices of the World Bank-backed and IDCOL administered Rural Electrification and Renewable Energy Development Project (REREDP). IDCOL was established in 1997 as a non-bank financial institution by the Government of Bangladesh. IDCOL's role is to bridge the financing gap for developing medium and large-scale infrastructure and renewable energy projects in Bangladesh. In general, IDCOL financially supports partner organizations with grants and soft loans, but withdraws step by step as sales grow and market forces and demand take over.

IDCOL is a collaborative effort of partners including the Government of Bangladesh, donor agencies (including the World Bank and Global Environment Facility), partner organizations (POs) and manufacturers and suppliers. Each partner has a role:

Government: sources program funds and creates incentives (waiver of duties, tax benefit etc.)

IDCOL: provides grants and soft loans to POs to reduce SHS cost and capacity building, offers technical assistance (training, logistic and promotional supports) and monitors implementation of the program

Donor Agencies: provide grants and soft loans through IDCOL

Partner Organizations: provide technical assistance to the program, select areas and customers and install SHS, extend micro-credit to customers, and provide after sales services

Manufacturers/Suppliers: sell SHS or its components to POs

As the leading partner organization (PO) of IDCOL under REREDP, Grameen Shakti selects the project areas and potential customers, markets solar power in villages, arranges micro-credit loans and ensures the systems are installed, serviced and maintained properly. IDCOL channels grants and soft loans to GS, sets technical specifications for solar equipment, monitors partner's financial performance and helps build their capacities. The government contributes by waiving duties on

the import of key components. With a loan from the World Bank and Global Environment Fund via IDCOL, Grameen Shakti (GS) was able to increase the scale of their micro-financing agreements and lower costs to purchasers.

Grameen Shakti also maintains a unique and extensive infrastructure to facilitate the SHS loan process serving over 3 million people as described above. In order to promote their program they regularly do demonstrations and door-to-door visits, meet with village leaders and hold local science fairs. They also hold workshops for policy makers at the national level. To ensure community involvement and acceptance they train and recruit local youths as technicians, reach out to women by providing them training and opportunities to make extra income, and provide scholarships for children of SHS owners.

Results

Revenues: Since 2003 GS has been making small profit and they can cover their costs by the revenue they earn from the solar program.

Environmental Impact: By avoiding the use of kerosene lamps, each solar home system cuts household carbon emissions by around 350 - 450 kg per year, for a reduction of about 200,000 metric tons. Solar home systems also improve indoor air quality and health.

Community-Level Impact: Over 500,000 rural homes have been powered with solar systems. These systems bring renewable electricity to more than 3,000,000 people. In addition, the GS technology centers are managed mainly by women engineers, who train women as solar technicians. The women are equipped with tools to service and repair the systems in their areas, and to manufacture solar home system accessories. Seven technology centers are already in operation and there are plans to expand to 30 technology centers and to train 2000 women technicians.

Guidance for Replication

- The biggest hurdle for the SHS program is the high price of the equipment and accessories. Solar panels are imported from abroad and the government exempts vat & tax for the solar panel only. GS is paying vat and taxes for components such as batteries, charge controllers, LED lamps, cables etc.
- Batteries are produced locally, but LED lamps, charge controllers, lamp circuits etc. are being imported from abroad. If Bangladesh could produce them locally, the cost would come down significantly.
- Grid solar businesses could be expanded if the government introduced finance policies and/or subsidies to make more funding available or bring down costs.
- Determining customers' ability to pay in advance through market studies and surveys can help define affordable finance structures from the beginning of the project, avoiding costly errors.

Further Information: <http://www.gshakti.org>

Pro-Poor Energy: Loans

Loans to Promote Small Scale Production and Local Use Of Biofuels



Case Study: Gota Verde

Loan Type: Credit

Country: Honduras

The Gota Verde Project was a three-year effort to introduce jatropha as an intercrop to small farmers in Honduras to be used as feedstock for biofuel production. The biofuel would then be sold locally to reduce transportation costs, provide a local fuel source, and buffer farmers against world fuel prices while supplementing their income from other crops. The project was funded by a consortium of European and Honduran organizations that contributed about US \$490,000 to finance a credit program through March 2012 to enable farmers to purchase and plant jatropha at 0% interest. Gota Verde developed a risk sharing arrangement in which 30% of the farmer's harvest was retained for payment of loans with a maximum

Financial Instrument

Honduras imports 100% of its fossil fuel amounting to 18.7 million barrels in 2008. Fuel imports are a major drain of foreign exchange, thus reducing drastically the available purchasing power for local products. At the same time, Honduras has an enormous agricultural potential that is only partially exploited. In response the Gota Verde (Green Drop) project was launched. The general objective of the Gota Verde project was to demonstrate the economic and technical feasibility of using jatropha as an intercrop to fuel small-scale biofuel production for local use. Specifically, the project aimed at removing the technical and organizational barriers that impeded the biofuel production chain from taking off in the Yoro region, one of the most impoverished areas of the country. Barriers included: lack of technical knowledge (at the level of farmer, processing enterprise and end-user), lack of an organizational structure, lack of markets and lack of access to capital.

The Gota Verde project was established in 2006 by a consortium of seven European and two Honduran organizations, coordinated by the Social Trade Organisation (STRO, The Netherlands). The other members of the consortium were: AGERATEC (Sweden), Dajolka (Denmark), FACT Foundation (The Netherlands), Humanistic Institute for Development Cooperation (HIVOS, Netherlands), Institute for European Environmental Policy (IEEP, United Kingdom), Executive Agency for Competitiveness & Innovation (EACI, European Union), Foundation for Rural Enterprise Development (FUNDER, Honduras), and Fundación Hondureña de Investigación Agrícola (FHIA, Honduras). Approximately US \$2,006,400 was invested in the project for technical assistance, of this US \$735,680 was contributed by the EACI, US \$815,936 by the Dutch NGO HIVOS, and US \$300,960 by the Dutch Foundation DOEN. The other organizations provided in-kind contributions such as technical training and support.

In 2008, the biofuel processing and marketing company BYSA was established to produce and sell the jatropha-based biofuel with 62 founding member farmers. By the end of 2009, the enterprise had grown to 197 shareholders: 196 local Jatropha farmers (13% female) and FUNDER. Total capital, contributed by shareholders was about US \$10,000. FUNDER holds 51% of the shares, while the farmers hold the remainder. FUNDER's share will be sold back to farmers once BYSA has become a self-sustainable enterprise (expected after 2012). Statutes prohibit one farmer from holding more than 5% of the total share value of the enterprise so that the financially strongest farmers cannot dominate the decision making process of the company.

Approximately US \$168,000 was provided in the form of loans to 416 farmers through 2009. Most of the loans (78%) were for the purchase of Jatropha and were long-term (jatropha takes 5-7 years to mature) and at 0% interest. The remainder were for short cycle intercrops such as beans or corn to help support food security. Non-jatropha loans carried a 9% interest rate (the 9% rate was set to account for an expected 6% rate of inflation, 2% for administrative costs, and 1% for expected defaults). The average loan amounted to about US \$400 and terms varied based on use: for short cycle crops loans were expected to be paid back within a year, for irrigation systems, three years and for longer term jatropha plots, seven years. For jatropha loans, farmers were expected to begin repayment after two years, however loan payment could never be greater than 30% of total income received by the producer annually from the sale of its production to the BYSA processing plant. Farmers are expected to sell their entire production to the BYSA processing plant until they have repaid the loan. The first jatropha loans are not expected to be completely paid back until 2013.

The loans are administered by FUNDER through BYSA. Initial attempt to process loans through the local banks proved unsuccessful because the costs were too high. Therefore BYSA manages its loans internally and many of the transactions occur without an actual exchange of money. BYSA gives agricultural inputs or provides ploughing services to farmers; and farmers hand over their harvest to BYSA for processing and marketing. Repayments to farmers take place mainly in produce, but also sometimes as deposits to their BYSA account.

BYSA has also created a voucher system that serves as a local currency. The vouchers have a value printed on them, are accepted by over 30 businesses in the Yoro region and are used as payment to BYSA suppliers including the farmers. BYSA also accepts the vouchers in exchange for its products (e.g. biofuel) and as a re-payment of loans. This way, BYSA can increase its working capital and sales, reduces the risks of theft and assaults, and promotes itself within the Yoro region.

Auditing Procedures:

FUNDER is responsible for screening beneficiaries, receiving applications, analysis and monitoring of loans. The process of approval or denial of applications is the responsibility of a loan review committee. Periodic visits to farmers are carried out to verify that the loan is being used as intended and monthly reports on the overall loan portfolio are prepared. The reports include: amount in the portfolio, and number of producers with funding by geographical area and type of project. Loan delinquency projections are also prepared on a regular basis. Corrective actions have been developed to recover any balance due. Before a loan is made, growing areas will be selected by the technical team according to location and technical and financial viability for investment return.

2006-ongoing: Support to Develop Financial Instrument

In 2003 and 2004, research, sponsored in part by the Netherlands, was conducted to determine the possibility of using biodiesel or pure oil as a substitute for diesel in Honduras. This experiment proved successful and so in 2006, the Holland NGO STRO, jointly with FUNDER initiated the "Proyecto Gota Verde" (Green Drop Project). This effort was strengthened by the fact that Honduras is the only Central America country that has a law and a regulation for both biofuel and ethanol production. The law provides exemptions from customs tariffs, income tax, and other related taxes for 12 years. "The Law for the Production and Consumption of Biofuels" was passed in November 2007 and provided incentives for the Gota Verde project.

In addition, building a biofuel supply chain requires multiple technical capabilities and since biofuel was a completely new concept, capacity had to be built from the ground up. In order for this project to succeed, initial capacity building included agricultural training and advice, biofuels production and engine adaptation training, and business and management

guidance to help farmers create a shareholder structure, prepare business plans, and do cost calculations for different crops and transformed end-products.

Results

Revenues:

FUNDER anticipated that initial loans would start to be repaid by 2008 from jatropha planted in 2006, creating a revolving loan fund that would generate new investments. This in turn was expected to increase the willingness of financial institutions to invest in the crop, however, jatropha harvests in 2008 were minimal and the low oil prices in combination with the worldwide financial crisis meant that financial institutions were (and still are) very reluctant to invest in crops that do not have a proven track record. In order to continue the project, FUNDER secured additional investment funds, approximately \$239,000 for technical assistance and \$322,000 for the credit scheme, from three new partners: TechnoServe, Fundación Cosecha Sostenible (FUCOHSO) and the Ministry of Agriculture in 2009. This additional funding will be depleted by March 2012.

As of 2012, the project has yet to generate profit or revenue.

Environmental Impact:

While the overall impact has not been assessed, the program is replacing fossil fuel consumption with biofuels in the local market. The Yoro area currently depends on external supplies of large quantities of fuel, electricity, and concentrates for livestock and petroleum-based fertilizers. BYSA is expected to replace part of this demand with local biofuel product. Jatropha hedges also enable farmers to reduce pesticide use: jatropha is a repellent and works also as a natural pest barrier.

Community-Level Impact:

The project helps to ensure food self-sufficiency for farmers by establishing jatropha as an intercrop. By selling jatropha to BYSA, farmers are better able to supplement their income. BYSA also provides affordable access to credit for both food crops and jatropha. This was not available before the project.

The project created a new industry in the Yoro area and educated community members on biofuels processing and engine adaptation. The development of the voucher system has created a local trade network based on a local currency.

Guidance for Replication

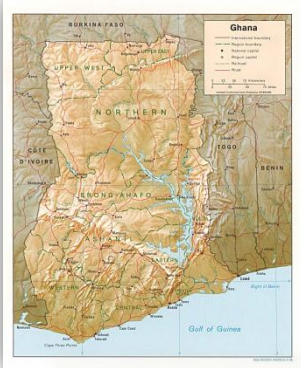
- The unclear stand of the Honduran government on its biofuel policy has not been helpful. The law requires an obligatory mix of biofuel and diesel but the percentage is revised each year. This has frightened off investors. If the government adopted a law that enforced biofuel blends with diesel (5%, 10% biodiesel), a viable market would be created.
- Small-scale biofuel processing enterprises (as well as large ones) face a highly volatile petroleum market. Highly profitable enterprises may go bankrupt within months because of these dramatic changes in international fuel prices. Small enterprises are more vulnerable to this market instability, due to the fact that they generate less economies of scale. Thus, deepening the production chain by creating multiple sub-products (soap, biogas, fertilizers, etc.) can reduce that vulnerability and attract investors.
- The creation of a fully sustainable biofuel chain, based on Jatropha, takes at least 5 to 7 years. Projects promoting Jatropha as a new cash crop among small farmers should include sufficient investment funds for farmers to establish plantations and maintain them during the first 4 to 5 years.

- The 5-7 year timeframe is beyond the time horizon of many investors, let alone subsistence farmers. Investors are reluctant to enter into biofuels based on jatropha production because of the lack of knowledge on how this plant behaves in the long run under different circumstances.
- The investment fund is gradually becoming empty because farmers need loans to maintain their plantations, while income is still very small. If not planned well, this may result in abandonment of the plantations, just before they become productive.
- Even if the project proves successful in generating a revolving loan fund, it is still unlikely that the conventional financial sector will express interest until commercial viability has been proven (possibly after year 5).
- A viable biofuel finance system should take into account the multicrop production reality of small farmers. Jatropha should not be seen as a monocrop, but as an intercrop. This requires multiple parallel financing schemes.
- Once jatropha is mature, new agricultural finance mechanisms can become possible. For example BYSA can give a loan for corn to a jatropha producer, which is guaranteed by the future Jatropha production. Even if the corn harvest fails, the loan will be repaid by the jatropha production (which is more stable than short-cycle crops). In addition, based on a historically stable jatropha production, BYSA could in the future attract loans as an enterprise and redistribute the loans to farmers. By negotiating better terms than individual farmers, BYSA can generate a margin and reduce finance costs for farmers.

Further Information: <http://www.gotaverde.org>

Pro-Poor Energy: Loans

Achieving the 4 “E”S: Energy, Efficiency, Employment And Environmental Protection



Case Study: *Toyola Fuel Efficient Cookstoves*

Loan Type: *Credit*

Country: *Ghana*

Toyola Energy manufactures and sells energy efficient cook stoves in urban and rural Ghana. The stoves use charcoal but are 40% more efficient than the traditional stoves used in the country. Due to a reduced amount of charcoal needed, users save money and reduce carbon dioxide emissions, also lowering indoor air pollution of the home environment for better health. About 75% of recipients buy on credit at about a 20% - 30% mark-up over the cash price, one third using the Toyola money box, a small container similar to a coin bank, which Toyola distributes to its customers. In five years of operation, the company estimates that it has sold about 160,000 cookstoves in Ghana and offsetting 150,000 tons of carbon dioxide emissions per year.

Financial Instrument

Ghana is the largest per capita consumer of charcoal in West Africa and as a result, Ghana's forested areas are disappearing at an unsustainable rate of approximately 3% per year. In Ghana, around 30% of households rely on charcoal for cooking and 55% use firewood. While cooking with charcoal is the most affordable energy option, it contributes significantly to carbon dioxide emissions and indoor air pollution. In response, Toyola manufactures and distributes improved efficiency charcoal cookstoves using locally available materials (scrap metal and fired clay liners). These stoves reduce the amount of charcoal needed for cooking by around 35% resulting in significant household savings, and can offset approximately a ton of carbon dioxide equivalent per year. Toyola based their cookstove concept and business plan on another Ghanaian cookstove project – the Gyapa/Enterprise Works program.

Toyola, which has more than 200 workers, has a decentralized operation. It makes stoves in five locations in Ghana and one in nearby Togo; its "stores" are trucks, driven by independent agents that sell and deliver cookstoves. The stoves, which cost about \$7 to \$10 to manufacture, are sold at just above cost. In order to determine the appropriate price point, Toyola conducted informal surveys through traditional village channels and community markets using local agents to speak with target consumers. They also looked at what was currently being paid for standard, inefficient cookstoves plus fuel expenses.

Toyola Credit Scheme

About 75% of recipients buy on credit at about a 20% - 30% mark-up over the cash price, one third using the Toyola money box, a small container similar to a coin bank, which Toyola distributes to its customers. The mark-up is determined by the independent sales agent based on the operational costs to collect payments, period of credit and distances he or she has to travel to make collections for credit sales. Those who buy the cookstove on credit, place their savings derived from reduced charcoal purchases in the money box until they have saved enough to pay Toyola. Based on projected savings from fuel efficiency, Toyola expects a payback period of about two to three months. The payback is in installments or at once depending on customers' preference and patterns of individual or household cash flow. The period is determined from estimated fuel saving that can be used to pay for the stoves, and discussions and agreement with customers. Payments are made to Toyola retailers and agents who are provided with bookkeeping training and support.

According to Suraj Wahab of Toyola Energy, "We know our customers can afford the stoves without any extra capital outlay because they already spend more than these amounts on inefficient stoves and fuel. We know the payback period of our stoves is two to three months in fuel savings. We demonstrate the stove and show customers they can afford it from fuel saving through the use of the "Toyola Money Box" whereby fuel savings pay for the stoves." Toyola does not require collateral but there is an understanding that stoves can be repossessed for nonpayment. However, they "hardly ever need to exercise this option [because of] social pressure at the community level [which] can lead to stigmatization" if customers default. As a result, delinquency rates are at less than 5%.

Finally, in order to sustain an affordable credit scheme and increase production, Toyola introduced specialization into the cookstove value chain. Rather than each independent cookstove artisan being responsible for the entire product, manufacturers specialize on a specific part of the stove, which increased productivity from five stoves per person per day to 30. In addition, each manufacturer works as a self-employed entrepreneur, which provides incentives to produce larger quantities since if they produce more they get paid more. Toyola also pre-finances its vendors so that they have minimal risk and avoid upfront costs while Toyola can easily expand its sales force.

2006-Ongoing: Support to Develop Financial Instrument

In 2002, USAID in partnership with Shell Foundation and EnterpriseWorks, an international NGO, provided training in the production of the stoves to 78 local artisans. As a result of this training two of the trainees, Mr. Suraj Wahab and Mr. Ernest Kyei, created Toyola. In early 2006, the new entrepreneurs went to the Kumasi Institute of Technology and Environment (KITE) a nonprofit organization based in Ghana, for assistance with the preparation of their business plan to secure a loan for their new company. E+Co (a company that makes clean energy investments in developing countries) also assisted in the development of Toyola's business plan. The plan included a strategy to develop a mobile stove delivery system and E+Co invested US\$70,000 for the purchase of a truck and supplies. The business expanded rapidly, selling 20,000 stoves in the first year (2008). As a result, E+Co is working with the entrepreneurs to further expand production and distribution and has made two additional loans to Toyola each in the amount of US\$100,000.

Moving forward, in order to keep costs affordable as the price of raw materials inevitably increase, Toyola, with the support of E+Co, has begun to sell credits on the voluntary carbon market. E+Co estimates the useful life of the stove to be three years, and that each year the stoves reduce about 0.8 tons of greenhouse gases. That means, depending on the price of carbon, that each stove generates more than \$20 of carbon value. Once Goldman Sachs purchases its first batch of offsets from E+Co—likely in the first quarter of 2010—every stove owner will receive a rebate, which means they've ultimately spent less than the stove costs to make. As the project continues, the rebate scheme will be eliminated and the stove price will simply drop, as each stove's carbon value outweighs the cost of manufacture. "If you have the right financial mechanisms in place, you can drop the price as low as you want and still make money," says Erik Wurster, carbon finance manager for E+Co.

Results

Revenues: Toyola Energy Limited is a for-profit business, founded in 2006 by Suraj Wahab Olugburo and Ernest Kwasi Kyei. It has a 90% shareholding in KT ceramics that makes stove liners, and a wholly-owned subsidiary, Toyola Solar, that sells PV systems. In 2009/10 Toyola Energy had an income of US\$550,000 (72% sales and 28% carbon finance) and five staff.

Environmental Impact: The Toyola stoves currently in use are saving about 26,000 tons of charcoal each year, which reduces the use of wood to make charcoal. Currently, about 73% of the wood used in Ghana to make charcoal and directly as fuelwood is non-renewable (i.e.: not replaced by new trees). This means that saving charcoal and fuelwood by using the Toyola stoves helps to reduce deforestation. Charcoal and fuelwood savings also cuts greenhouse gas emissions. Detailed assessments show that a cookstove in use for one year in Ghana saves the equivalent of 1.03 tons of CO₂. 84% of this is actual CO₂, produced because of the use of non-renewable wood. Most of the remainder is methane emitted during charcoal production. Thus the stoves currently in use are saving about 150,000 tons/year of CO₂e.

Community-Level Impact: User surveys show that food cooks more quickly: women save about 30 minutes per day, which they use mainly for family time and relaxation. The heat retention of the liner means that food keeps warm for longer, and the insulated stove base can be used like an oven for roasting vegetables while a pot cooks on the top. The insulation that helps cut fuel use also reduces the temperature of the outside of the stove. Burns are reduced by over 90% and the person cooking does not get so hot. Health surveys show reduced incidence of eye irritation, shortage of breath and coughing.

Benefits: Toyola Energy has grown rapidly since it started selling stoves in 2007, but demand for stoves in Ghana outstrips supply. To meet this demand, Toyola is planning to open new production centers in other parts of Ghana.

Guidance for Replication

- The technology is not difficult for others to replicate. However, to reach large numbers of users requires the type of quality control systems and sales and finance network that Toyola has built up.
- While Toyola has managed to grow, they and their workforce are severely constrained by access to capital, which limits their ability to provide credit. According to Suraj Wahab of Toyola Energy, they need more financial resources to offer credit to more customers. Toyola also finds it difficult to finance their self employed artisans that are contracted to produce the Toyola stoves. Currently Toyola funds their raw material purchases because they cannot attract loans from local banks.
- Even though 76 artisans were trained by the USAID/Shell/EnterpriseWorks program in 2002 (which included an extensive marketing campaign, and rigorous scientific testing of the stoves' benefits), the program did not offer business training or access to finance. It wasn't until 2006, with the financial support of E+Co and KITE that Toyola was born.
- Very early on, Toyola introduced specialization to the value chain and sub-contracted manufacturing to the informal sector artisans, purchasing from them on a piece basis. It applied this same idea to delivery truck drivers, making them responsible for their own gas and maintenance while paying an output-based fee. As a result they were able to reduce their overhead, keep costs down and provide work incentives to their independent artisans.

Further Information: www.eandco.net/

Pro-Poor Energy: Loans

“Business in a Box” Thinks Out of the Box to Provide Solar to Rural Poor



Case Study: *ToughStuff Solar*

Loan Type: *Installments/Layaway*

Country: *Kenya*

The founders of ToughStuff recognized that a very small solar photovoltaic (PV) module could power a range of useful products including LED lamps and mobile phones, and that by selling modules and products as individual items, they could be made more affordable for off-grid households, both rural and urban. ToughStuff uses a variety of financial tools including credit, layaway and a merry-go-round scheme in which a group buys a kit upfront and uses savings realized from the initial purchase to buy additional solar kits for other members of the group. Costing about US \$9.00, ToughStuff has sold approximately 140,000 PV modules in Kenya. Its innovative ‘Business in a Box’ partnership with NGOs and microfinance groups helps to set up rural entrepreneurs, to sell products, charge phones or rent lamps.

Financial Instrument

ToughStuff International is a socially-driven enterprise selling a modular range of low-cost solar products for off-grid customers across Africa. ToughStuff's mission is to bring affordable energy products to people without access to electricity thereby helping to increase living standards, improve health, enhance the environment, and build enterprise and employment. ToughStuff has developed a modular range of affordable solar powered energy solutions to the three main power needs of poor consumers in the developing world – lighting, mobile phones and radios.

Prices vary between countries because of different duties and distribution costs. For Kenya, current retail prices are:

- PV module US\$9.30
- Lamp US\$7.60
- Phone connector US\$1.20
- Radio connector US\$2.80
- Power Pack US\$8.00

ToughStuff started their efforts in Madagascar in 2008, where they experimented with community groups buying solar kits upfront for a certain number of the members and with the savings they realized more kits were purchased until each

member of the group had a kit. This “merry-go-round” approach to financing was introduced to Kenya along with various group finance options including layaway and installment plans. In the installment plan, customers receive the solar product upfront while with the layaway option, they must wait until they have set aside funding in full before they can take home their solar kit. In both cases, group leaders are in charge of taking payment from the members and paying ToughStuff distributors when the kit is delivered. ToughStuff is investigating the possibility of mobile payments but they have ran into difficulties since customers want to “see” who they are paying and don’t trust a mobile system. In general, layaway usually takes about three months while the installment plan is variable and depends on the customer’s ability to pay but is generally around 2 – 3 months. There is no interest collected on either finance plan.

ToughStuff does not offer credit, however it works with Financial Service Associations (FSA) in Kenya to help rural customers secure microfinance. FSAs are microfinance institutions that provide a range of financial services including loans to poor and low income households. Also known as village banks, they use equity financing from shareholders to encourage local capacity development and ownership. (Africa Platform, 2008) FSAs work with local ToughStuff entrepreneurs to help them extend credit to customers. However, unlike ToughStuff layaway or installment plans, FSAs charge some interest.

ToughStuff keeps their own costs low by working through local NGOs and finance institutions, and requires a strong distribution infrastructure and reach before it will begin working with local entrepreneurs. Once they have established partners on the ground and have identified their market, ToughStuff provides their products, working capital, product and sales training and marketing support to local entrepreneurs. This ‘Business in a Box’ partnership links NGOs and microfinance groups with rural entrepreneurs in remote areas, to sell products, charge phones or rent lamps under a variety of finance schemes as discussed above.

2008-Ongoing: Support to Develop Financial Instrument

To start their business, ToughStuff received an initial seed investment in the form of a loan. Market research, product development and piloting started in Madagascar in 2008, and the commercial products were launched there in 2009. ToughStuff has 50 full time employees, and teams of local sales agents. Recent equity investment will enable future expansion to Indonesia, Malawi, Ghana, and Ethiopia just to name a few.

In each country where it works, ToughStuff sets up a traditional sales structure, with distributors and wholesalers providing stock to retailers that range from supermarkets to small rural stores. Currently the main countries of operation are Madagascar and Kenya. All products are manufactured in China to ToughStuff specifications, with a local ToughStuff office responsible for quality checks and shipping to national distribution partners. Promotional campaigns are undertaken in the target areas of each country of operation, using radio, TV, posters and flyers. Local sales agents work in each area to encourage retailers to stock ToughStuff products, and to build business for retailers and rural entrepreneurs. Product demonstrations are undertaken both during the day and at night, so that people can handle products and see their benefits first hand. Once the traditional distribution system is in place, the company starts to build its own ‘alternative’ distribution networks to extend the reach of products into more remote areas, often partnering with NGOs and microfinance institutions (MFIs). This may involve working with savings and credit groups, or providing the working capital to establish rural entrepreneurs. (Ashden, 2011)

Results

Revenues: In 2010 ToughStuff had an income of about US\$2.4m, mainly from sales. In addition, ToughStuff products typically retail for around \$10 or less and have payback times of just 2-3 months. For the life of the product, customers benefit from free energy, saving around \$100 per year. Selling ToughStuff products also creates local employment.

Environmental Impact: Each ToughStuff lamp replaces one kerosene lamp, which saves about 24 litres of kerosene per year. As a result, lamps in use at the end of March 2011 are avoiding the emission of about 8,800 tons/year of CO₂. By avoiding the use of kerosene for lighting, ToughStuff lamps also reduce the risk of house fires, and cut air pollution with its associated health impacts.

Community-Level Impact: The LED lamps allow children to work on their homework after dark, and light indoors and outdoors increases safety and security. Kerosene and phone charging use a significant proportion of household income, in rural Kenya the wage for a laborer is about US\$1.20 per day, so the savings from using ToughStuff products are very important. ToughStuff has directly provided employment to 50 full time staff and 53 local sales agents. It has also helped about 250 rural entrepreneurs to start businesses, selling products, renting lights, or charging phones. Entrepreneurs earn around 25% of the retail price of products. Improved light provides extended hours for home-based work, and the opportunity to increase income. Informal provision of phone-charging also increases income and keeps money in the rural economy.

Guidance for Replication

- Establishing partnerships with local financial institutions provides flexibility to the product finance options. This is critical to establishing affordability for poor rural consumers.
- Providing startup capital to rural entrepreneurs allows them to provide finance options (i.e., layaway, installments) to their customers.
- Equity investment is essential to solar market development. ToughStuff has recently secured substantial investment from a major European development finance institution and continues to work with commercial and non-profit partners to replicate its model.
- Affordability at all levels of the distribution chain remains a barrier to expansion.

Further Information: www.toughstuffonline.com

Pro-Poor Energy: Loans

Village Energy Committees Bring Light to Laotian Rural Communities



Case Study: *Sunlabob*

Loan Type: *Rent*

Country: *Laos*

The financial system in Laos makes it very difficult for individuals in remote areas to take out loans. Sunlabob Ltd. set up a rental programme for users of solar home systems (SHS). The rental approach allowed Sunlabob to retain control of quality, maintenance and training – factors that have not always been managed well in other programmes to supply solar systems in Laos. The rental programme was runs on a commercial basis, so the rent covered all capital and maintenance costs. However, monthly payments were unreliable and the Sunlabob SHS was undercut by a heavily subsidized World Bank SHS, and so the Sunlabob program was phased out in favor of renting solar lanterns instead.

Financial Instrument

Laos is a poor country and although 48% of the population has access to grid electricity, this is concentrated in cities and towns. Outside urban areas, most people use kerosene lamps and firebrands for lighting in their homes, with the associated risks from burns, fire and air pollution. In response, Sunlabob Renewable Energy Limited, a for-profit solar energy company, introduced affordable solar-home-systems (SHS) in 2003 that were rented at prices starting lower than the cost of kerosene for lighting.

Sunlabob developed their rental scheme from their own research and experience which showed that only around 5-10% of households of a typically remote Lao village could afford to raise the capital to buy a solar home system unless the costs could be spread over at least 10 years. However, the financial system in Laos makes it very difficult for individuals in remote areas to take out loans so Sunlabob set up a rental program for users of SHS. The rental approach meant that Sunlabob retained control of quality, maintenance and training and the rent covered all capital and maintenance costs.

The cheapest SHS, rated at 20 Wp, cost US \$2.71 per month to rent, while a 100 Wp system cost US \$12.41 per month. Households typically spent between \$2.80 to \$4.65 per month on kerosene for lighting, so that if they chose a small solar PV

system just to provide lighting, they would save money in comparison. Prices were raised gradually over time to reflect increased costs.

Rental System

The rental system was structured so that Sunlabob did not rent equipment directly to the end users; instead it required each participating community to set up a Village Energy Committee (VEC), to whom it rented the solar equipment. The community selected the members of the VEC, and the VEC rented the equipment to individual households. Users were not allowed to be charged for evenings when their rented system did not provide light, so there was a real incentive for the VEC to manage systems well. The VECs usually set up local franchises that were responsible for the physical installation and maintenance of the equipment. Each franchise was an independent business, usually based around a family. The franchises trained local technicians in the villages, but the technicians were paid and managed by the VEC.

The VEC was responsible for collecting payment from households. Local management of payments allowed the VEC to be flexible if someone could not pay due to temporary problems with their finances. Late payment and defaults were rare, since customers knew that by not paying the company they were letting the whole community down.

Undercut Product and Unreliable Revenue

While Sunlabob spent over three years understanding the needs of their consumers before launching the SHS business, they could not improve upon the erratic nature of villager's monthly incomes (largely reliant on agriculture) and so could not rely on steady revenue streams from their rental services. At the same time, in 2006, the World Bank introduced a rural electrification program, which included highly subsidized solar home systems that could be rent-to-owned. For example, for a World Bank subsidized 20 Wp SHS end users pay US \$1.6 per month, while Sunlabob customers would pay US \$2.71 per month to rent the same system. As a result, Sunlabob phased out their SHS rental program and introduced a new Solar Lantern Rental System (SLRS) in 2011 to its rural customers.

2008-Ongoing: Support to Develop Financial Instrument

Sunlabob was established as a registered Lao for profit-company in 2000 with an initial investment of US \$500,000. Sunlabob then conducted a pilot project to verify operational and financial mechanisms for a rental service. This small pilot "proof of concept" was well received by villagers and service providers, and the demand for their rental systems increased rapidly. According to Sunlabob, the reliable short-distance servicing, combined with the operational role for a village energy committee (trained by Sunlabob) were the crucial factors for their initial success.

The process by which Sunlabob contacts a village, sets up the VEC, and interacts with the VEC and the franchisees has been developed very carefully, to provide a quality service at low cost. Before starting work in a village, Sunlabob gains support from both village and district authorities, and spends time in the village explaining how solar systems work, what the rental charge will be, and what the VEC does. A demonstration system is installed in the village to show what services it can provide, since most villagers have never heard about SHS.

The concept of a Village Energy Committee replicates the existing governance infrastructure. The country is administratively divided into provinces, districts, and villages. Central government is represented at each level. At the village level, there are three representatives of the state in each community: a village chief, a representative of the Lao Women's Union, and a representative of the Lao People's Revolutionary Youth Union; all three representatives are elected by their community.

Communal matters are generally decided upon by a committee, which lends itself well to the creation of a village energy committee. The three figures of authority at village level are the representation of the state and act on behalf of the central government, channeled through province and district offices. Their authority is recognized by the community, and hence by including at least these three people in a village energy committee, Sunlabob ensures good governance of a village service. In addition, villages normally designate one person out of these three to be responsible for and arrange support for the poorest households of the community.

In addition, Sunlabob helped to set up the Lao Institute of Renewable Energy (LIRE) to carry out research and policy work that would not be appropriate or possible for a single company to pursue, and to be an independent voice for renewable energy in the country. It also works closely with the government, in order to target the rental program at areas least likely to get a connection to the electricity grid. Sunlabob constantly receives technical and policy support from LIRE.

Every piece of rental equipment has a unique serial number, and the company can track any individual item to an end-user. Sunlabob maintains an office in Vientiane, where there is also a workshop for the assembly and testing of equipment. Sunlabob currently employs 34 people and recruits technical staff from the Lao National University.

Results

Revenues: Sunlabob was not able to realize consistent revenue from its SHS and concluded that their operations were not commercially viable. In addition, rental services require large upfront investment, and because the rates were so low, an adequate return and profit were slow in coming. To supplement these longer term revenue streams, Sunlabob operates a number of different programs including direct sale of SHS equipment (panels, wires, charge controllers, battery, switches, inverters etc.) for the World Bank's Rural Electrification Program. In addition, they also sell rechargeable solar lanterns and charging stations to USAID in Afghanistan

Environmental Impact: The replacement of kerosene lamps with solar PV lighting in homes brings a range of benefits, including a reduced risk of burns and fires, improved air quality and better quality light.

Community-Level Impact: Sunlabob installed more than 5000 SHSs (500 system/ year) in off-grid areas of Lao PDR. The improved light is especially useful for children doing their homework – a Lao government study into rural electrification indicated that children with electric light at home performed better in exams than those without.

Guidance for Replication

- Renting Solar Home Systems (SHS) to rural households was Sunlabob's first rural electrification initiative. It was however soon realized that, even on a rental basis, only the top third of village households could afford the systems.
- Secondly, systems and services needed to be carefully adapted to existing consumer behavior. For the SHS, money was collected by the franchisee from the end-users on a monthly basis. This turned out to be difficult, as most rural households, on the one hand, do not have regular monthly incomes (largely depending on agricultural output) and on the other, are not used to putting money aside on a monthly basis for their expenses. These factors led to Sunlabob winding up its SHS initiative and paved the way for Sunlabob to develop the Solar Lantern Rental System (SLRS).
- The SHS experience taught Sunlabob several important lessons including the importance of involving local individuals, loyal and empowered, in a local distribution network, which plays an important role of developing new business, collections and maintaining presence at the provincial level.
- The SHS project also gave Sunlabob its first experience with forming and training Village Energy Committees. However, it became evident that training energy committees, though crucial for sustainability, is not a commercially-viable activity, hence the need to involve other sources of funding for some of the project components.

Further Information: <http://www.sunlabob.com/>

Pro-Poor Energy: Loans/Subsidy

Subsidizing Solar Hot Water Systems to Stimulate an Industry



Case Study:	PROSOL
Loan Type:	Bank Loan
Subsidy Type:	Grant
Country:	Tunisia

PROSOL was a two-year project designed to stimulate the solar industry in Tunisia by providing commercial loans through participating banks, discounted interest rates and a capital cost subsidy on solar water heaters. In less than one year, sales reached a record figure of 7,400 solar water heating systems and by year two an additional 11,000 units were sold. Banks granted loans for more than US \$4.1 million in 2005 and US \$6.2 million in 2006.

Financial Instrument

PROSOL (Programme Solaire) was a 2-year project to revitalize the declining Tunisian solar water heater (SWH) market in Tunisia. The project had a total budget of US \$2.3 million, donated by the Italian Ministry for the Environment, Land and Sea. The project was initiated in 2005 by the Tunisian Minister for Industry, Energy and Small and Medium Enterprises and the National Agency for Energy Conservation (ANME), with the support of the UNEP-MEDREP Finance Initiative. PROSOL actively involved the finance sector, turning it into a key actor for the promotion of clean energy and sustainable development. Since then, by identifying new lending opportunities, banks have started building dedicated loan portfolios, thus helping to shift the SWH market from a cash-based to a credit-based. The main features of the PROSOL financing scheme were:

- A commercial loan mechanism for domestic customers to purchase solar water heaters
- A capital cost subsidy provided by the Tunisian government, up to US \$277 depending on the size of the SWH, and
- Discounted interest rates on the loans (starting at 0%, raised to 4% and phased out at 7%), progressively phased out.

Besides UNEP and ANME, key partners included:

- The Société Tunisienne de Banque (STB)
- Two commercial banks (UBCI and Amen bank)
- The State electricity utility STEG (Société Tunisienne d'Electricité et du Gaz)
- Manufacturers, importers and installers of solar water heaters

- Local consultants

In the PROSOL scheme, SWH loans were driven by suppliers, who acted as indirect lenders to their customers. The process began when a customer decided to purchase a solar water heater from an accredited supplier. The SWH supplier submitted a loan application to a participating Tunisian bank that qualified the customer's ability to repay the loan. Once the bank approved the loan to the supplier, the solar water heater was installed at the customer's home. The only upfront payments for the customer were for the administrative costs. After the installation, the supplier received:

- The subsidy payment from ANME of US \$138 for a 200-litre system or US \$277 for a 300-litre unit, and
- A payment from the bank of US \$519 for the 200-litre solar water heater, or US \$657 for the 300-litre system.

The customer repaid the loan on a pro-rata basis over a five-year term, through their electricity bills issued bi-monthly by STEG. The engagement of STEG in recovering the loan payments through its electricity bills provided enough guarantees to banks to extend the loan terms to five years and lower the interest rates from the standard 14% to 7%. Through the funding provided by the Italian Government, UNEP also provided a 7% interest buydown for loans disbursed in the first 12 month and 3% for subsequent loans. This meant the rate initially charged to customers was 0% and after 12 months 4%. After the two year pilot period, the interest subsidy was phased out completely.

Within this scheme, banks did not have any direct contact with the customer - the final beneficiary of the loan. They worked instead with SWH suppliers who were responsible for loan repayments. The consumer could not easily default because the loan debt was recovered through the customer's electricity bill. However, if the customer did not pay their bill, banks could take action against the solar water heater suppliers that were granted the loan. At the same time, STEG suspended the electricity supply to the customer.

The amount paid back through the electricity bill was calculated so that it remained lower than the savings on electricity made by using SWH. Over 18,000 SWH systems were installed by 2007.

Auditing Procedures:

The transparency of the system was guaranteed by independent third party evaluation. At the beginning of 2007, PROSOL was audited by KPMG. In addition, only suppliers accredited by ANME could operate within PROSOL and their SWH products were required to meet a series of technical requirements and performance standards.

2008-Ongoing: Support to Develop Financial Instrument

Solar thermal has been repeatedly proposed as a solution to lower the country dependency from imported fossil fuel sources. The first solar thermal energy strategy was developed by the Tunisian government in the 1980s. But only in the period 1997-2001 was a real market and technology infrastructure developed, through a project financed by the Global Environment Facility (GEF) and the Belgian Cooperation. The support mechanism was based on a 35% capital cost subsidy. At the end of the period, 50,000 new solar thermal panels were installed, and eight suppliers (three of which were manufacturers) and over 130 installers were operating in the market, for a total of 260 new jobs created. However, as soon as project funds expired solar water heater sales dropped again.

For the PROSOL project the engagement of commercial banks proved critical, as did an extensive advertising campaign. In order to give visibility to the project, inform customers on the advantages of the financial mechanism and encourage the purchase of solar water heaters, a comprehensive communication plan was developed at the national level and promoted through TV, radio, posters and brochures. Moreover, a Training Support Facility was established to build capacity amongst commercial lenders and expand their confidence in and understanding of renewable energy technologies.

Results

Revenues: In less than one year, sales reached a record figure of 7,400 solar water heating systems and by year two an additional 11,000 units were sold. Banks granted loans for more than US \$4.1 million in 2005 and US \$6.2 million in 2006. In addition, by 2007 the Tunisian Government passed a new law that would provide a 20% capital cost subsidy on all new solar water heating installations. The subsidy is funded through a tax on new license plates and provided further stimulus to the

development of the SWH market. The law also exempted SWH from VAT and decreased custom duties, which helped create a more level playing field with conventional energy sources.

Environmental Impact: Over its life, each SWH in Tunisia avoids 7.5 ton of CO₂, which is equivalent to about five years of a typical car emissions. If government targets are met, by 2001 136,000 tons of CO₂ will be displaced every year, which could be worth about US \$2 million. As of 2010 there have been over 90,000 SWH installations, equivalent to over 500,000 tons of CO₂ avoided.

Community-Level Impact: The PROSOL program provided the necessary stimulus for the creation of new business and jobs and helped the growth of and financial flows to the solar industry. By 2008, Tunisia had five SWH manufacturers, 212 suppliers and over 550 installers.

Guidance for Replication

- Because the SWH suppliers were responsible for the loans, their level of exposure was too high and their success was often measured by his level of indebtedness. This process was implemented because banks neither had enough confidence in the solar thermal market or its customers. After the success of PROSOL, the banks now issue grants directly to the customers, who in turn pay the suppliers.
- An audit of half of the solar thermal surface installed during the GEF project showed that over one third of the sample was defective due to lack of maintenance. To avoid this problem in the future, a maintenance cost subsidy has been incorporated in the new Solar Water Heating Loan Facility.
- The interest rate subsidy was phased out at the close of the pilot project in 2006 with no impact on sales.
- Making use of an already existing financial infrastructure (electricity bills) for loan repayment had several advantages; it was an extremely simple mechanism, had lower transaction costs and involved low bureaucratic effort.
- Engaging the banks was a successful strategy, because they have the capacity to leverage enough financial resources to stimulate the creation of a market for SWH. By identifying new lending opportunities, banks have now started building dedicated loan portfolios, thus helping to shift from a cash-based to a credit-based SWH market.
- Success of such a program is dependent on the strong involvement of various stakeholders: government, banking sector, electricity utility, manufacturers, importers and installers of SWHS and local consultants. This provides the key players a platform for developing partnerships, capacity building, and information exchange.

Further Information: http://www.medrec.org/en/download/estec2007_Conference_PROSOL.pdf ,

<http://www.anme.nat.tn>

Pro-Poor Energy: Subsidy/Loan

Entrepreneurs Bring Light to Rural Haiti



Case Study:	<i>Sirona Cares</i>
Subsidy Type:	<i>Grants</i>
Loan Type:	<i>Franchise/Rent</i>
Country:	<i>Haiti</i>

Sirona Cares, a US based foundation, and the Institute for Electrical and Electronics Engineers (IEEE) have come together to bring sustainable energy to rural Haiti. The project has pioneered a leasing structure wherein local operators lease a solar generator from Sirona, and then rent rechargeable battery pack and home kits to 40 homes in their areas. The project is both sustainable and scalable as Sirona raises the upfront costs and maintains the equipment, operators lease charging stations and rent out batteries to their communities, customers pay operators for the battery service, and operators pay back Sirona.

Financial Instrument

The IEEE and Sirona Cares have partnered to bring a business-based approach to help solve a major issue in Haiti: provision of basic, reliable, sustainable electricity to rural homes. Haiti's grid does not reach many in its population and so Sirona and IEEE designed a solar-based generator run by local operators that will re-charge 40 home kits a day to bring homes without grid access light and enough power to charge a cell phone or run a small appliance. Under this scheme, Sirona is responsible for maintaining the support infrastructure, generators and solar kits which they lease to local operators for US\$200 /month. The operators then rent the solar kits to 40 homes in their areas for \$10/month for a total income of \$400. The operators are responsible for collecting rent from the kits and repaying Sirona. Pricing was set based on market surveys regarding cost of purchasing inferior substitute products such as candles or kerosene. The first 6 units were priced lower than the target price above in order to help penetrate the market quickly (US\$6.25/month for the customers, US\$130 /month for the operators). All units quickly sold out which leads Sirona to believe that operator and customer rate increases will have little impact on future market penetration. Target pricing is set at sustainable levels providing a viable income for operators and a respectable return for Sirona. The operator also has the ability to increase revenue by operating an additional business using surplus power from the generating station. If the operator is unable to make the \$200/month payment, the generator is removed along with the in-home battery kits. In the future, operators will be expected to make payment to Sirona either through deposits to the project account in UniBank (a local Haitian bank) or deliver the payment to Sirona's in-country managers. Sirona is also working with Digicel to explore the possibility of accepting payments using mobile phones.

Resistance to the financial structure of the program came from a number of quarters. Some community members claimed the price was too high. However, the price is the minimum amount required to sustain the program. Sirona has accepted that there are some communities that are too poor to rent the kits, but in general they have determined that it is affordable to most. In addition, a number of operators challenged the franchise fee concept and wanted a rent-to-own program instead. They believed that if they are paying \$200/month, they should eventually own the equipment. Sirona rejected that request because they need to maintain the operability of the generating units. If ownership is transferred to the operator, then there is a risk that the operator eventually stops operating the equipment and lets it fall into disrepair or sells it for parts. Finally, the biggest resistance came from community members who have grown accustomed to grants as the financial tool of preference.

2008-Ongoing: Support to Develop Financial Instrument

The program is the result of a cooperative effort among both private companies and non-profits. The effort was launched in 2008 as part of the Humanitarian Technology Challenge (HTC), a joint partnership between the IEEE and the United Nations Foundation, co-sponsored by the Vodafone Foundation. Now known as the Community Solutions Initiative, it continues to be supported by the HTC and is now part of the IEEE's Power and Energy Society. Funding was provided by HTC, PES (Power and Energy Society), NPSS (Nuclear Plasma Sciences Society), IEEE Canada, IEEE Region 9, Vodafone, the UN Foundation, John Lorts Engineering and Nextek Power Systems (NPS). Engineering and design work was provided by NPS employees and members. Additional funding and support came from Sirona Cares' donors and in-country partners – Mission of Hope International, in particular. Approximately \$250,000 was provided in cash for equipment purchases and shipping from the IEEE and its societies and another \$10,000 in donations through Sirona Cares. This grant funding was necessary to subsidize development and prototype costs to prove the concept demonstrate commercial viability.

As a concept, the IEEE, UN Foundation and Vodafone initiated the HTC in response to the UN Millennium Development Goals in July 2009. Together with Sirona, they developed both the business model and the technology that would be used to implement the finance model. Sirona received their first funding to build units in Mid-November 2010. All six units were fully built and deployed by July 4 (approximately 8 months from initial funding to completing field deployment). The cycle for the next units is expected to be much shorter.

Following this first phase, the commercial program will be launched (designed to reach 1 million people within five years) using a combination of debt and equity investment. Debt is focused on equipment purchasing and is based on the type of asset based financing (collateral) used for larger generating stations in the United States – debt is secured by the equipment and repaid through the revenue generated by that equipment.

Results

Revenues: Until now the project has been driven by subsidies (grant funding) and sweat equity. Financial returns are driven entirely by the following assumptions:

- Equipment Costs: \$12,000;
- Monthly Maintenance Costs: \$10;
- Average Equipment Life: 10 years;
- Revenue to Sirona from each unit: \$200/month.

Each unit generates approximately \$190 per month to support debt repayment and corporate overhead. Return on investment (ROI) is ultimately driving by the cost of overhead. Once 700 units are in place, ROI is around 7%; when 4000 units are in place, ROI is up around 13%.

Environmental Impact: While the emissions reductions have not been calculated the project is providing a clean and renewable source of energy to poor communities in Haiti. The introduction of one solar kit results in a 75% reduction in use of candles and kerosene. Introducing solar energy also leads to better indoor air quality and health.

Community-Level Impact: While it is impossible to measure the effect of bringing electricity to those who have never had it, Sirona has had a community impact in many ways. This project has created good jobs for generator operators earning \$200/month after making their franchise fee payments. Field technicians have also been employed to maintain the generators and they are paid approximately \$250/month. With three extra hours of light per day, in-home battery customers have been able to increase household income by \$10 per month by reducing household costs such as mobile phone charging, disposable battery purchases, and kerosene and candle purchases. And finally, children's study time has been increased by five hours per week.

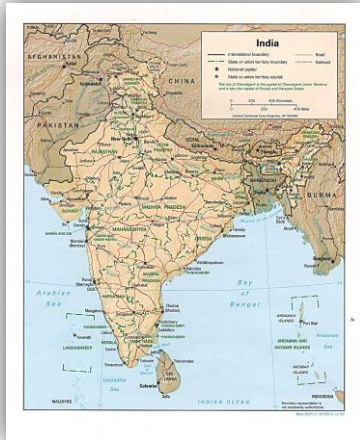
Guidance for Replication

- The key legal issue Sirona faced was from the Ministry of Public Works, which wanted to be sure they were not selling electricity. EDH (the Government-owned electric company) has the exclusive franchise to sell electricity. Sirona designed their business around this issue: they are not selling electricity, they are providing an in-home battery service, which is not prohibited by law.
- Access to capital is an ongoing problem. Sirona is seeking a line of credit or other source of funding of approximately \$1 million, which would allow them to build 75 units at a time and a significantly lower cost (including repaying the debt).
- Any project must have some measure of an economic base to work from. Investors need to investigate the potential market and customers and confirm that they are already spending enough money on substitutes to support the enterprise. Market surveys need to be focused on actual expenditures on what you will be displacing. Asking people how much money they have or how much they would be willing to pay for electricity is of no value.
- There must be a community to work with that operates for the good of the community and will support the project. That community must understand that they are receiving the generating stations only if they can financially support it. If they steal the units or batteries or don't pay for the service then they all lose the resource.
- Control must be turned over to the local people. This program works because it is run by and for Haitians. The Haitian operator is responsible for building the market, addressing security issues and dealing with customers that don't pay. Each community has its own effective ways of dealing with these and other issues. Investors should not impose their own view on solutions to what the local people determine they need to achieve their goals. The more involved non-community members are in the market interactions, the higher the risk of failure is. As long as the operators make their payments, take care of the equipment and allow the field technicians to monitor the business and maintain the units, let them run their business as they see fit.

Further Information: <http://sironacares.org/>

Pro-Poor Energy: Subsidies/Loans

Indian Solar Home Program



Case Study:	UN Environment Program (UNEP)
Subsidy Type:	Interest Rate Subsidy for Loans
Country:	India

A four-year \$7.6 million effort was launched to develop the market for financing solar home systems in southern India. The project was a partnership between UNEP and Indian banks to create lending portfolios specifically targeted at financing solar home systems (SHS) through interest rate subsidies. The interest rate draw down was initially 7% reducing interest rates from 12% to 5%. The term of the loans was generally not less than 5 years and covered all costs including supply and installation of the SHS. The subsidy was eventually phased out after four years with no impact on loan volumes.

Financial Instrument

A four-year \$7.6 million effort was launched in April 2003 to help accelerate the market for financing solar home systems in southern India. The project was a partnership between the UNEP Energy Branch, two of India's major banking groups - Canara Bank and Syndicate Bank, and their sponsored Grameen banks. The goal of the effort was to help Canara and Syndicate bank develop lending portfolios specifically targeted at financing solar home systems (SHS). With the support of the UN Foundation and Shell Foundation, the project provided an interest rate subsidy to lower the cost to customers of SHS financing. The interest subsidy was developed to help the banks build solar financing portfolios without distorting the credit risk or the existing cash market for solar home systems. The effort targeted twenty thousand homes and small businesses.

The interest rate draw down was initially 7% reducing interest rates from 12% to 5%. This was equivalent to 16% of the total capitalization (i.e. the cost of the system plus the cost of financing over the life of the loan). The draw-down amount was derived from negotiations with the two banks as well as willingness-to-pay studies. The costs of systems varied since customers could choose their own product providers from pre-qualified vendors. The systems cost between US \$350 to \$650. The term of the loans was generally not less than 5 years and covered all costs including supply and installation of the SHS.

By 2007 the banks had financed 19,533 Solar Home Systems and the subsidy has been fully phased out. Over the four year program period, the interest rate subsidy was reduced from 7% to 5% and then to 3% before it was phased out completely. There was no significant impact on the loan volumes as the subsidy was removed.

In addition to the subsidy, UNEP financed training for bank branch managers and vendor qualification. UNEP also provided a marketing incentive, which allowed the banks to prepare brochures for promoting the loan program. US \$10 was provided for each system financed.

As of 2011 the Indian government continues to use lessons learned from this program and has implemented new interest subsidy schemes to support SHS in poor rural areas. The success of the UNEP program was instrumental in making the rural banks one of the primary stakeholders of their solar mission.

Auditing Procedures:

Banks were free to formulate their own audit criteria. UNEP also developed audit safeguards to ensure that the interest subsidy grant was utilized correctly and in conformity with the business plan. UNEP reimbursed the banks based on audited quarterly reports of the numbers of installations.

2003-2007: Support to Develop Financial Instrument

The UNEP program learned from an earlier Indian Government interest rate subsidy program to promote the implementation of solar thermal systems. Lessons were also gleaned from private company Selco Solar India that had been providing rebates to reduce the cost of financing SHS.

Significant barriers to industry growth included the lack of wide spread service infrastructure for PV products and systems. This issue began to be addressed in the latter 1990s with the extension of the first true solar rural electrification companies into rural areas, allowing them to act as mini-utilities.

Additionally, only a small percentage of rural households and entrepreneurs could purchase solar systems on a cash basis. The remainder lacked access to credit to allow them to shift their existing energy expenditures into regular loan payments. While there was a strong demand for Solar Home Systems, banks did not yet have enough confidence in the technology to include SHSs in their standard lending portfolio. In response an in-depth study and survey was prepared in advance of the financial tool implementation. The analysis included:

- An overview of available power systems as well as alternatives including SHS,
- An assessment of the SHS likely customer including psychological motivators and marketing strategies for vendors,
- A study of banks and their overall perception of SHS, and
- A financial feasibility analysis including risk analysis and lifecycle costs.

The survey indicated the need for a scheme to help banks begin providing consumer access to credit. A number of market catalyst models were considered during project preparation, including providing capital cost subsidies to solar vendors, end-user subsidies directly to customers, or financing subsidies through one or two partner banks. It was determined that direct links with vendors or customers was not needed or cost-effective and that working through the banks would be the most effective approach. The two pilot banks were chosen based on their large size, national presence and access to rural areas.

Results

Revenues:

The US \$900,000 in interest subsidies that UNEP invested in the Indian program generated US \$6.7 million in commercial financing for solar home systems. In addition, as of 2003, the solar home sector had been primarily a cash-only business, but by 2007 over 50% of sales were financed and other commercial lenders now offer SHS loans.

Environmental Impact:

While the overall impact has not been assessed, because the program is replacing reliance on kerosene lamps and generators with solar systems, greenhouse gas emissions would have been reduced. The project also helped grow the sustainable energy sector in South India through expansion of solar rural electrification service infrastructure in targeted regions.

Community-Level Impact:

One of the important objectives of the UNEP program was to create a credit market for solar home systems (SHS) in the rural and semi-urban areas of the State of Karnataka, India, where most families did not have access to clean and reliable energy. They used kerosene and other polluting sources to light their homes, which impacted their health from respiratory diseases and limited their economic and social development. In rural and semi-urban areas, households also suffer the most from power shortages and have limited access to better and more expensive alternatives. Within households, women and children are primarily affected by the indoor pollution from dirty fuels as users of the light for cooking and school studies.

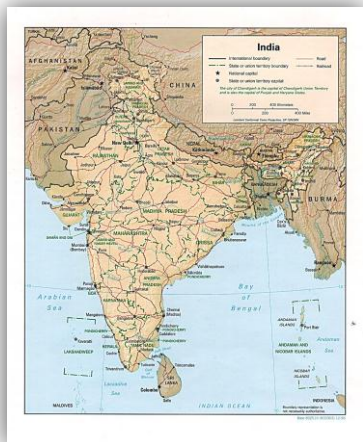
Guidance for Replication

- Although the interest subsidy did provide an incentive for customers early on, the real driver of market growth was the access to financing afforded by the 2076 bank branches taking part in the program. The program showed that the barriers to bank engagement in clean energy can indeed have more to do with soft market development barriers and perceptions than underlying economics. Most financial institutions are unaware of this market: it's more an awareness issue than an economic or financial one.
- Today banks in many developing countries have sufficient liquidity (i.e. capital) and in general are seeking to develop new loan products. It is the combination of the newness of renewable energy technologies and inconsistencies in the quality of product/service offered by the different vendors that can make lending difficult. In these situations the development community needs to shift away from simply relying on traditional credit line approaches and instead start to focus on more subtle incentive programs that help banks set up their first loan portfolios and gain experience with the clean energy sectors.
- The UNEP experience has been that once loan portfolios get beyond 10,000 systems then the sector is considered a strong commercial credit market and the banks will generally take it from there. Getting past this 10,000 threshold could help accelerate renewable energy uptake in many countries.
- An extensive banking system with local rural branches was essential to providing access to capital.
- According to the willingness-to-pay analysis, proving loan terms of less than five years made the offer extremely unattractive to borrowers, thus patient loan terms were critical to the success of the project.
- The subsidized loan was available to Individuals, self-help groups (SHGs) and small businesses. While there was reasonable success in financing self-help groups, the solar home systems were still too expensive for the poorest households. Self-help groups are village-based and composed of 10–20 local women. Members make small regular savings contributions over a few months until there is enough capital in the group to begin lending. Funds may then be lent back to the members or to others in the village for any purpose.

Further Information: <http://www.unep.fr/energy/activities/islp/>

Pro-Poor Energy: Subsidies/Loans

Financing Biogas Plants with Subsidized Loans



Case Study: Ministry of New and Renewable Energy

Subsidy Type: Interest Rate Subsidy for Loans

Country: India

In 1981 the Indian government implemented a subsidy program to support the purchase of biogas plants in poor rural communities. Subsidies were initially calculated as a percentage of cost based on the size of the biogas dome as well as the income level and caste of the purchaser. When this proved too difficult a flat rate was introduced between US \$76 and US \$280. As the subsidy in relation to cost has been reduced over time, more rural families are turning to bank loans to purchase the domes at 12% interest with an average payback term of 3 to 4 years.

Financial Instrument

India has the largest cattle population in the World and cattle dung offers a very high potential for producing biogas, which can provide multiple benefits to rural people. Indigenously developed simple-to-construct and easy-to-operate domestic biogas plants have been promoted mainly for processing of cattle dung under a government sponsored scheme. The objectives of program are (i) to provide fuel for cooking purposes and organic manure to rural households through family style biogas plants; (ii) to improve the lives of rural women and reduce pressure on forests; and (iii) to improve sanitation in villages by linking sanitary toilets with biogas plants.

Through the National Biogas and Manure Management Program (NBMMP), India has been implementing and financing the biogas program for almost 30 years with government subsidies. In the early years of the program the subsidy was large enough for many poor rural families to purchase the biogas domes with cash, however as the parts and installation costs have grown, the subsidies have not kept pace as a percentage of the entire price. As a result, more domes are being purchased with long term loans. The fixed dome Deenbandhu (meaning 'friend of poor') model made of brick masonry structure is the most popular, representing over 85 percent of the plants installed, because of its low capital and maintenance costs.

NBMMP implemented the subsidy program in 1981. The subsidy was given on percentage level, between 33% and 50% depending on income levels and caste and the size of the biogas dome to be purchased. The percentage level of subsidy was difficult to administer due to vast variation in the cost of plants from State to State and even among districts. In the late 1990s, when evaluation survey studies pointed out that people installed plants of sizes higher than what was necessary, so they could receive a higher subsidy, a flat rate system was implemented instead. The flat rate of subsidy was found to be much easier and transparent to administer. The flat rate subsidy coupled with advance release of funds from the Central Government to State Governments to the district governments and in turn to farmers.

Currently, flat rates range from between US \$76 and US \$280 depending on region, caste, income level and size of the plant. An additional central subsidy of US \$19 per plant is given for linking plants with sanitary toilets and US \$28 is available to subsidize the first five years of maintenance. The government will also provide financial support for repair of old non-functional plants at the rate of 50% of the subsidy available for that plant.

While the government provides the subsidy, buyers must contract with banks for a loan. Each bank can set its own terms but in general banks require farmers to contribute at least 10% of the cost in cash or kind. As of 2009 the rate of interest was 12 percent and repayment period was fixed between 3 to 4 years. Collateral is required and banks confirm the technical feasibility of plants from field staff before approving a loan. The loan amount is disbursed directly to the plant construction company or NGO in 2 or 3 installments linked with the progress of construction of plants. The borrower is solely responsible for repaying the loan with interest to the bank at pre-determined half yearly installments. If the payment delayed, then the bank may fine the debtor or take possession of the collateral.

Auditing Procedures:

Each biogas plant includes a serial code for monitoring purposes. Reporting is done on a monthly, quarterly and annual basis and in-person field investigations are carried out through local agencies. The NBMMP provides monitoring and reporting support for the program. Third party auditing and verification is also implemented by some states.

2003-2007: Support to Develop Financial Instrument

The National Project on Biogas Development began in 1981-82 and was renamed National Biogas and Manure Management Programme in 2002-03. It has been included in the current five year plan (2007-12). The NBMMP is administered through the Ministry of New and Renewable Energy (MNRE), which implements the program through State nodal departments and agencies. They in turn involve district level organizations, nongovernmental organizations (NGOs) and trained private entrepreneurs. Village local bodies, called 'Gram panchayats' are involved in the selection and monitoring of beneficiaries. For technical and training support, Biogas Development and Training Centres (BDTCs) have been established in ten different States.

In order to create a business model and infrastructure for the installation of Biogas plants interest-free loans are available to biogas companies and entrepreneurs up to about US \$38,000. The payback period is five years and the program is operated through the *Indian Renewable Energy Development Agency Limited (IREDA)* in partnership with local commercial banks.

The Syndicate Bank, was the first to develop and implement a scheme of financing of biogas plants that included liberal terms suited to rural communities in October, 1973. By 1976 more than 20 banks were giving loans for biogas plants, which triggered fast growth of the plants.

Results

Revenues: Fixed dome plants are financially viable for commercial banking institutions when economics of scale can be achieved. Returns are highest and costs can be reduced when three or more plants are constructed at the same time in the same village. The average payback period for a subsidized plant is about 3.2 years.

For the rural villager, in general, the financial benefits are in terms of avoidance of costs in fuel and chemical fertilizer. In addition, in agriculturally prosperous villages close to cities, biogas and manure are being sold to neighbors.

Environmental Impact: The impetus behind the program was to meet ever increasing cooking fuel requirements, promote recycling of organic waste and soil health, and improve agricultural production and sanitation in rural communities. Biogas plants create clean and renewable cooking fuel and enriched manure, which can be used by the families and/or sold.

Community-Level Impact: In the past 26 years, the NBMMP program has been implemented in all states and territories and over 4 million plants have been established since 1981. The use of biogas has helped save about 2-3 hours of daily work per household, mainly for women who would have been collecting fuel. Biogas also reduces smoke derived eye and lung diseases which decreases health costs.

Guidance for Replication

- In general, biogas plants provide benefits in terms of avoided costs and do not usually generate direct income to households.
- A mix of financial instruments, such as a subsidy plus credit on easy terms will be more likely to motivate farmers to adopt biogas technology.
- Some states have provided additional financial support to supplement the subsidy. While this may have seemed like an attractive concept to support the dissemination of biogas plants, in reality it was determined that plant owners who have little or no financial stake were less likely to sustain interest in or maintain their biogas plants.
- Even with a long history of commercial finance support and success, local bank branch managers continue to be concerned over loans for a product that does not generate a cash flow. Failure of even a single plant in an area can discourage banks from sanctioning future loans.
- The program would be more successful if commercial lenders set 5 to 7 year repayment periods and allowed borrowers to keep 50 percent of gross savings from the plants after deducting the amount of their annual repayment installments.

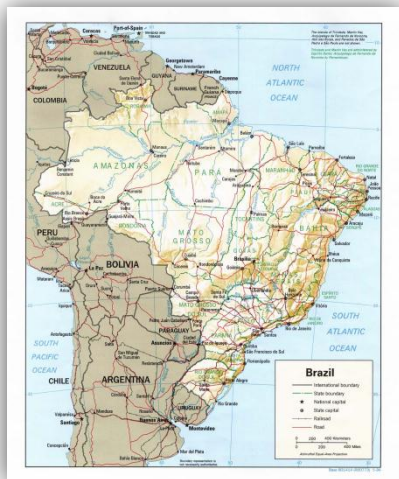
Further Information:

http://www.snvworld.org/en/Documents/India_international_workshop_on_financing_of_domestic_biogas_plants_2008.pdf

<http://indg.in/rural-energy/schemes/national-biogas-and-manure-management-programme-nbmmp>

Pro-Poor Energy: Subsidies

A Sliding Scale Subsidy Supports Mini-Hydro in Southern Brazil



Case Study: Creluz
Subsidy Type: Sliding Scale
Country: Brazil

CRELUZ is a rural cooperative in Brazil that owns and operates six run-of-river mini-hydro plants. Generating cheaper electricity through its hydro plants has helped CRELUZ to make an operating profit each year. This has been used to expand the distribution network, build more hydro plants, keep the tariff low and reduce it for poorer customers, and also for social activities within the local communities. With a sliding scale of tariffs, larger wealthier users pay more and poorer families are subsidized with up to a 64% price discount and six hundred of poorest families receive free electricity under the CRELUZ social program.

Financial Instrument

The Cooperativa de Energia e Desenvolvimento Rural do Médio Uruguai Ltda. (CRELUZ), was set up as a cooperative in the state of Rio Grande do Sul in 1966 by a group of local people who wanted to improve the supply of electricity to rural areas. CRELUZ has now grown to 20,000 members, and 87 full time staff who are responsible for operating six run-of-the-river mini hydro plants which account for about 27% of their electricity needs. In addition, they maintain 4,500 km of power lines, supplying power to 36 municipal areas and to rural communities.

CRELUZ sells electricity to its members at similar prices to other electricity distribution companies. In 2009, the hydro plants supplied 17 GWh of electricity at a cost of about US\$0.04 per kWh. CRELUZ purchased the remaining electricity from the national grid at US\$0.06 per kWh. Generating cheaper electricity through its own hydro plants has helped CRELUZ to make an operating profit each year. This has been used to expand the distribution network, build more hydro plants, keep the tariff low and reduce it for poorer customers, and also for social activities within the local communities.

CRELUZ members pay an average of US\$0.20 per kWh for electricity, with a sliding scale of tariffs, where larger wealthier users pay more and poorer families are subsidized with up to a 64% price discount called the Social Electricity Tariff (TSEE).

In addition, 600 of the poorest families receive free electricity under the CRELUZ social program.

Until 2010 the CRELUZ Board of Directors along with the Cooperative Director determined the rates for subsidized and unsubsidized consumers. CRELUZ did not change its energy rates for seven years, however since 2010 the National Agency of Electric Energy (ANEEL) has become responsible for setting all rates nationwide and makes adjustments based on local economic conditions as well as by customer class such as residential, rural, industrial, commercial, government, and others.

The billing is done through service agencies, which are spread throughout the area of the cooperative, close to the communities it serves. In case of late payment, the local service agency manager notifies the debtor and engages him/her in a conversation to assess the situation. By practice, the Cooperative rarely suspends the service, and always seeks to speak with the debtor before taking action. The average annual default rate is 1% to 2%.

Auditing Procedures:

CRELUZ has a yearly assembly that elects the members of the administrative and fiscal Councils, as well as the President, Secretary and Treasurer. The Councils appoint a Board to manage CRELUZ's day to day operations. CRELUZ maintains standard operating procedures that describe the activities and the controls to be followed by individual departments. The procedures are under constant review in order to meet current legislation and internal standards. Regular audits monitor the proper execution of internal working processes, such as purchasing, payment and billing, and reports are prepared and delivered to the Directors. CRELUZ also maintains an independent external audit, which assesses internal controls, financial statements and compliance with current laws.

1966-Ongoing: Support to Develop Financial Instrument

Since 1966, the cooperative purchased its electricity from the national supplier, but supply was inadequate and the power quality variable, which restricted development in the region. So in 1999 CRELUZ applied to ANEEL to receive authorization for a hydroelectric concession. The permit was granted that same year and within approximately 2.5 years, the first mini-hydro plant was completed and put into commercial operation. The first plant was financed through the cooperative's savings. The next five plants would be financed through hydro-energy revenues. The cost for a 1 MWh plant is approximately US\$3,700,000.

Because of frequent blackouts on the national grid, many Brazilian energy companies had had started to investigate and develop alternative forms of energy including small hydro turbines. By 2001, Brazilian companies began to manufacture mini-hydro on a larger scale, which made the technology locally available to CRELUZ.

Results

Revenues:

Per Mini-Hydro Plant

- Approximated revenue US\$480,000/Year
- Approximated total cost US\$128,000/Year
- Approximated annual net revenue US\$352,000/Year

CRELUZ average annual profit: US\$1,405,285

Environmental Impact:

Greenhouse gas emissions have been cut by approximately 7,000 ton/year CO₂, by displacing fossil-fuel generation. CRELUZ has taken care to minimize environmental impact through developing run-of-river plants that do not require large areas of land to be flooded to create reservoirs. Some of their projects have also included fish ladders and moveable dams. Disturbed sites are replanted with native plants. CRELUZ also offers environmental education projects in local schools.

Community-Level Impact:

Once they become members and receive their electricity from CRELUZ, cooperative members are required to participate in its activities, including voting in assemblies and being part of the social and environmental activities that are part of CRELUZ's work. Cooperative members also decide how the profits will be used including increased energy capacity and social programs. These program currently include connecting off-grid homes, providing free electricity for poor families, and installing clean water in over 100 rural communities. Many businesses can now operate more efficiently because they can rely on using machinery such as milking machines, milk coolers and electric fencing on farms, and compressors for drills in the amethyst mines. Tourism has also increased, which has benefited communities in the area.

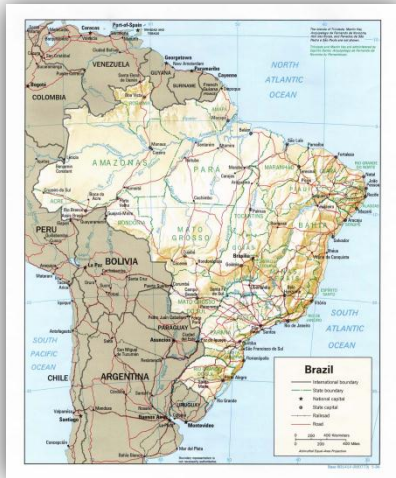
Guidance for Replication

- CRELUZ has found some difficulty funding energy generation projects through hydroelectric plants in their region. CRELUZ has a partnership with three other energy Cooperatives to leverage their resources and is currently seeking funding to implement two more energy generation projects. However the process of working with financial institutions requires a series of guarantees and insurance which are difficult to obtain. The bureaucracy is cumbersome and delays the start of the work.
- The current interest rate of 9.5% is extremely high and makes it difficult for CRELUZ to finance new plants.
- Speaking to debtors and delinquent customers about why they are not paying their bills has worked very well and has maintained an overall extremely low delinquency rate.
- CRELUZ could provide even more environmental and social benefits to their communities if the Brazilian government provided more incentives to be socially responsible.

Further Information: www.creluz.com.br

Pro-Poor Energy: Subsidies

Subsidizing Efficient Cookstoves with Carbon Credits



Case Study:	Instituto Perene
Subsidy Type:	VERs – Carbon Credits
Country:	Brazil

Instituto Perene is reaching 30,000 people in over 70 rural communities in Bahia, Brazil through a program financed by the sale of carbon credits. Funding for building and monitoring domestic stoves was secured from the Brazilian company Natura through its voluntary Carbon Neutral program. The substitution of 6,000 rudimentary, wood-burning cookstoves with efficient, durable stoves will generate 102,000 tons of Verified Emission Reductions (VERs) by 2018. Perene Institute's cookstove projects are developed in accordance with The Gold Standard.

Financial Instrument

Instituto Perene promotes projects that benefit rural communities while helping conserve the natural resources of the Atlantic Forest biome of Brazil. To address the widespread problems of dwindling Atlantic rainforest and inefficient wood-burning cook stoves, they developed an improved stove with the help of local stakeholders. In order to scale-up the project they are 100% financed through the sale of carbon credits.

Instituto Perene's efficient stove program successfully obtained carbon financing through the Voluntary Carbon Credit Market (VERs) to fund widespread dissemination of efficient stoves. In 2009 Perene began the first carbon-financed stove project in Brazil. Funding for building and monitoring 1,000 domestic stoves was secured from the Brazilian company Natura through its Carbon Neutral program, through which Natura voluntarily offsets the annual emissions generated by production and distribution of its products. Perene's project was one of five selected throughout Brazil by Natura to offset its 2008 emissions. Perene will deliver approximately 18,000 tons of VERs by 2018 from this project. In 2010, Perene was again selected by Natura, to offset the company's 2009/2010 emissions, through a 5,000-stove project delivering 94,000 tons CO₂e. Over 25,000 people will benefit from the 6,000 stoves. Projects are developed in accordance with Gold Standard in order to generate certified Voluntary Emission Reductions (VERs).

Stoves are not donated, they are subsidized in return for the rights to the carbon credits. The stove materials cost \$100, and beneficiaries are required to contribute 30 bricks and a bag of cement, which equals an “in-kind” cost of about \$20, or 16% of the total. Once the stove is built, beneficiaries “sign over” their rights to carbon credits to Perene through a Terms of Agreement. Added to the materials cost is labor, transport and monitoring. As the average monthly income in the region is below \$250, the carbon financing is indispensable for financial feasibility.

Additionally, Instituto Perene has developed the necessary elements specific to a carbon project and key to the finance: identification and application of Baseline and Monitoring methodologies, systematic testing and surveying, multi-temporal analysis of satellite imagery to assess non-renewability of biomass, rigorous identification and recording of stove installations, contractual agreement with each individual stove user, and ability to fulfill the step-by-step process for project registration, validation, verification and certification by an independent, internationally-recognized entity, in this case The Gold Standard.

Like most VER carbon financed projects, the price of carbon credits is negotiated between buyer and seller and the actual amount that Perene receives from Natura remains proprietary information. However, according to Bloomberg, the average price for Gold Standard VERs in 2011 is about US\$10/tCO₂e and can range as high as US\$35/tCO₂e to a low of about US\$5/tCO₂e. In addition, buyers are traditionally willing to pay more for certain projects based on scarcity (such as solar home systems); unique or locally-based activities (project types like composting and cookstoves); and social and environmental co-benefits. (Bloomberg, 2011)

2009-Ongoing: Support to Develop Financial Instrument

Prior to building their first stove, Perene conducted meetings, house visits, and interviews to collect information about cooking practices and needs to determine the best specifications for a cookstove and the motivational drivers of their target communities. Perene learned that health and hygiene are the main concerns of women and the main motivation to adopting a new stove. Once that was determined Perene received funding from CARE Brazil enabling a consultant from Aprovecho Research Center to visit the project region and work on the cookstove design. The stove model was developed with carbon-financing in mind. Durability (estimated 8 years) was a key consideration in choosing materials and specifications. The greater expense in the material and labor is compensated by the longer operational life-time. The project has a crediting period of 7 years.

One cultural barrier encountered was a general skepticism about rural development programs because in the past, people or entities (usually political) had not fulfilled promises made. To overcome this, Instituto Perene used a community engagement strategy by installing a stove in the home of a local woman leader. After a few weeks, they hold a local meeting and invite all to see the stove, ask questions and hear their neighbor's first-hand account. Those interested sign a Terms of Agreement, and commit to providing their in-kind bricks and cement, and within a month construction has started and trust has been built. In order to ensure ongoing correct stove operation, a Community Agent is identified to assist Instituto Perene in various project engagement activities including house visits to help cooks get used to new practices (smaller pieces of fuel, putting out fire between meals, cleaning underside of stovetop and chimney, covering pots, etc.). Community Agents then help with monitoring and post-installation service.

Results

Revenues: As stated above, revenue from carbon credits is proprietary information, however based on Bloomberg estimates, revenue can range between a low of US\$500,000 to a high of \$3,570,000. Given that the price for 6,000 cookstoves is about US\$600,000, it is likely that Perene is receiving at least US\$10/tCO₂e for 102,000 tons of carbon emission reductions.

Environmental Impact: Efficient stoves have a positive impact on the entire home environment: cleaner air, soot-free pots, fewer accidents, and time savings are all benefits experienced by participating families. In addition there has been a 50% reduction in fuelwood use and a projected 102,000 tons reduction in carbon emissions.

Community-Level Impact: As of summer 2011, Perene has built 1,000 stoves and an additional 5,000 units will be built over the next three years. The construction team will be increased to meet the new construction rate of 200 stoves/month,

which will promote local jobs. In designing the stove, priority was given to locally-available parts and materials. The metal parts – stovetop and fuel shelf –are manufactured at a local machine shop; bricks and cement are bought from local distributors; the ceramic chimneys are made by hand in a nearby town famed for its ceramic handicraft.

Guidance for Replication

- Because carbon financing is critical to the success of the project durability was essential to the design of the cookstove as the longer operational life of the stove would permit a longer crediting period.
- The process of designing the project to meet all the requirements, as well as the need to overcome skepticism on the part of the buyer of the credit, to which this type of emissions reduction project was completely new, was very demanding.
- The choice to adopt the Gold Standard was critical in order to impart credibility to the project and facilitate the commercialization of carbon credits.
- Because VER deals are usually proprietary it is difficult to know what levels of finance might be expected for projects in other countries or other parts of the country. Researching the VER market and negotiating with potential buyers in advance is important.

Further Information: <http://www.perene.org.br/>

Cover Photo: *Dominic Sansoni, 2002/World Bank*

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