Access to **Energy** for the **Base** of the **Pyramid**

October 2009

A JOINT PROJECT OF

ASHOKA

HYSTRA
hybrid strategies consulting

WITH THE SUPPORT OF

GDF SUEZ

Schneider Electric

TOTAL

ACKNOWLEDGEMENTS

The authors would like to thank the social entrepreneurs who shared their innovative work, the entrepreneurs within corporations who carved the space for something new, and the experts who contributed insights over the course of this investigation. Your support and faith are deeply appreciated.

AUTHORS

HYSTRA

Jean-Elie Aron, Consultant

Olivier Kayser, Managing Director

Laurent Liautaud, Project Manager

ASHOKA

Aileen Nowlan, Senior Intrapraneur

FOR MORE INFORMATION

www.hystra.com

www.ashoka.org/fec

This report has been printed using environmental friendly ink and paper

FOREWORD

1.6 billion people do not have access to electricity. 3 billion people still use traditional biomass for cooking. This has serious consequences on the affected populations in terms of health, education, well-being, or development.

As major stakeholders in the energy sector and the development of energy-based products and services, Total, Schneider Electric and GDF SUEZ each have respective ways of getting involved. Together they have decided to share their analysis of the issue, and to devise new possible forms of action in that realm.

Those three corporations jointly entrusted Hystra, in collaboration with the international network of social entrepreneurs Ashoka, to conduct a study regarding different projects allowing energy access to poor sections of the population from developing countries — mostly initiatives started by local entrepreneurs.

Focused on energy access projects for the most underprivileged sections of the population (*BOP, Base of the Pyramid*), the work consisted in an in-depth field study including on-site visits, interviews of the relevant parties, as well as workshops for evaluation and experience sharing.

What is revealed through that study?

First, it appears that the gap between the social and the economic realms is not unbridgeable, as it is possible to both take into account social-related issues (in our case, access to energy) and create economically sustainable companies that meet with the demand of those "markets", that are sometimes seen as insolvent prior to examination.

The study also teaches us that the adequate response to the needs of underprivileged sections of the population can be elaborated not only by developing products and services that are cost and need-efficient, but also through the optimization of the "human capital" of the above-mentioned sections— i.e. their organization skills, the existing solidarities between them, and their social networks.

Lastly, the study shows us that the most successful social entrepreneurs are also the ones who tried harder to get the users who were implied in the value-added processes involved. Indeed, viewing users as agents and including them in the production, transformation and distribution processes, does seem to be a key condition to the development of promising social businesses.

We believe that corporations could have a supporting impact in bolstering, encouraging and developing the experiments that have been conducted in many countries, both in the "upstream" segments (development of adapted low-cost products, scaling effects, etc.) and the "downstream" segments (distribution channels, maintenance, etc.) of the value chain.

All this work is to be shared by as many people as possible, in order to foster debate between and fuel thought amidst the relevant parties. That is why Total, Schneider Electric and GDF SUEZ have decided to make the results of the study public.

This work should also make it easier to build up and implement partnerships in this realm.

Bernard Saincy *Director of Corporate Social Responsibility, GDF SUEZ*

Gilles Vermot Desroches *Director of Sustainable Development, Schneider Electric*

Manoelle Lepoutre *Senior Vice President, Sustainable Development and Environment, Total*

INTRODUCTION

The opportunity to write this report could not have come at a better time. The crisis that is battering the world's economy has edged out the imperative to act on climate change for popular attention, but perhaps briefly. It calls us away from the ongoing travesty that poor people are excluded from participating in the market economy, and the development deep freeze that arises from their lack of access to energy.

This is a moment when we are calling into question our economic relationships and our relationships with the environmental systems we depend on. At Hystra and at Ashoka, we are motivated by a desire for economic inclusion arising from the knowledge that poor people do not contribute much to the formal market, and don't get much from it either.

Economic citizenship is extremely urgent in the context of access to energy, as lack of energy prevents children from studying at night, hinders the growth of small enterprises, and imperils the health of families struggling with kerosene, waste, and other precarious fuels. To top it off, it becomes increasingly clear that soot from cooking fires is advancing the forces of climate change.

There is indeed a widespread enthusiasm for the possibility that market-based solutions will be as successful in addressing critical social and environmental issues. Coming from different points in the horizon, social entrepreneurs and business executives seem to converge, offering the opportunity to build hybrid value chains that combine social and environmental impact in profitable business opportunities.

We want to alert readers that this report cannot fully represent how much these projects are the result of years of work of social entrepreneurs, outstanding individuals who have had the vision, taken the risks and committed their lives to eradicate an injustice and make our world better.

We hope this report will meet their approval because they are our masters and our inspiration.

Olivier Kayser, HYSTRA *Paris, France*

Valeria Budinich, ASHOKA *Washington DC, USA*

Contents

8 About this project

10 Executive Summary

13 Statement of the problem

16 Promising market based approaches for Access to Energy to the BoP

- 17 Grid connections
- 33 Devices
- 53 Solar Home Systems
- 69 Rural cooperatives
- 77 Financing

87 Recommendations

- 88 Aid agencies
- 89 Governments
- 89 Strategic Social Investors and Foundations
- 90 Citizen Sector Organizations
- 91 Energy social entrepreneurs
- 91 Multinational companies

93 Appendix

- 94 The Hystra / Ashoka team
- 94 BOP income figures explanation
- 95 Case rating methodology

1. ABOUT THIS PROJECT

The Access to Energy project is an effort to broaden the understanding of the range of possible strategies to provide modern, clean, and safe energy to the poorest population, the Base of the Pyramid (BOP).[1] The BOP as defined by "The Next 4 Billion"[2] is the four billion customers living on an annual per capita income that is less than $3000 in purchasing power parity (PPP). The BOP is further divided in 6 income level groups. The lowest segment groups those with an annual revenue per capita below $500PPP (BOP500) and the highest one those with a revenue comprised between $2500 and 3000PPP (BOP3000).

This work has been sponsored by three global energy industry leaders: GDF SUEZ, Schneider Electric, and Total.

The project took place over the course of 4 months in early 2009, involving a team of Hystra consultants, Hystra's network partners and Ashoka experts.

Instead of adding to the already very complete analysis of the problem, our methodology is to learn from "what works" in the field. Indeed, we surveyed 138 Access to Energy initiatives across the world to understand what made them successful and what were the obstacles to their generalization. The team also interviewed almost 40 industry experts.

Projects have been selected by scanning the networks of Ashoka, open sources such as NextBillion.net, projects sponsored by development and multilateral agencies, internal corporate projects, and other sources. Each project is evaluated against three criteria:[3]

Does it solve the problem?	Is it economically viable?	Is it scalable?
▸ Is it targeting the poorest? ▸ Is it sustainable? ▸ Is impact demonstrated?	▸ Is it a profitable business? ▸ Does it require subsidies?	▸ Is the market environment favourable elsewhere? ▸ Is the operational model scalable?
The combination of these three questions offers some surprising insights. For example, some projects which are otherwise attractive don't reach the poorer levels of the BOP or have unsustainable maintenance systems.	This criterion reveals a diversity of financing strategies. Many projects started with some sort of grant-based or low-interest funds, and are now moving to a purely commercial financing model.	This criterion focuses on the likelihood that the model could be replicated in other geographies, with the intention that projects which can't be scaled or replicated will not be as relevant for practitioners.

1 Please see pg. 94 for an explanation of Base of the Pyramid levels, and how they are utilized throughout this report

2 The Next 4 Billion; World Resources Institute and International Finance Corporation. March 2007.

3 Please see pg. 95 for a more detailed explanation of the rating methodology

The projects discussed reflect market-based solutions either already at scale, or with high potential to reach scale. Although the projects highlighted here are very strong projects, the report is not exhaustive and is not meant to put forward certain enterprises over others. Promising but too recent initiatives are not discussed (e.g., jatropha projects). For ease of communicating our evaluation, we used a simple but visual system, rating each project on each criterion from one to three stars.

The report reflects a co-creation process with social entrepreneurs, energy experts, and business leaders. The cases in particular have been discussed with the contacts from each project.

The names of some of the projects profiled in this report will be familiar to those who follow the access to energy field. The team hopes that our methodology will provide new insights to seasoned experts and new entrants alike.

From the outset this investigation has focused on market-based solutions to access to energy. Public investment, subsidies, multilateral spending and charitable giving have all figured in access to energy initiatives around the world. This study highlights enterprises - for or not for profit - that acknowledge the fact (now popularized by the inventor's of micro credit) that the poor do pay back, and want to pay for better service, as well as the realization that giving things away for free makes people value them less, which compromises the long term viability of the installation.

Energy is a subject that has become very popular in the context of climate change and the danger that increased energy use puts on the Earth's life-sustaining systems. What appear to be conflicting pressures from the development challenge of access to energy and the global obligation to mitigate climate change can be turned into mutually reinforcing solutions. Therefore the question of access to energy is particularly timely. Although not all profiled solutions employ renewable energy sources, they offer an improvement over the status quo. For example, a grid connection may provide electricity generated by burning fossil fuels, which is an improvement over electricity from disposable batteries.

* * *

Hystra is a new, hybrid type of consulting firm. Hystra works with business and social sector pioneers to design and implement hybrid strategies, innovative business approaches that are profitable, scalable and eradicate social and environmental problems; and combine the insights and resources of business and citizen sectors. Hystra itself is a hybrid organization, a for profit tool for social change. Its Advisory Board vets its choice of clients and projects, ensuring that they have a major potential for societal impact. Hystra helps leading social entrepreneurs scale up their impact with money (10% of its profits) and its staff time. Hystra ensures its clients embrace an "open source" philosophy, and accept to share all (non confidential) insights and methodologies. Hystra consists of a core team of full time consultants and of a growing network of partners already present in 7 countries. For more information, visit www.hystra.com.

Ashoka Innovators for the Public: founded in 1980, Ashoka is the world's working community of more than 2,000 leading social entrepreneurs. It champions the most important new social change ideas and supports the entrepreneurs behind them by helping them get started, grow, succeed, and collaborate. As Ashoka expands its capacity to integrate and connect social and business entrepreneurs around the world, it builds an entrepreneurial infrastructure comprised of a series of global initiatives that supports the fast-growing needs of the citizen sector. Ashoka's vision is to create change today, for an everyone a changemaker society to become the reality of tomorrow. For more information, visit www.ashoka.org.

Ashoka's **Full Economic Citizenship** (FEC) initiative has built businesses that serve low-income people in housing, health care, and small farming. These Hybrid Value Chains™ combine the resources of the business and citizen sectors to transform markets. They are active across Latin American and India and reach almost 75,000 people.

ASHOKA

HYSTRA hybrid strategies consulting

2. EXECUTIVE SUMMARY

The video that Harald Schützeichel likes to share about his Solar Energie Foundation shows how dark it gets in rural Ethiopia when the sun goes down. For those who haven't lived in the darkness that 1.6 billion people without electricity face at night, it is perhaps surprising that energy be ranked among other pressing concerns such as health, or education, or housing.

For the poorest 4b people of the world, access to modern, clean and safe energy is an entry into a new life. Right now, energy means batteries, kerosene or paraffin lamps, or cooking with firewood or waste. Urban households perhaps have an unreliable and dangerous informal hookup to a grid. Women and girls in particular spend hours in collecting firewood or inhaling smoke over a dirty stove. A staggering 1.6m people die every year due to the toxic effects of indoor air pollution from cooking fires.

Access to energy for low-income people means choices about what to do at night, improved health and safety, and the ability to direct scare funds to more productive uses. It means pumping water when the crops are ready, keeping a shop open at night, or not fearing for a child studying with a candle. For low-income communities, it means forests preserved from firewood scavenging, clean air at cooking time, and streams without leaking battery acid. Lack of energy may be an inconvenience in the rich world, but it is a barrier to development of the most basic kind for low-income people.

Despite being poorly served or even endangered, the poor are paying for energy. The BOP spends $500b (PPP) on energy each year to meet their cooking, lighting, communications and income generation needs.[4]

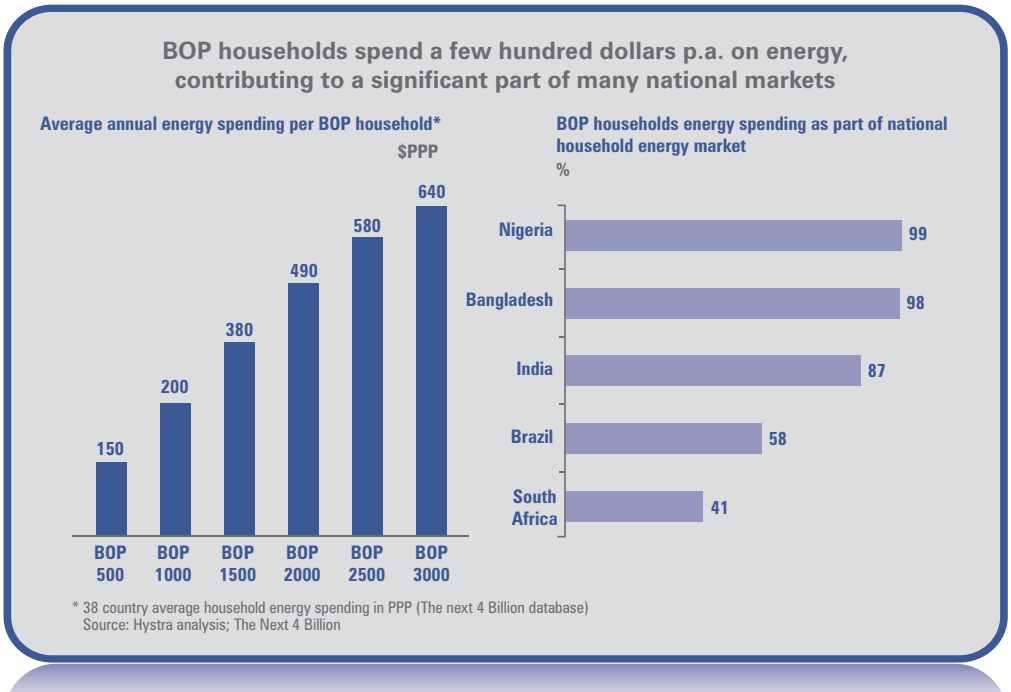


Figure 1: *Size and distribution of access to energy market*

4 Opportunity size based on current expenditure data

ASHOKA

HYSTRA hybrid strategies consulting

Despite its size, the BOP energy market is fragmented and immature. Energy needs and solutions change from country to country, rural to urban, wet season to dry. Few intermediaries exist to describe the market, aggregate demand, and provide finance or technical assistance. Multilateral and government efforts have put only a dent in the need for access to energy; most top-down and subsidy-based approaches have failed. In addition, the lives of poor people differ according to common categories such as rural and urban, or informal and formal workers, as well as between people at the same income level, the same city, and even the same street.

The combination of pressing social need and stalled traditional approaches is prime territory for social entrepreneurs. For decades, social entrepreneurs have been expanding the realm of possibility in access to energy. Solutions such as unsubsidized solar LED lanterns or rural cooperatives are the result of the dauntless determination and innovation of social entrepreneurs.

Local private companies and multinational corporations (MNCs) also have been experimenting with access to energy initiatives, and the results serve hundreds of thousands of low-income people.

The trends highlighted in this report show a convergence of the private and the citizen sectors - a new way of working that can transform access to energy, and provide social impact and financial returns.[5]

The purpose of this document is to articulate the promising cases that have emerged from decades of experimentation, describe trends in successful business models, and chart a path for a transformation in the access to energy market, one that brings clean, safe, affordable energy to billions.

While the projects we identified are remarkably diverse, their business models can be regrouped in four categories:

1. **Grid connections** turn slum communities into legal, paying customers using community organizing, technological innovation, and complementary business lines. These enterprises, in Sudan, Colombia, or Argentina, are economically viable without subsidies and very attractive to their customers. With some work to overcome hesitations from utilities and slum dwellers, grid connections could reach more of the 1b people currently living in slums.
2. **Devices** such as solar lanterns and efficient biomass cookstoves provide energy for lighting and cooking and are affordable to the poorest of the poor. Both solar lantern and cookstove enterprises demonstrate high potential for profitability, and are receiving social venture capital. Growth goals are ambitious and entrepreneurs expect significant scale over the coming years.
3. **Solar home systems (SHS)** provide electricity for households and home-based entrepreneurs with a stand-alone solar photovoltaic panel wired into lamps and a plug. SHS enterprises have demonstrated profitability, but are vulnerable to the expectation of free help from governments and the swings in input prices that have characterized the solar PV market. SHS entrepreneurs expect strong growth, and are working to reduce complexity in their operating models.
4. **Rural cooperatives** take the challenge of providing sustainable power supply and create income generation opportunities that increase people's ability to pay for the electricity generated. Such models are technologically neutral as they can use biomass gasification, wind, or hydro. But rural cooperatives require local maintenance and administration and often an effort to set up local enterprises to use the increased power supply. Economic viability is possible in theory but remains an unmet challenge. Expanding rural cooperatives requires complex relationships between governments, enterprises, and communities.

5 See http://ashoka.org/citizensector for a definition of the citizen sector - the activities carried out by citizens, defines as what they do. This definition goes beyond being not businesses (non-profits) or not governments (NGOs). The term CSOs is used to describe a new generation of citizen engagement.

Finally, **financing** and financial intermediaries have matured with the market, and increasingly provide a variety of financing, from grant-based assistance to start the market, to patient capital with sector expertise, to links with broader capital and carbon markets. However, financing is still a significant bottleneck for energy entrepreneurs. Subsidies in some form were necessary to launch almost all energy enterprises targeting low-income people, even those with a self-sustaining market-based operating model. Further creative financing solutions are needed which are tailored to the high risk, expensive early stages of energy enterprises.

From these solutions a pattern of innovation emerges. Energy entrepreneurs move from grant-based funding to commercial viability over time, in recognition of the fact that building a new market takes more time and effort than one enterprise can recoup. In their working model, energy entrepreneurs often employ hybrid strategies that combine the resources of the citizen sector and the business sector. For example, early SHS entrepreneurs each have 15 years experience working with rural communities. Citizen sector partners move into new roles in designing, marketing and distributing clean energy solutions, and in doing so strengthen the economic viability and social impact of energy enterprises.

This report should be a call to action for local and multinational companies, financial institutions, entrepreneurs and governments. From solar home systems in Ethiopia to cookstoves in India to grid connections in Colombian slums, market-based solutions have delivered safe, affordable energy to satisfied customers.

The final section of the report offers **recommendations for action**. It outlines principles for action for:

- Aid agencies
- Governments
- Strategic social investors and foundations
- Social entrepreneurs
- Citizen Sector Organizations
- Multinational companies

These recommendations should enable collaboration and creativity to reach a $500b market for safe, clean, affordable modern energy.

3. STATEMENT OF THE PROBLEM

Energy is intertwined with development needs. When people lack access to energy, they lose an opportunity to study or generate income, and face health problems and constant danger. For low-income people, energy is more than just a light at night, or a way to cook a meal. Access to energy provides a direct benefit in terms of poverty reduction and improved health. The UN Millennium Project estimates the impact of providing electricity to a rural Philippine household at $81 to $150 per month due to "improved returns on education and wage income".[6] In Mali, 80% of households said they hoped to start an income-generating activity when they had a reliable power source.

The World Health Organization estimates that 1.6m people every year die due to indoor air pollution from cooking indoors on firewood, dung, refuse, etc.[7] Women and girls in rural India spend an hour each day collecting firewood for cooking. Clean cooking alternatives improve respiratory health, reduce drudgery and leave more time for other activities.

These impacts are not isolated to poor communities. A recent study found that 18% of greenhouse gas emissions are caused by 'black carbon' - soot from fires.[8] When low-income people lack clean, safe energy, it increases everyone's risk from climate change.

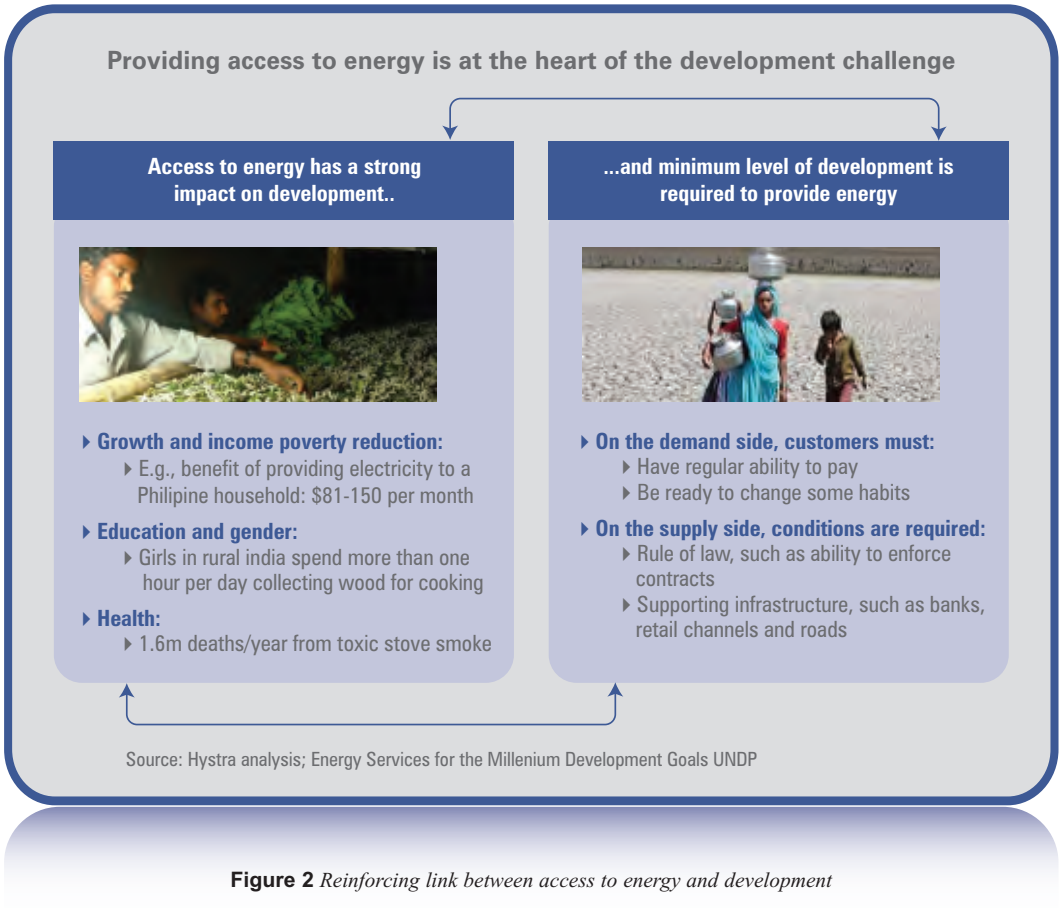


Figure 2 *Reinforcing link between access to energy and development*

6 Energy Services for the Millennium Development Goals; UNDP

7 World Health Organization; http://www.who.int/indoorair/health_impacts/burden_global/en/index.html

8 Third-World Stove Soot Is Target in Climate Fight; New York Times, April 16, 2009; http://www.nytimes.com/2009/04/16/science/earth/16degrees.html?hp

At the same time, the access to energy market is large, and represents diverse needs. Around the world, the 4b people who form the "Base of the Pyramid", living on a few dollars a day, spend over $500b on energy every year. In some countries poor customers form the vast majority of the energy market. For their money, they receive energy that is unreliable, expensive, hard to access, and unsafe.

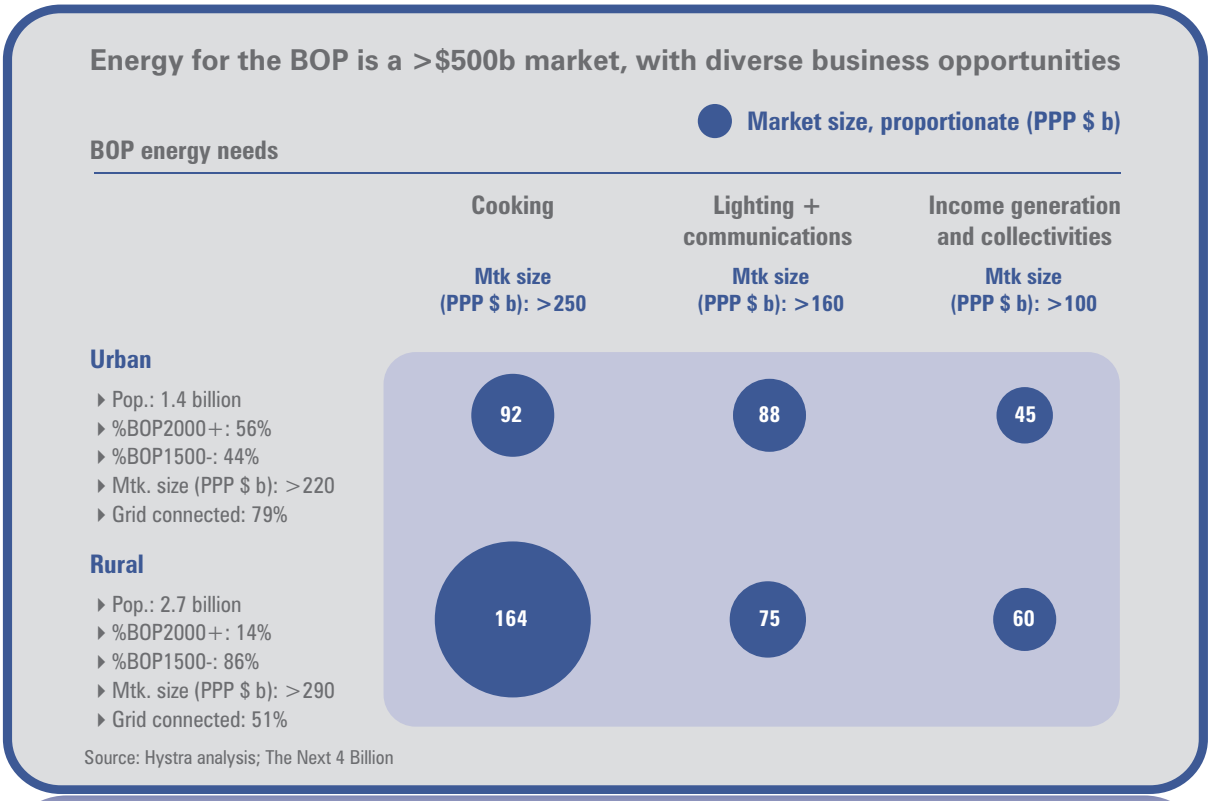


Figure 3 *Energy market for BOP customers*

Serving low-income customers is challenging, as the market is fragmented and immature. Energy is needed for lighting, cooking, and income generation. Within these categories, solutions differ based on whether customers are rural or urban, working at home during the day, mobile during the year, and a number of other factors. There are high costs for first entrants as they overcome the false promise of free government help, and work to construct multiple stages of a value chain-training staff, educating investors, promoting the new solution through social marketing, and setting up consumer finance schemes.

Although the need is great, public investment programs have been mostly unsuccessful to date. There are notable exceptions: South Africa almost doubled electricity access in less than 10 years. However, most developing countries are more similar to the case of India, which has met only ~50% of its

electricity generating targets over the last decades due to bureaucracy, inefficiency, and low investment. As half a million people migrate to cities each week, 1b people live in slums, and rural areas remain in the dark after sundown, it becomes increasingly untenable to count on ways that have not worked.

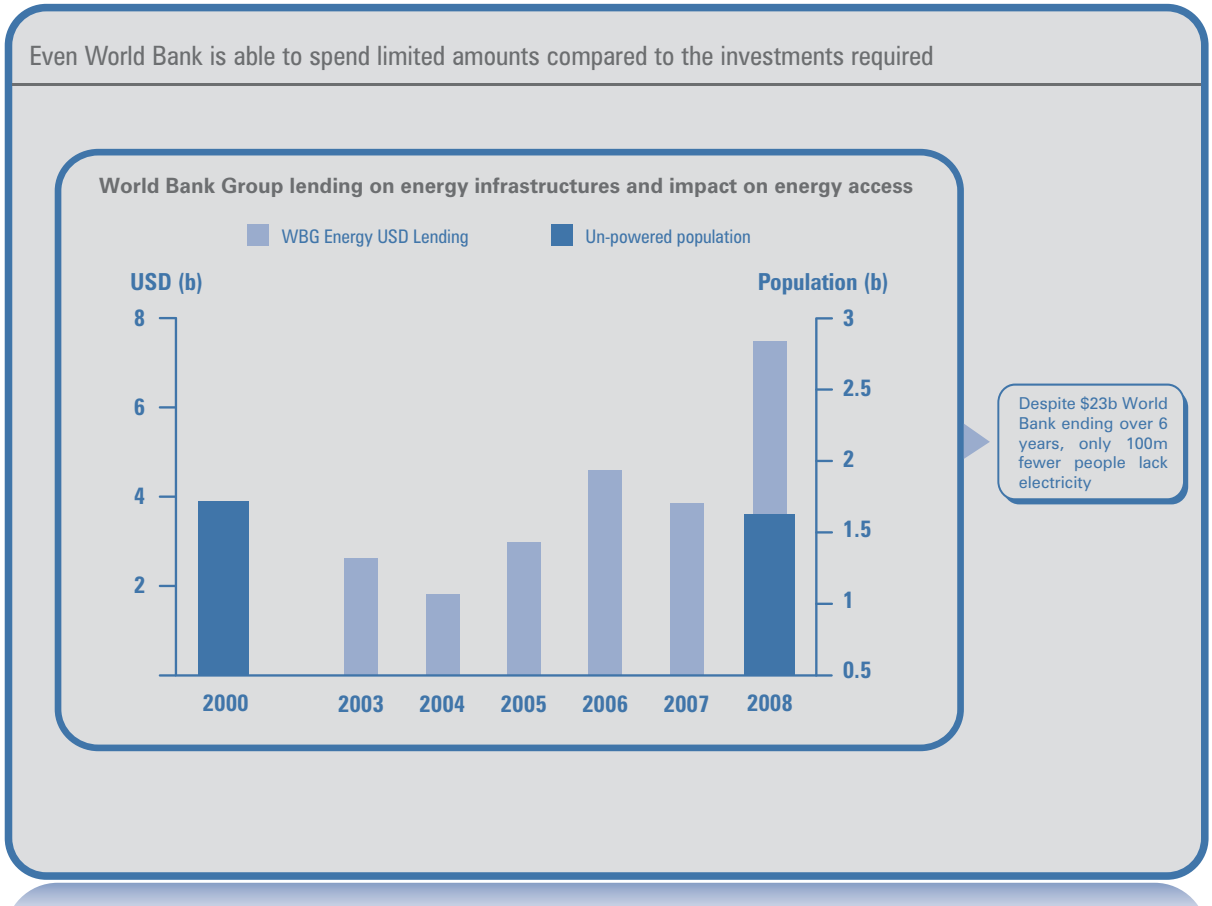
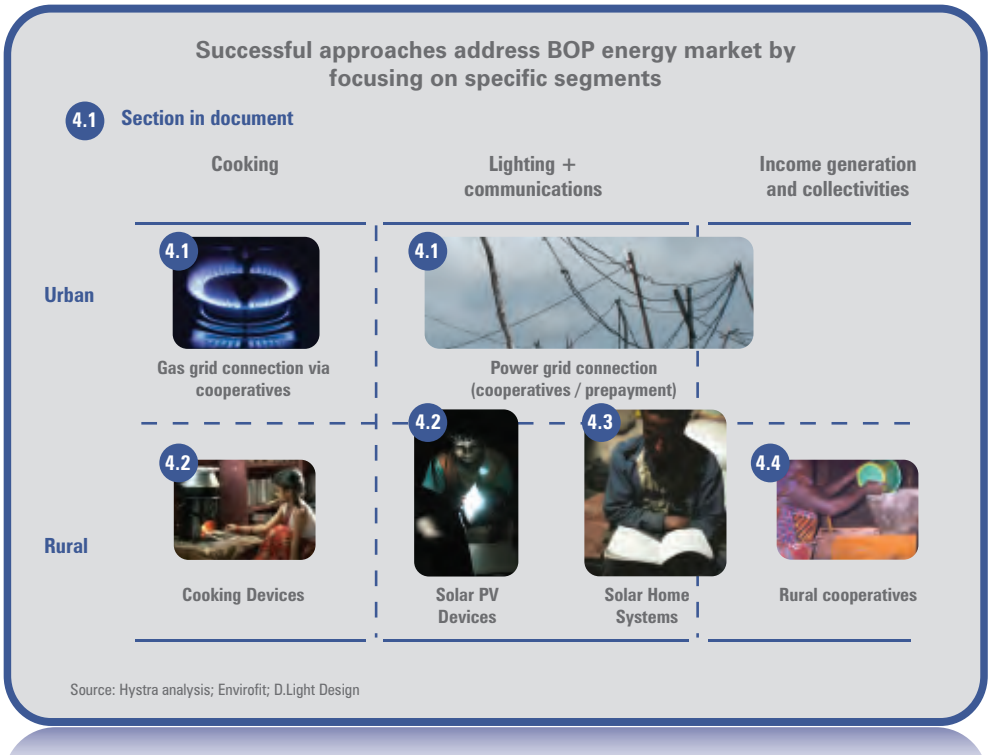


Figure 4 *World Bank Group lending compared to number of people without electricity*

4. PROMISING MARKET BASED APPROACHES FOR ACCESS TO ENERGY TO THE BOP

Social entrepreneurs and multinational corporations alike have experimented with market-based solutions to the challenge of access to energy. A scan of market-based initiatives in early 2009 found 138 projects in 40 countries. These initiatives cover the range of needs, including cooking, lighting, communications, and income generation. They promote a humble cookstove, or a sophisticated hydro plant. Customers are rural households far from the grid, slums households without legal energy connections, or urban households with unreliable, legal energy.

In the face of this diversity, successful energy entrepreneurs focus on a specific segment distinguished by need and location.



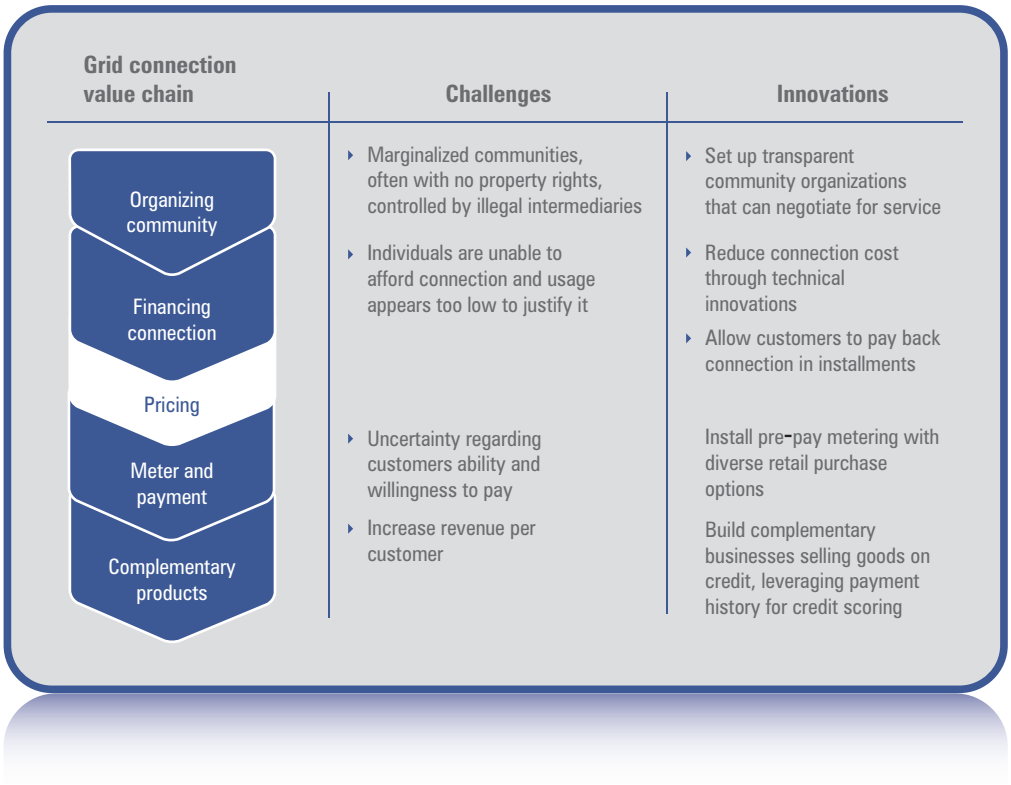
For the 1b people living in slums, grid connections through technology or social organization offer large-scale access to safe, reliable, affordable energy. Rural households look for devices like cookstoves and solar lanterns, solar home systems, and rural cooperatives to tie energy access to income generation. Some urban consumers with unreliable grid supply also turn to cookstoves and solar products for a secure source of energy.

From these solutions a pattern of innovation emerges. Energy entrepreneurs move from grant-based funding to commercial viability over time, in recognition of the fact that building a new market takes more time and effort than one enterprise can recoup. In their working model, energy entrepreneurs often employ hybrid strategies that combine the resources of the citizen sector and the business sector. Citizen sector partners move into new roles in designing, marketing and distributing clean energy solutions, and in doing so strengthen the economic viability and social impact of energy enterprises. The market-based solutions profiled below are not incremental improvements on previous programs. Rather, they aim for systems-changing solutions to provide access to energy to low-income people.

4.1 GRID CONNECTIONS

Transforming slum dwellers into attractive customers through business model and technology innovations

The picture most people know of slums is shacks, open drains, crowded lanes, and tangles of wires on teetering poles. Utilities have grown resigned to sizeable non-technical losses, and stolen power drives up the price that formal customers pay. Slum residents live with dangerous connections, and most people receive unreliable energy at a higher price per unit than more wealthy customers.



The challenges of grid connections in slums are many. As with any business that serves low-income people, slum grid connections face low purchasing power and complexity of collecting payments. In addition, residents often have no property title, which is a common pre-requisite for installing a connection or enforcing a bill. There are illegal intermediaries who make money reselling in slums. Finally, it requires a mentality shift from thinking of poor people as a source of loss to thinking of them as customers.

Over the past 10 years, more hopeful stories have emerged. Enterprises in Khartoum, Casablanca, Buenos Aires, or Bogotá have connected poor residents to gas and electricity grids profitably, and to the great satisfaction of their new customers. Moreover, these businesses are financially viable and deliver significant social impact for their clients. The new ideas profiled in this section include:

- Using community associations to leverage the power of organized residents
- Employing pre-pay technology to reduce losses and increase convenience
- Building complementary businesses based on payment history

Today more than 1b people live in slums.[9] This number grows by 500k a week.[10] The solution to grid

9 Report Reveals Global Slum Crisis; BBC News, 16 June 2006; http://news.bbc.co.uk/2/hi/5078654.stm#slums

10 Press Release on UN-HABITAT State of the World's Cities Report 2006/2007

connections will provide safe, reliable energy to poor residents, and a remarkably well-tested and profitable business to those willing to take up the challenge.

Reliable, safe, and legal grid connections for slum residents

The strategies employed by grid connection enterprises fall into three categories: community associations; employing innovations in pre-pay technology; and building complementary businesses.

Both LYDEC in Casablanca and Provivienda in Buenos Aires developed community-based solutions. LYDEC connected 75% of slum residents in Casablanca legally to the electricity grid with a solution affordable to customers down to BOP1500. This solution was designed by end-users and is managed by them: community representatives manage metering and payment for a block of 20 people. If one bill is late the whole block is disconnected; 98% of bills are paid. Connected slums enjoyed 17% increase in commercial activity, at about the same price as an informal connection. Provivienda also built a community trust fund and a diverse collection of partners to bring piped cooking gas to poor communities in Buenos Aires.

When Khartoum's utility was $70m in debt because of non payments from official customers, it turned to Conlog's pre-payment system. These innovative pre-pay meters are installed in houses and apartment buildings. Customers purchase tokens at retail outlets, utility stores, or even over their cell phones. Now over 1m pre-pay meters are installed in Sudan and all new meters are pre-pay. In this case, the initial purpose was to collect payments from existing customers, but the system also enables the utility to connect new users. However, technology by itself is not sufficient. The utility still had to convince those who had not been paying about the benefits of doing so in order to reduce resistance to this new business model.

Codensa, the Colombian electrical utility (and subsidiary of Endesa) could not increase its customer base in Bogotá due to government restrictions on market share. Codensa realized that the poor were not spending on electricity because they could not afford to buy electrical appliances. In response Codensa built a complementary business to offer household credit so customers can purchase electrical appliances and pay back over time with amounts included in their electricity

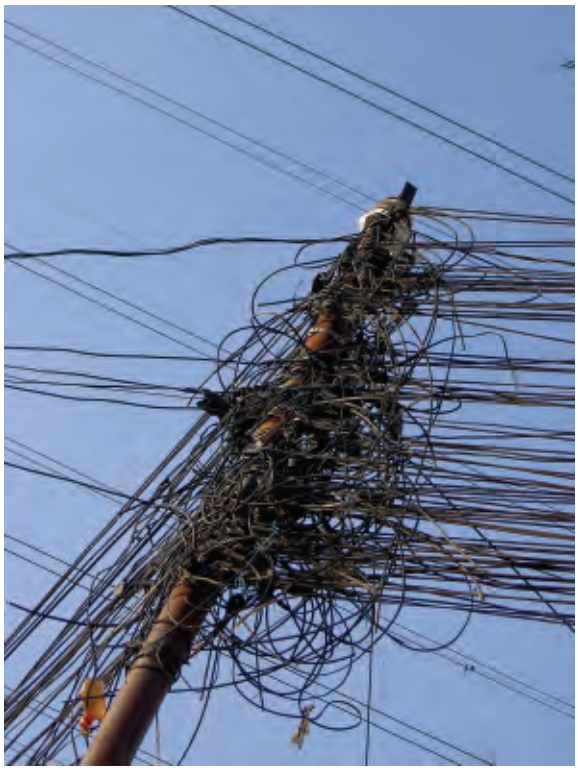


Figure 5 *Electricity pole in Colinas, Sao Paolo, Brazil*

Figure 6 *Crew working outside Buenos Aires*

bill. Prevented from growing its customer case, Codensa was able to increase revenue per customer. The credit offering was so successful that Codensa then offered magazine subscriptions and classifieds for sale. Codensa now covers 31% of the market for electronic appliances in Bogotá.

A utility has two competitive advantages when it comes to consumer finance:

- It has a database of payment history with which to do an accurate credit scoring
- It can invoice and collect small amounts at a very low marginal cost by including them on the electricity bill

Benefits of grid connections are significant. Provivienda's gas lines increased real income by 7%, decreased respiratory illness by 30%, and created community organization and understanding that can be used to tackle other problems. Customers paid five to seven times less for piped natural gas than they had paid for LPG. The poorest beneficiaries now pay $2 for gas instead of $50.

In Bogotá the impact on customers was due to newfound financial access; before Codensa, 66% of customers had no bank relationship.

Profitable and growing businesses, not using subsidies

Four grid connection enterprises profiled have reached profitability and continue to grow. This profitability is due to a variety of factors. Reduced losses, in the case of LYDEC and Conlog, revenue from newly formalized customers, in the case of Conlog, LYDEC and Provivienda, and increased revenue from existing customers, in the case of Codensa.

Interview

Gabriel Lanfranchi runs the Fundacion Provivienda Social program that connects Buenos Aires low income people to the gas grid.

Gabriel, what is the most important factor to connect low income areas to the grid?

The community must be highly involved, from the beginning of the project. They have to participate in the design of the offer and be associated to the management of the program as much as possible.

This allows us to find local project sponsors who will convince their neighbors to subscribe to the scheme. And local ownership is the best way to guarantee that people will pay and take care of the infrastructures. On top of that, this is an amazing opportunity to reinforce the links within the community.

Figure 7 *Stand promoting Codensa credit program in local supermarket*

Before 1999, LYDEC experienced a loss of $1.4m p.a. and power shortages for non-slum customers. The block organizing method eliminated the losses, improved LYDEC's reputation, and resulted in a gross profit of $400k for the program. This was due to reduced losses from old customers, as well as introduction of new customers. The block representatives made about $270 a month through this work. All funding was provided internally, the connection was paid back, and no subsidies were required.

Conlog's client, the National Electricity Corporation, was facing a debt of $70m due to inability to collect bills. Although the pre-pay meters cost more than traditional meters, they recover this cost in about nine months. There is no extra cost to customers, and the utility is no longer in debt.

Grid connections are also a method to gain new customers. Provivienda established a community trust fund to manage the installation and payment of informal residents outside Buenos Aires. It received an initial investment of $1.7m from the World Bank and FONCAP. This investment has been paid back with savings the families realized. Provivienda has secured funding to reach 10k more families. Partners are excited about this channel to learn about low-income consumers.

Faced with a cap on market share, Codensa successfully grew revenue and provided a unique service to a low-income customer base. Codensa turned an intimate knowledge of payment history into a profitable business line providing household credit. Average revenues from the 550k credit clients rose approximately 40% and represent 7% of total revenue. While serving low-income people, the default rate of 2% is at the banking average. Codensa is outsourcing credit assessment, and is considering moving into other household products such as construction materials. Promigas, another Colombian utility that provides gas, has replicated a similar initiative that is now providing over 200k customers from the lowest income level with credit for electronics and home improvement products. It is already profitable after launching only in 2007.

Scalability depends on regulatory environment and ability to manage partners

The cases profiled below demonstrate how grid connections are a promising market for distributors, companies that serve utilities, and consumer product companies looking for untapped markets.

In order to take advantage of these innovations, certain conditions for success apply:

- Residents must be able to access the grid without a formal title
- Community organizations to help aggregate and articulate resident needs

Figure 8 *Girl in Colinas favela, Sao Paolo, Brazil*

- Grid must be able to handle the increased load
- Utility must acquire new skills such as risk administration for credit allocation (as with Codensa), or managing a retail distribution chain (in the case of Conlog's credits)

As the example of Delhi's Slum Electricity Cooperatives illustrates, a certain amount of political will is required on the part of the utility and municipality in order to attempt a new way of working. Finally, leaders of grid connection enterprises emphasize that the most important thing is that the community takes ownership. The community must be defining, supporting, and refining the service; otherwise, it does not work.

The cases discussed below illustrate that community associations, pre-pay technology and building complementary businesses enable companies to connect poor people to the grid in a safe, affordable, and profitable manner. These innovations have largely come about one at a time as a response to unfavorable market conditions. It remains to be seen what will be accomplished when these innovations are pro-actively combined to bring access to energy to the 1b poor people in slums.

CASE STUDY		PRODUCT	PAGE
	LYDEC	Gas grid connection	23
	Provivienda	Electricity grid connection	25
	Slum Electricity Cooperative	Electricity grid connection	27
	Conlog	Pre-pay electricity meters	29
	Codensa	Consumer credit through electricity bill	31

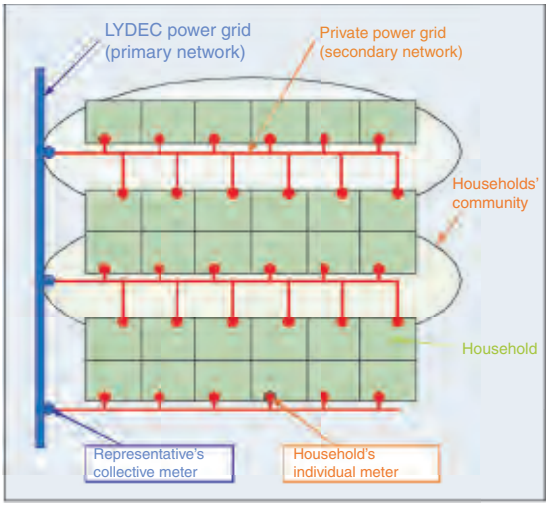
LYDEC
Legal slum grid connection in Casablanca
Morocco

Executive Summary:

In 1999, LYDEC decided to electrify 30k households in Casablanca slums to eradicate the fraud that caused power shortages in its network. Overcoming regulatory, technical and operating issues, the project connected 75% of Casablanca slum households within 5 years, thanks to 1.3k community representatives in charge of 20 household blocks. The operation required a limited financial investment from LYDEC (paid back by beneficiaries over a 3-year period), is viable and saves the utility the $1.4m previously lost due to fraud. Replication of such a model in other geographies requires available power supply, adapted regulatory framework and strong collaboration with local community.

Project basic information

- **Date of creation:** 1999
- **Main products delivered:** 220V, 15Ah legal access to grid power for domestic use
- **30k slum households served at end 2004** (=75% penetration of estimated market)
- **Company:** LYDEC (a GDF Subsidiary owned at 51%), Casablanca power distribution company since 1997
- **Internal leadership:** slum electrification working group reporting to top management
- **HR:** dedicated LYDEC team and 1.3k customers representatives
- **Community based power delivery:**
  - LYDEC: builds primary (public) and secondary (private) grids, sells electricity to representatives based on collective meters
  - Representatives: intermediates between LYDEC and 20 individual end-customers (one block), resell power and gather monthly payments based on individual meters
- **Social marketing scheme:** participative involvement of end-customers to define adapted service requirements and secure their buy-in



Slum electrification 2 layered network: LYDEC's owned network in blue, private community network in red

Project ability to solve the problem ★★☆

- **Problem and magnitude:** before 1999, most slums households had a fraudulent access to grid, resulting in expensive and unreliable power
- **Estimated to reach BOP1500:**
  - Initial grid connection (with financing): $5.5 monthly payments over 3 years
  - Post-paid billing: $0.11 / kWh + $1 for meter rental (social tariff)
  - ~$15 monthly bills, comparable to previous spending for a better service
- **Needs addressed:**
  - Households power applications (from lighting to fridges and satellite TV)
  - Business and income generation applications
- **Sustainability:**
  - High recovery rate (98%): if one household fails to pay, the whole block is disconnected
  - Fixed maximum retail price guarantees fair price for end-customers
- Impact (measured through GRET report):
  - Fraud eradication
  - +17% commercial activity in connected slums
  - +70% color TV and +50% fridges equipment

Project economic viability ★★★

- **Profitable for LYDEC:**
  - Before 1999, fraud caused $1.4m losses p.a. (incl. anti-fraud measures) and power shortages for non-slums users
  - Program's gross margin (2004) = $400k covers operative expenditure
  - Technology optimization reduced connection costs from $350 to $170 per client - affordable for end-user with no financial risk for LYDEC
  - Positive impact on brand image (LYDEC is recognized as a pioneering social firm)
- **Remunerative for representatives:**
  - Purchase at $0.10 and resells at $0.11 to $0.12 per kWh
  - Est. net monthly income = $270
- **No use of subsidies were required at all**
- **Ability to attract funding:**
  - Power network CAPEX required approx. $4m, financed at 94% by customers
  - LYDEC ensured funding needs internally

Project scalability ★★☆

- **Regulatory barriers due to absence of property rights must be overcome:**
  - Create "temporary and dismissible" contracts
  - Commit to be able to uninstall the whole network within 24h to get governmental clearance
  - Sell power to a representative who "retrocedes" it, since slum dwellers cannot be invoiced
- **Technological issues:**
  - Necessary adaptation of electrification standards in order to reduce installation cost by more than 50%
- **Operating issues:**
  - Reliable representatives required to overcome individual customers identification and billing issues and reduce operating costs
- **Power availability:**
  - National power supply is sufficient in Morocco to take additional slum consumption

Sources: Hystra analysis; GRET report: "L'accès au service électrique dans les bidonvilles de Casablanca", 2005

FUNDACION PRO VIVIENDA SOCIAL
Natural gas grid connection
Argentina

Executive Summary:

In 2000, Fundacion Pro Vivienda Social (FPVS) started a pilot project aimed at connecting Cuartel V suburb of Buenos Aires to the natural gas (LNG) grid. As connection financing is the main bottleneck, FPVS managed to mobilize the community, convince enough families and coordinate multiple stakeholders (social investors, the gas utility and the gas line constructors) around the creation of a Trust Fund. This fund, owned by the 3k connected families, was built on a $1.7m development fund loan and a World Bank Award. Thanks to 80% saving versus previous LPG spending, grid customers can afford to reimburse this loan through the gas bill. Although the poorest families are facing difficulties in financing their connection, the project can be replicated throughout South-America, as there exists an abundance of metropolitan areas eligible for grid building.

Project basic information

- **Date of creation:** 2000
- **Product / service delivered:** LNG grid connections in Buenos Aires
- **Pilot project customers:** 3k urban families (reaching the 70% adhesion goal)
- **Scale-up targets:** +10k families in 4 new communities by 2013
- **HR:** 38 staff, 78 volunteers
- **Partners involved:**
  - Project leadership and trust fund administrator: FPVS
  - Promotion and community building: Comunidad Organizada
  - Social investors: FONCAP, World Bank
  - Gas network construction: Gigas S.R.L.
  - Gas supply and invoicing: Gas Natural
- **Operational mechanisms:**
  - FPVS train neighbors and convinces construction companies, banks and LNG distributors about the viability of the project
  - Comunidad Organizada convinces families (50% of community required to start) to commit on connection payback upon gas arrival
  - Gas beneficiaries own the trust fund
  - Gas Natural collects payments for gas consumption and repayment of gas connection on behalf of the trust fund
- **Marketing & promotion scheme:** Promoted by neighborhood organizers

Provivienda community: Cuartel V in Buenos Aires

"We believe that a successful strategy for moving these families out of poverty involves building ties between their isolated community and the rest of Buenos Aires... and the gas grid is a perfect tie"

"FPVS role is to let investors decrease their risk-premium while allowing the neighbors to better organize in order to save money and fulfill their financial obligations."

Gabriel Lanfranchi
FPVS Planning Manager

Project ability to solve the problem ★☆☆

Gas network infrastructure building

A drawing made by a 10 years old girl who attended school in Cuartel V

- **Problem and magnitude:**
  - 3m people lack gas grid connections in Buenos Aires metropolitan area
  - Too high transaction cost to connect underserved areas: lack of credit and high risk level perceived by utilities
- **Down to BOP2500 served:**
  - Average saving from shifting to the gas grid: $14
  - Minimum $14 per month (on 10 years) to pay for the grid connection
- **Addresses cooking and heating needs**
- **Sustainability:** 4–6% default rate (lower than Gas Natural average)
- **Measured impact for the community:**
  - Creation of **trust** and **social capital**
  - Future Trust Fund surplus to be reinvested in development projects in the area
  - **100 local jobs** created
  - **30% decrease** in respiratory illness
  - **10% increase** in property value, more than invested in LNG lines
  - **Greater spending** in local business such as masonry, home improvement, etc.

Project economic viability ★★★

- **Viable trust-fund financing:**
  - Net investment of $1.7m (loan from FONCAP and World Bank)
  - >1.2k families finished reimbursement
  - >0 net value of trust fund from 2013 onwards will benefit to the community
- **No dependence on subsidies:**
  - Banks will be refunded for their loan
  - FPVS OPEX repaid on gas spending
- **Ability to attract funding:**
  - IDB and a local bank are considering to finance $7m for scale-up
  - Ferrum/FV (leader in bathroom and kitchen fixtures in Argentina) is taking over technical office management to sell home improvements

Project scalability ★★☆

- **Specific area eligible for LNG grid connection** (relevant for many South-American metropolitan areas):
  - Excess domestic supply of LNG
  - Proximity to existing main LNG line
  - Urban area with roads and delimited properties required for grid construction (technical reasons, excluding slums)
- **Regulation:** permitted in Argentina; works as long as residents can receive LNG without property title
- **Required partnerships:**
  - Strong community organization
  - Coordination of multiple stakeholders (investors, LNG utility, ...)
- **No special technology required**

Sources: Hystra analysis; Interview FPVS Planning Manager; Changemakers.net

SLUM ELECTRICITY COOPERATIVE
Slums grid connection
India

Executive Summary:

After massive demonstrations in Delhi in 2005, Ashok Bharti managed to get the commitment from North Delhi Power Limited, the local utility, to connect three slums in the city. His idea was to delegate the management of the service to a cooperative of local users, in order to reduce the burden for the utility and to ensure the sustainability of the connection by involving the community. NDPL finally connected Haiderpur, a 5k HH slums, reducing the influence of the local mafia who used to provide electricity. However, the company finally preferred to appoint a contractor rather than a cooperative, which limits the benefits of the program.

Project basic information

- **Date of creation:** 2005, after demonstrations in Delhi
- **Service delivered:**
  - Legal connection substituting for poor and unreliable service provided by local mafia
- **Pricing:**
  - 2 different schemes
    - Flat fee
    - Metering
  - In both cases, HH pays ~Rs150 ($3)
- **Beneficiaries:** 5k HH in Haiderpur, one of the poorest neighborhood in Delhi
- **Partners involved:** North Delhi Power limited, the local utility
- **Leadership:** created by Ashok Bharti, an Ashoka fellow
- **Operating model:**
  - NDPL provides the connection
  - **Initial plan was that a local users cooperative** would handle the service
  - However **NDPL finally decided to appoint a contractor**, bypassing the cooperative

Slum in New Delhi

Ashok Bharti with Haiderpur people

ASHOKA

HYSTRA hybrid strategies consulting

Project ability to solve the problem ★★★

Ashok Bharti, Founder

In 2005, you managed to get the utility to connect slums through users cooperative. What happened then?

A. Bharti: We achieved to get a local connection for Haiderpur. But the utility had finally been unwilling to work with a cooperative and appointed a contractor.

How do you explain that?

A Bharti: Large corporations are reluctant to change their mindset and prefer keeping working as they are used to.

- **Problem and magnitude:** 200k HH get illegal, poor access to electricity in Delhi
- **Ability to serve the poorest:**
  - A large part of Haiderpur population belongs to BOP500
  - The connection is ~25% cheaper and more reliable than when it was provided by the local mafia
- **Needs addressed:** All electricity needs
- **Sustainability:**
  - Using a contractor rather than the cooperative has raised several issues:
    - Unreliability of successive contractors
    - Doubts of the population on price scheme fairness
    - Poor relationships between contractor and community affect users behaviors (e.g., material degradation)
- **Impact:**
  - No formal impact measurement
  - Reduction of tensions within neighborhood (mafia influence and troubles due to electricity shortages decreased)

Project economic viability ★★★

- **Financials:**
  - Cooperative running costs would have been covered by a very limited charge:
    - Cost would have been ~$1,000 per month (4 staff + 1 office)
    - Monthly charge of $0.2 per family for Haiderpur 5,000 HH
  - Current contractor mark up is unknown

Project scalability ☆☆☆

- **Status**: initial plan was to set up cooperatives in 3 slums but difficulties in Haiderpur discouraged scale-up
- **Regulation:**
  - A. Bharti believes that a law is required to implement his model, forcing utilities to serve slums
  - However in other countries such a law has not been necessary

Sources: Hystra analysis; Interview and meetings with Ashok Bharti (Founder)

CONLOG
Grid electricity with pre-pay metering
Sudan

Executive Summary:

Conlog pre-pay meters provide a solution to a problem many utilities face - inability to collect bills. The National Electricity Corporation (NEC) of Sudan and Conlog have installed over 1m pre-pay meters in Khartoum, which eliminated the utility's $70m debt, and provided customers with a convenient and reliable way to purchase electricity - so convenient that traditional users started demanding pre-pay.

Project basic information

- **Date of creation: 1997**
- **Product / service delivered:** pre-pay meters
- **Pricing:** price of meters is volume dependent; electricity tariff US$0.086 per kWh
- **Customers: >1m installed meters,** growing at **~150 – 200k** per year
- **Leadership:** from National Electricity Corporation and Conlog
- **HR:** meter readers retrained to install pre-pay
- **Partners involved:** NEC and Conlog
- **Operational infrastructure and mechanisms:**
  - NEC installs and maintains meters
  - Customers purchase credit tokens at utility office, local stores, or on mobile phone
- **Marketing & promotion scheme:**
  - Initial target customers were utility staff and high ranking officials, to demonstrate quality
  - Due to convenience of bills and paying, customers without pre-pay started to demand it
- **All new meters are now pre-pay**

ASHOKA

HYSTRA
hybrid strategies consulting

Project ability to solve the problem ★★★

- **Problem and magnitude:**
  - NEC had a debt of $70m due to inability to collect payment from users, mainly government offices and officials
  - For customers, 1b people live in slums, often without regular, safe connection to electricity
- **Needs addressed:**
  - For **utility**, ability to collect payment for electricity
  - For **customer**, safe and regular electricity without confusion of irregular and incorrect bills
- **Ability to serve the poorest:**
  - Pre-pay meters are used in South Africa to dispense government allocation of 50 kWh/month to poorest resident
- **Sustainability:** maintained through utility
- **Impact:** very high satisfaction rate from customers and from utility

Project economic viability ★★★

- **Financially sound for utility:**
  - Pre-pay meter is more expensive than traditional meter, but utility can recoup this difference within 9 months
  - Utility is no longer operating in debt
  - No extra cost to customers
- **Dependence on subsidies:**
  - No subsidies for utility or clients
- **Ability to attract funding:**
  - Conlog was acquired by Schneider Electric in 2000, indicating confidence in business model of pre-pay electric services
  - Company has undertaken NGO funded projects i.e. World Bank initiatives

Project scalability ★★★

- **Market conditions for success:**
  - Very important to educate customers about benefits of safety and quality, as people who are used to free power will resist paying
  - Scalability is not threatened by grid expansion or subsidies
- More than **5m** meters installed in 20 countries
- **Staff:** does not require specialized skills
- **Infrastructures & services:**
  - Requires rapid installation of meters
  - Flexibility and access is crucial in retail channel – e.g., POS, cell phone service,
- **Partners:** requires active utility with strong relationship with customers, and very strong retail distribution network, which Conlog consults on
- **Access to technology:** Standard Transfer Specification for prepayment is the world's only standard for prepayment – any company or country could utilize.

Sources: Hystra analysis; Interviews with Conlog

CODENSA
Slum Electricity grid connections
Colombia

Executive Summary:

Codensa, a Colombian subsidiary of Endesa utilized its unique knowledge of 6m transactions each month to dramatically increase its revenue per customer. For its 550k BOP customers it offered microcredit for electrical appliances and other household items. This grew average monthly operating income from targeted customers from $23 to $32. The consumer credit business experiences less bad debt than the banking sector average.

Project basic information

- **Date of creation:** 1997
- **Product / service delivered:**
  - Credit (up to 4 times monthly income) to purchase electric appliances, insurance, magazines and classifieds
  - Repaid through electricity bill
- **Customers:** 550k clients from the lowest income strata
- **Leadership:** General Manager: Cristián Herrera
- **Partners involved:**
  - 18 retailers (Alkosto, Carrefour, Makro)
  - Over 120 electric appliance manufacturers (LG, Samsung, Sony, Microsoft, Motorola, Nokia, Phillips, Black & Decker)
  - Insurance (Mapfre)
- **Operational infrastructure and mechanisms:**
  - Credit scoring and bad debt collection outsourced to specialized agencies
  - Delivery of products through retail partners
- **Marketing & promotion scheme:**
  - Advertises through retail partners, in Codensa catalogue sent to clients, and on electricity bills

Stand promoting the Codensa Hogar credit card

Project ability to solve the problem ★★★

- **Problem and magnitude:**
  - Codensa operating in highly regulated environment that capped market share at 25%
  - Customers unable to access credit; 66% of clients were not bank users as they lacked official ID, proof of income or credit history
- **Needs addressed:**
  - For **utility**, ability to increase revenue in regulated environment
  - For **customer**, ability to purchase assets and build credit history
- **Ability to serve the poorest:**
  - 90% of Codensa Hogar clients in lowest 3 income strata
  - Program reaches at least BOP2000
- **Sustainability:** Default index at 90 days: 2.06% (vs.2.01% average banking; 3.5% credit cards)
- **Impact:**
  - Program gives access to a wide range of product and services, including computers and insurance
  - 45% of clients previously without formal credit got access to new financial services

Project economic viability ★★★

- **Profitable line of business:**
  - Program is more profitable than Codensa's mainstream business: generates **7% of company revenue** and **9% of EBITDA**
  - Average revenues coming from the 550,000 Credito Facil clients **rose approximately 40%** representing an **additional USD 54 million** in 2006
  - From Sept 2006 to Sept 2008 **EBITDA has increased from 41.7% to 43.4%;** net margin has **increased from 17.0% to 19.2%** in environment of capped market share
- **No use of subsidies**
- **Ability to attract funding:**
  - Continues to be financed through company and earnings

Project scalability ★★★

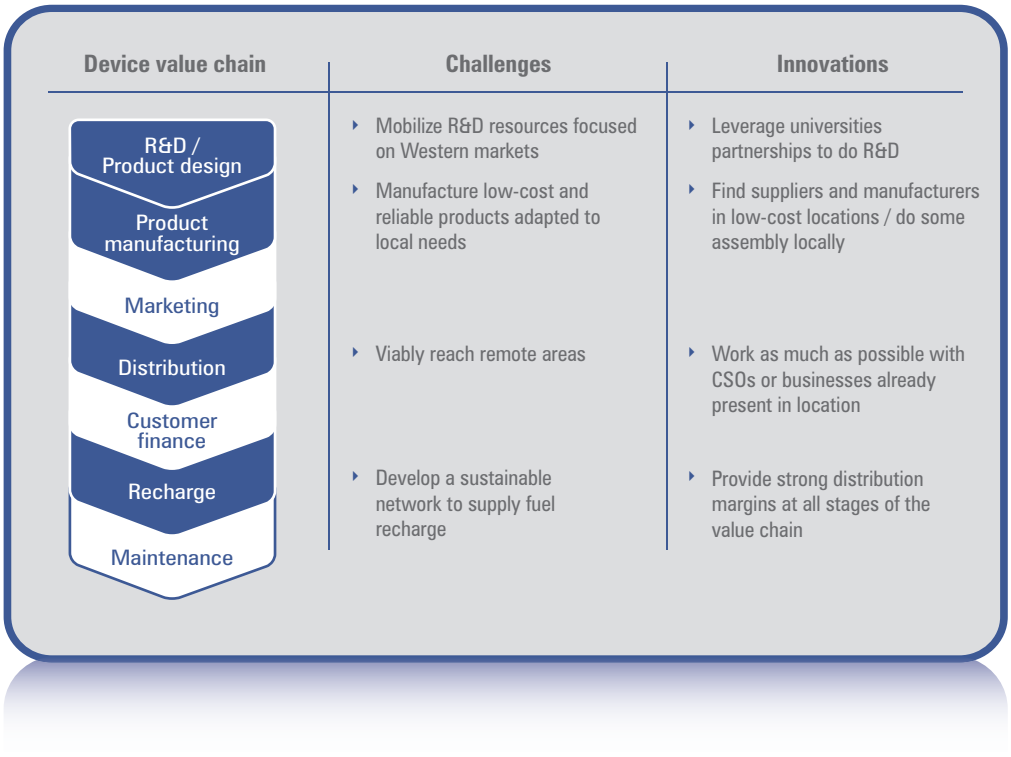
- **Client base in Colombia:** 2m people in lowest 3 income strata
- **Market conditions for success:** Utilities must build new skills around credit
  - **Risk administration** for BOP customers
  - **Commercial retail and brands integration**
  - **Operational efficiency** in massive credit allocation
- **Partners required:**
  - Retailers
  - Electric appliances
  - Specialized credit rating and debt collection agencies

Sources: Hystra analysis; interviews

4.2 DEVICES

Providing
mass-market devices
to cover basic needs

The simplest solutions are sometimes the most significant. A humble cookstove or a solar lantern makes a world of difference to someone breathing over a smoking fire, or reading by the timid flame of a dangerous kerosene lamp. Distributed devices such as efficient cookstoves and solar lanterns emerge as an immensely powerful solution already enjoyed by hundreds of thousands of people. These mass-market devices are affordable by the poorest of the poor. The challenge is making them accessible for the 3b people who still cook over biomass or 1.6b without electricity.



Recent innovations in distributed devices have reduced the cost of components and manufacturing, built reinforcing business models that employ local people, and leveraged citizen sector organizations to distribute effectively. D.light Design's founders Sam Goldman and Ned Tozun call it designing for the other 90%. Usually, R&D budgets are directed to the wealthy minority of consumers. When the majority world becomes the priority, solar lanterns or efficient cookstoves are the result. These devices display consideration of the needs and desires of low-income consumers. Successful devices are high value and low cost, and include details such as a plug that allows users to charge a mobile phone off a solar lantern.

A Mightylight, Cosmos pioneering solar LED lantern

A typical Solar LED lantern contains:

- A small solar panel (0.5-2.5W)
- A bright LED light (upto 400 Lux)
- A replaceable battery storing >10 hours of light

Options may include:

- Multiple bright settings
- Battery level indicator
- Mobile charger

A BP Oorja stove

Efficient and clean cookstoves can rely on various fuels and technologies:

- Wood and unprocessed biomass burned in an improved combustion chamber
- Processed agricultural residuals catalyzed in a combustion chamber stirred up by an electric fan
- LPG or plant oil burned with a burner
- Solar energy heating a cooking chamber

The growth trajectory of mass-market devices is impressive. BP has reached 350k customers with its Oorja cookstove, which launched only in 2006, and created over 6k direct and indirect jobs. Envirofit had sold over 50k efficient cookstoves by the beginning of 2009, expects 200k customers by the end of the year, and aims for 10m by 2012. Cosmos and D.light have both sold tens of thousands of solar LED lanterns, and have large ambitions. Efforts are apparent to make LPG devices accessible to the BOP, as Vidagas is doing for small enterprises in Mozambique. In Bangladesh, Totalgas is exploring how to bring LPG to the homes of customers using mobile distributors.

Despite these promising developments, mass-market devices struggle to find the distribution channels that would allow them to reach the potential market. Low-income communities, at least in the rural context, suffer from a lack of retail distribution channels. Device makers struggle to find distributors who could handle inventory control, provide maintenance, or float working capital. Envirofit and BP created distribution systems in India for their cookstoves. This strategy was successful at moderate quantities but becomes increasingly onerous at scale. Although taking on multiple stages of the value chain is a common business strategy, such vertical integration is a challenge in low-income markets. The expertise required to manufacture a solar LED lantern does not necessarily translate to building a distribution channel, and it is difficult, time-consuming and expensive to be an expert on multiple fronts. Still, new entrants such as protos keep coming - and protos is building a plant in Indonesia that can manufacture 50k efficient cookstoves, which is a strong sign of commitment to this market.

In addition to distribution bottlenecks, device makers face challenges common across BOP businesses. These include periodic subsidies or the promise of free help, local preference for the status quo, especially regarding such personal practices as cooking, and the need to form complex partnerships to overcome all of these barriers.

With a global market of billions of people, device companies expect to break even in coming years. They continue to receive social investor funding, demonstrating confidence in the impact and scalability of the mass-market device business model.

Figure 5 *Envirofit cookstove*

Allows the poorest to cook, light homes, work, and protect health

3b people cook on traditional biomass, and every year, 1.6m people die as a result of indoor air pollution. Collecting firewood and cooking on traditional stoves can take 3 hours a day, mostly from women and children, and it degrades the local environment. 1.6b people don't have access to electricity, and rely on unhealthy fuels such as kerosene for lighting. Lack of modern energy also hinders development goals such as health care as vaccines and medicines can't be kept cold.

An efficient cookstove allows the poorest to cook with convenience and safety. BP Oorja users purchase pellets made by local entrepreneurs out of agricultural waste. The BP Oorja cookstove reduces toxic emissions by 98%, reduces fuel consumption, and takes preparation and cooking time down to 40 min a day from 3 hours.

The Envirofit stove operates with traditional fuel such as wood, but reduces fuel consumption by up to 50%, cooking time by 40%, and toxic emissions by up to 80%. The Envirofit cookstove costs $17 and the BP Oorja cookstove costs $14 upfront and $0.40 a week for pellets; both are expected to last over five years. At these prices cookstoves are affordable by the BOP500, the poorest level.[9]

Figure 6 *Improved air quality with clean cookstove*

Novel mass-market solar lanterns allow low-income consumers to charge mobile phones and secure light for education, working, and fishing, at a cost of $10 to $45. High energy efficient light emitting diode (LED) technology means these lanterns are cheaper, last longer and require less energy than with traditional or CFL bulbs. LED lighting is eight to ten times brighter than kerosene, and does not cause a gas or fire risk. At this price, solar lanterns are affordable for the BOP500; some companies also provide microfinance for the poorest customers. The cost savings compared to previous sources recoup the expense in about 8 months.

Energy means health in places like rural Mozambique, where Vidagas distributes LPG cylinders to health clinics, restaurants, and increasingly households. Vidagas ensures a cold chain between 2 and 8°C over the "last mile" to clinics. Since 2002 there has been a 27% increase in childhood vaccination. For BOP3000+ families, LPG also provides a safe cooking alternative to wood or charcoal. LPG is affordable to small enterprises that serve the BOP, such as clinics or businesses, but is not affordable to BOP individuals without subsidies.

Interview

Avik Roy is running Access, a distribution company in the state of Maharashtra, India and is a Hystra network partner.

Avik, what is the main challenge to spread cookstoves and lanterns to the BOP?

These products now need to find their way to the remotest areas and social marketing and distribution are both tough challenges. This means setting up a supply chain and finding the right people to sell them in every village. And you have to convince customers to change their habits, for instance to use enhanced cookstoves. This is a challenge but also a fantastic opportunity to build local entrepreneurs.

Do you think rural distributors are going to take on the challenge?

Yes, this additional business is very attractive for rural retailers, even those currently selling FMCG or commodities.

9 Please see pg 89 for an explanation of the BOP income levels

Enterprises on the way to being profitable

With low prices, high demand, and continuing innovation to drive down cost, mass-market energy devices promise to be a financially rewarding business with significant social and environmental benefit. All the enterprises profiled in this section are structured as for-profit companies. The leading entrepreneurs expect to break even in the next few years. In addition, the business model offers strong margins at each step of the value chain, which aligns incentives of all players and drives expansion. BP Oorja's model employs a 'razor and blades' approach by selling the stove slightly below cost and making it up with a 10% gross margin on the pellets.

The promise of mass market energy devices has been seized by investors. D.light has raised $6m in investment capital, most recently $4.5m in Series A financing from 6 investors including Acumen Fund and Nexus India Capital. Envirofit's initial $3.5m funding came from the Shell Foundation, but it expects to be self-sustaining by 2010 for all elements of the business. This initial status as a citizen sector organization (CSO) has assisted relationships with the government and the citizen sector.

One way to reach low-income customers more effectively is to partner with a citizen sector organization (CSO). Social entrepreneurs often have incomparable knowledge of BOP markets. BP Oorja works with CSOs to distribute the cookstoves, train local entrepreneurs to make the pellets, and expand to new regions. Cosmos works with CSOs and microfinance institutions, and has built a network of micro-franchised village entrepreneurs with "energy kiosks" as a distribution network. CSO networks prove to be highly efficient to acquire customers and expand the reach of distributed devices.

Interview

Matthew Scott is co-founder and director of Cosmos Ignite, an Indian based company selling Solar LED lanterns

Cosmos has been one of the first movers on solar LED lanterns. What are the key success factors in this market?

Providing good quality products with good maintenance and after sales service is key for sustainable success. For instance, customers should be confident that they will find a replacement battery and that they will be able to afford it. Further, success will come to those with the right customer micro-finance and last-mile distribution partners.

What prospects do you see for this market?

It is an un-explored territory and an exciting market. In our case, after wide-spread pilots across market segments such as children, fishermen, farmers, and crafts-persons we are now ready for rapidly scaling-up with a standardized process. Our latest version of the MightyLight delivers more than four times better brightness and costs 60% less. We have put in place key partnerships on the distribution side and are now able to help village entrepreneurs set up micro-energy kiosks. We expect that the micro-finance market will continue to develop and boost affordability.

Global market of billions of customers requires distribution partners

The aggressive goals of device companies and their success acquiring financing testify to the scalability of distributed devices. Market experience indicates that poor customers recognize that the time they save and the ability to work at night translates into income. They are willing to invest and usually highly satisfied with their new devices. Unlike more expensive solutions, these devices don't always require microfinance, which greatly expands the potential customer base.

Figure 7 *BP Oorja marketing*

For solar LED lanterns and cookstoves, entering a new market requires:

- Local management
- Market research
- Distribution partners such as CSOs, MFIs, and local retailers

LPG supply chains present a more complicated case for scale up. As Vidagas experienced in Mozambique, infrastructure difficulties such as poor roads cause great difficulties transporting LPG. In addition, Mozambique has insufficient domestic LPG storage plants.

As with any new product, distributed device entrepreneurs must educate consumers about the benefits of changing their behaviour and trusting in a new and unfamiliar way of living. This requires diligence, creativity, and abundant patience. With 3b people relying on unclean fuels for cooking and lighting, innovative companies are placing their bets that the distributed devices market is ready to take off.

See the following pages for detailed cases:

CASE STUDY	PRODUCT	PAGE
BSH protos	Cookstoves	39
BP Oorja	Cookstoves	41
Envirofit	Cookstoves	43
Cosmos Ignite	Solar LED Lanterns	45
D.light	Solar LED Lanterns	47
Total LPG Mobile Retail Dealers	LPG stoves	49
Vidagas	LPG stoves	51

BSH PROTOS
Plant Oil Stove
Indonesia and The Philippines

Executive Summary:

In 2004, BSH (Bosch und Siemens Hausgeräte) a leading global manufacturer of home appliances decided to make an investment in an innovative technology that allowed cooking with pure plant oil. This "protos" technology was tested in The Philippines, Indonesia, Africa and Latin America. The project plans to sell over 100k stoves per year by 2011. By targeting mid-level BOP customers cooking on fossil fuel or purchased biomass fuel, protos leverages BSH's competencies to tackle deforestation, indoor air pollution and CO2 emissions. Most tropical countries, with excess plant oil production capacity, are suitable for distribution.

Project basic information

- **Market launch:** 2006 (project start 2004)
- **Product delivered:**
  - Plant oil stove: tank, pump, frame, valve, fuel line and innovative burner
  - Compatibility with most vegetable oils, e.g., coconuts, jatropha, used frying oils
- **1k units sold** (test phase) in urban and rural areas (targets 10k p.a. in 2009 and >100k p.a. in 2011)
- **Project leadership:** Samuel N. Shiroff
- **BSH staff** from a variety of departments
- **Main partners involved:**
  - Original financial support: The German Environmental Foundation
  - Initial research: Hohenheim University
  - Development: Leyte State University
  - Testing and training: GTZ
- **Operational infrastructure:**
  - Upcoming distribution scheme: Partner retailers for B2C and direct sales for B2B
  - Rely on existing plant oil production and distribution infrastructures
- **Promotion & marketing:**
  - Customer trainings (with NGOs)
  - Rickshaw advertising in urban areas

Protos Generation II: >2 kW output

Protos Generation I

User training in The Philippines

Project ability to solve the problem ★★☆

How did the Protos project start?

Samuel N. Shiroff: "It started with the rekindling of a friendship between Professor Muhlbauyer in Hohenhein University who created the stove and the head of our cooking unit who wanted to take on the technological challenge of using BSH core capabilities to help some of the world's poorest families".

So BSH saw a business opportunity in it?

Samuel N.Shiroff: "The primary added value for BSH is reputational. We use our capacity as a world leader in home appliances to help reduce indoor air pollution, deforestation and climate change in developing countries. But this must also be economically self-sustaining."

Samuel N. Shiroff, Director

Jatrpha seeds

Plant oil production

- **>2.5b people are cooking on "three-stone fire-place" or kerosene worldwide:**
  - Deforestation and pollution
  - 1.6m deaths from indoor air pollution p.a.
- **Protos stove benefits:**
  - Reduced cooking time
  - No toxic smoke, 10 times less emissions than kerosene, neutral CO2 emissions
  - High temperature flame (700 °C)
  - Value-creation from local plant oil
- **Mid-BOP customers cooking on purchased biomass targeted:**
  - Approximate plant oil for 1 month: $6-12
  - Plant oil is 20% more expensive than kerosene but 50% more efficient
  - Targeted stove market price: $15-$30
- **Needs addressed:** access to modern cooking (clean, ready to use, adjustable power output) on biomass
- **Sustainability:**
  - Stove life expectancy: 4-5 years
  - Focus where oil plants don't compete with food crops

Project economic viability ★★☆

- **Project targets OPEX self-sustainability:**
  - $35 current manufacturing cost
  - $15 market price to be achieved by:
    - Mass-production, including local manufacturing (50k unit p.a. opening in Indonesia by Q3 2009)
    - Carbon credit financing
- **"7 digit" CAPEX funding** by BSH: Protos is a social business investment of which returns will mainly be in brand reputation
- **Ability to attract funding** from foundations and development agencies: partnership with 4 German and European institutions

Project scalability ★★☆

- **Market environment:** unregulated market of customers cooking on purchased biomass or fossil fuels
- **Requires availability of plant oil:**
  - Tropical and sub-tropical areas with adequate plant agriculture targeted
  - Suitable countries: Indonesia, The Philippines, Vietnam, India, Central and Latin America
- **Online outreach to potential partners:**
  - Target distribution partner able to purchase stoves, train users and commit to communication guidelines
  - 3-5 requests for blue print per week

Sources: Hystra analysis, Interviews with protos Director; www.bsh-group.com

BP INDIA
Mass-market bio-fuel pellets and cookstoves
India

Executive Summary:

BP designed the Oorja, a clean and efficient bio-fuel cookstove burning agricultural waste-based pellets. 2 years after market launch, this innovative "razor and blade" business model allowed BP to improve drastically the cooking habits of >350k households. The Oorja reduced indoor air pollution (400k casualties a year in India), reduced cooking and fuel gathering time, slowed down deforestation and created over 3,000 indirect jobs. However, BP is currently rethinking its alternative energy strategy and is considering selling the Oorja business.

Project basic information

- **Market launch:** 2006 (project start: 2004)
- **Products delivered:**
  - High-combustion efficiency stoves (including an electric micro-fan)
  - Burns agricultural waste-based pellets designed specifically for Oorja stove
- **350k stoves** (targets 1m by end 2009) and **>10kt pellets** sold
- **Project initiator:** John Browne (former BP CEO)
- **HR:** 35 BP FTEs and 3,000+ indirect jobs
- **Partners involved:**
  - Market research contractor: Ogilvy
  - R&D: Indian universities (mainly IISc)
  - Manufacturing and development: SPS
  - Distribution scheme set-up and running: NGOs (SSP, CCD and IDPMS)
- **Operational infrastructure:**
  - Distribution increasingly outsourced to Adharam (NGOs ad-hoc company)
  - Local "Jyothis" distribute stoves and pellets in villages
  - Pellets produced by local micro-entrepreneurs using a processing machine rented by BP

"This product was created with these rural communities - with significant support from local NGOs. We kept taking working models back into the communities to see if they were meeting the people's needs."

Mahesh Yagnaraman,
BP Energy India's managing director

Advertising for BP Oorja

ASHOKA

HYSTRA hybrid strategies consulting

Project ability to solve the problem ★★★

A rural housewife cooking on a BP Oorja

Agricultural-residuals pellets produced by BP

- **Cooking on firewood drawbacks:**
  - Deforestation
  - Time consuming (wood collection, low efficiency)
  - 400k deaths p.a. in India (toxic smoke)
- **BP stoves' end-users benefits:**
  - Combustion efficiency from 40% to 80%
  - Cooking and fuel gathering time from 3h to 40' per day
  - Carbon monoxide emissions down 98%
- **BOP1000 targeted (India, 2008 prices):**
  - Stove market price: $14 (RS675)
  - Pellets for 1 week: $0.4 (RS20)
- **Needs addressed:** access to safe and affordable cooking for almost all traditional dishes
- **Sustainability:** 4-5 years life expectancy
- **Impact:**
  - Improved cooking for 250k families
  - Entrepreneurs in 3000 villages in Karnataka, Tamil Nadu, Maharashtra and Uttar Pradesh

Project economic viability ★★☆

- **Profitability expected with "razor and blades" business model:**
  - Stove manufacturing cost is still approx. $4 (RS200) higher than retail price
  - BP benefits expected from pellets selling (estimated 10% gross margin on pellets sold at $0.1/kg)
  - USD10m investment
- **Partners' financials:**
  - IISc: revenues from patent selling
  - Jyothis: average income of $10/month
- **BP pros to reach viability:**
  - Experience in scaling up projects
  - Funding as a business angel
- **0% subsidized**
- **BP plans to sell its cook-stove business** (new Group alternative energy strategy)

Project scalability ★★☆

- **Favorable market environment:** huge unregulated market of customers cooking on biomass (700m potential clients in India)
- **Competition:** Low cost traditional stoves, government subsidized stoves, Envirofit, Phillips, Bosch-Siemens
- **Business model scalability limit:** Oorja electric micro-fan battery requires intermittent power access (not available in some remote areas)
- **Multiple available partners for distribution:** 13m self-help groups accessible through NGOs
- **Reliance on NGOs:** requires building confidence and working with distributors in an innovative way for most MNCs

Sources: Hystra analysis, Management interviews, BP Magazine – Issue 4 – 2007; 2008 data

ENVIROFIT INTERNATIONAL
Mass-market biomass cookstoves
India & Global

ENVIROFIT
making the world fit for humanity
www.envirofit.org

Executive Summary:

Envirofit International develops energy-efficient, pollution-reducing technologies that enhance the environment, improve public health and foster local economic growth in developing countries. Envirofit's biomass cookstoves, developed in partnership with the Shell Foundation (investment) and Colorado State University's Engines and Energy Conversion Laboratory (R&D), target BOP500 customers in rural and peri-urban India. Since market launch in 2008, ~50k families have purchased Envirofit cookstoves to experience clean, fuel-efficient, fast-cooking using traditional biomass. Envirofit plans to launch new products and extend distribution to other countries.

Project basic information

- **Market launch:** 2008 in Southern India, targets global reach
- **Product delivered (since 2008):** Range of high-efficiency clean-burning cookstoves from the B-1100 single pot to the S-4150 double pot with chimney
- **~50k rural and urban customers** (target: 200k in 2009, 10m within 5 years)
- **Leadership:** Ron Bills (Chairman & CEO)
- **HR:** ~53 FTEs (13 in USA, 40 in India), over 600 indirect jobs
- **Partners involved:**
  - Investment and Indoor Air Pollution (IAP) awareness-raising: Shell Foundation
  - R&D: Engines and Energy Conversion Laboratory, Colorado State University (~20 principal investigators and staff)
  - Independent monitoring: Berkeley Air
  - Market Research: MART
- **Operational infrastructure:**
  - Centralized manufacturing and global supply chain
  - Multi-tiered distribution sales channels, NGO partnerships, MFI partnerships and direct selling
- **Marketing & promotion schemes:** IAP awareness-raising campaigns, region-specific advertising, marketing collateral support, PR and direct marketing

"Envirofit cookstoves are not only meticulously engineered to reduce toxic emissions by 80% and fuel use by 50%; they are also aesthetically designed and durable. Envirofit takes great pride in selling high-quality, affordable products to typically underserved global markets".

Ron Bills
Chairman & CEO Envirofit International

Envirofit S-2100 Clean Cookstove

ASHOKA

HYSTRA
hybrid strategies consulting

Project ability to solve the problem ★★★

Envirofit stoves save time and money and improve indoor air quality

- **Problem and magnitude:** 3b people cook over biomass - with low energy efficiency and harmful emissions
- **Envirofit stove benefits:**
  - Fuel consumption reduced by 50%
  - Cooking time reduced by 40%
  - Toxic emissions reduced by 80%
  - Independent 3rd party verification
- **BOP500 targeted (India, 2009):**
  - B-1200 stove market price: $17
  - Several microfinance partnerships
  - Savings on fuel purchasing / gathering
- **Needs addressed:** Modern cooking benefits (reduce IAP) paired with traditional cooking methods and no need for fuel modification
- **Sustainability:** over 5 year life-expectancy, 5 year warranty on the combustion chamber/ 2 year warranty on all other components
- **Impact:**
  - Improved cooking, health, environment, and economic status for ~50k families
  - Over 300 distributors/dealers in Karnataka, Tamil Nadu, Kerala & Andhra Pradesh

Project economic viability ★★★

- **Financials:**
  - Shell Foundation invested $3.5m in Envirofit (targets $25m fundraising)
  - Self-sustainable Indian operation by 2010 (incl. R&D for new models, manufacturing / supply chain cost drive-down, sales channel development)
  - Strong margin at each step of the value chain provides market-driven incentives
- **Affordable quality product:**
  - Centralized manufacturing ensures quality control and economies of scale that reduce costs
  - Award-winning stove technology
- **Not-for profit organization with self-sustaining business-model:**
  - Enterprise-model attractive to government foundation and corporate funding
  - Non-profit status helps in-country policy-makers and NGO relationships

Project scalability ★★☆

- **Global market:** 3b potential customers
- **Competition:** Low-cost traditional stoves, BP, Phillips, Bosch-Siemens
- **Scalable supply-chain:**
  - Business structured to scale globally
  - Centralized manufacturing provides high-volume capacity to meet demand
- **Multiple partners and distribution channels:** MFIs, NGOs, top-tier distributors, local retailers
- **Entering new markets requires:**
  - Expertise from local resources (e.g., in-country General Manager)
  - Market research and stove line development to meet market needs
  - Funding runway (3 years to break-even)
  - 5 years initial R&D investment (incl. fundamental combustion materials, stove geometry and testing protocols research)

Sources: Hystra analysis; Interviews with Envirofit's Marketing Communications Manager; www.envirofit.org

COSMOS IGNITE INNOVATIONS

Solar LED lanterns

India, Asia, Africa and South-America

Executive Summary:

In 2004, Amit Chugh returned to India to found Cosmos Ignite along with Matt Scott who had just graduated from Stanford. Cosmos is a pioneering global company that introduced solar LED lanterns to the BOP market with a fully for-profit approach. Since then, their venture sold several tens of thousands of 5-in-1 Mightylights and developed a full range of innovative solar devices. Thanks to Cosmos' low-cost design and microfinance partners, down to BOP500 benefit from bright modern light to fulfill daily lighting and communication needs. With its upcoming scale-up, including series A financing, the development of a micro-franchised "energy kiosk" network and governmental partnerships, Cosmos expects to reach cumulative sales of 2m devices by 2011 while maintaining its 10% net margin.

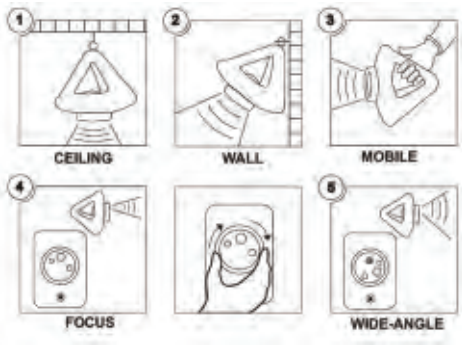
Project basic information

- Market launch: **2006** (first for-profit solar LED lantern project initiated in 2004)
- **Mightylight LED lantern (main product):**
  - Up to 2.5Wc solar PV + AC/DC charging
  - 5-in-1 multipurpose use
  - Multiple bright settings
  - Optional mobile / radio charging
- **Complementary range of solar devices:**
  - **Mightytorch** (low-cost flash light)
  - **Mightycharge** (mobile charger)
- **Tens of thousands lamps sold** in multiple countries (targets 2m by 2011)
- **Leadership:** Matt Scott & Amit Chungh (Stanford MBA)
- **HR:** 32 full-time employees
- **Multinational infrastructure:**
  - R&D in India, USA and Europe
  - In-house local manufacturing and assembly at Gurgaon plant in India
  - International sales through partners
- **Indian multi-channel selling through:**
  - NGOs (also involved in initial pilots)
  - Micro-franchised village entrepreneurs network of "energy kiosks"
  - Microfinance institutions and retailers

Mightylight set including the solar PV, AC and DC chargers

Mightycharge, low-costmulti-mobile charger

Project ability to solve the problem ★★★



Mightylight: "5-in-1"

Young Pakistani girl holding a Mightylight

- **Problem magnitude:** globally 1.6b people without electricity based lighting
- **Cosmos solar lanterns benefits:**
  - Very bright (up to 400 lux, meets EU norms for protection of eyesight reading)
  - No lethal gas exhausts / fire risk
  - Reduces household energy spending
  - Provide power for other usages than lighting (mobile charging, radios, etc.)
- **Down to BOP500 targeted:**
  - Retail prices range from $10 up to $35
  - Microfinance at $0.10 per day increases affordability for low-income customers
- **Needs addressed:** energy and lighting for education, household activities and livelihoods
- **Sustainability:**
  - 5-10 years lamp life expectancy
  - Replaceable battery (every 18 months)
  - User manual in 14 languages
- **Impact:**
  - 150k people benefiting of modern lighting
  - 3kT CO2 emissions offset p.a.

Project economic viability ★★★

- **Cosmos for-profit approach from the beginning:** demonstrated up to 10% net margin profitability over the last 3 years (audited measure)
- **Up to 30% mark-up for distributors** and volume based bonus slabs
- **Governmental lobbying:**
  - To reduce subsidies on kerosene
  - To partner on non-subsidized solar LED devices distribution approaches
- **Successful Indian-based seed funding:**
  - ~$1m raised capital including private investors (e.g., Vinod Khosla)
  - Looking forward to Series A raising with advice of KPMG
- **No subsidies at all**

Project scalability ★★★

- **Unregulated market of billions of potential customers**
- **Large global footprint:**
  - Currently active in Asia, Africa and Latin America
  - 50% sales outside of India
- **Limited competition:**
  - Customers who experienced LED lighting prefer it to kerosene lamps / candles
  - Market is still "untapped": for-profit competitors (e.g., D.light Design, Barefoot, SELCO, SEF) sold <100k units
  - Granted lamps programs (e.g., TERI) are expected to remain of a limited size
- **Continuous R&D since launch allowed >50% cost reduction in 4 years**

Sources: Hystra analysis, Management interviews

D.LIGHT DESIGN
LED-solar devices
India & East Africa

Executive Summary:

D.light Design is a multinational start-up initiated in 2006 by Sam Goldman and Ned Tozun while finishing their Stanford MBA. D.light Design is funded by private investors, with no subsidies at all, on the belief that a purely market and for-profit based approach is the best way to provide bright, clean and safe light to billions of BOP customers. Less than a year after market launch in India and East Africa, tens of thousands of lamps have already been sold through a retail distribution network, enhancing lighting of >150k lives. Their range of products can provide lighting for education, household activities and working at night, as well as mobile charging.

Project basic information

- Market launch: **June 2008** (project initiated in 2006)
- **Range of products:**
  - Nova Series: portable LED lamp
  - The Solata: lower-cost portable LED lamp
  - Features: attractive design, fast charge batteries with several hours of light and multiple brightness levels
  - Options: external solar PV or AC charger, mobile charging, battery load indicator
- **Tens of thousands of lamps sold** (targets 2m by end 2010)
- **Leadership:** Sam Goldman (former Peace Corps Volunteer, Stanford MBA) & Ned Tozun (Stanford MBA)
- **HR:** 25 in India, 15 in China, 11 in Tanzania, 2 part-time staff in US
  + 8 summer fellows
- **Operational infrastructure and mechanisms:**
  - HQ, sales/marketing and R&D in India
  - Manufacturing, R&D, International Sales and Logistics in China
  - Sales/marketing in Tanzania (for East-Africa, since October 2008)
- **Selling through distributors,** piloting with NGOs and microfinance institutions

Ned Tozun (left) / Sam Goldman (right) Co-founders

"We could have done it as a nonprofit over a hundred years, but if we wanted to do it in five or 10 years, then we believed it needed to be fueled by profit."

"Most products in the world - 90% of them - are designed for 10% of people. We are doing the opposite: designing for the 90%"

Sam Goldman, CEO

ASHOKA

HYSTRA hybrid strategies consulting

Project ability to solve the problem ★★★

Difference in light quality between kerosene lamp and D.light Nova

Mobile charging on a Nova S200

- **Problem magnitude:** globally 1.6b people without electricity rely on kerosene lamps for their lighting needs
- **LED lighting benefits:**
  - 8-10 times brighter than kerosene
  - Safer (no lethal gas exhausts / fire risk)
- **Targets as low as BOP500:**
  - Nova Series prices: $25 to $40
  - The Solata prices: $12 to $20
  - Cost saving on kerosene spending: return on investment in approx. 8 months
  - Microfinance for low BOP500 customers
- **Needs addressed:** lighting for education, household activities and working at night
- **Sustainability:**
  - 5 years lamp life expectancy
  - Replaceable battery (every 1-2 years)
  - Use existing battery recycling industry
- **Impact (March 2009):**
  - Improved lighting for >150k lives
  - Strong distribution reach: >500 Indian and African selling points

Project economic viability ★★★

- **D.light is a for-profit business:**
  - Still in investment phase
  - Break-even expected in coming years
- **Network of for-profit retailers:** margin varies depending on region and channel
- **No subsidies for main business:**
  - "Give Light" donation program is a side of main business stream and at limited scale (~600 lamps)
- **Proven ability to attract private investors:**
  - Successful $1.5m initial funding
  - $4.5m Series A financing from 6 investors, incl.: Acumen Fund and Nexus India Capital

Project scalability ★★★

- **Unregulated market of billions of customers** (incl. >500m in India)
- **Proven scalability (global supply chain):**
  - Distribution networks in ~10 countries
  - International shipping capabilities
- **Limited competition:**
  - Customers who experienced LED lighting prefer it to kerosene lamps / candles
  - Market is still "untapped": for-profit competitors (e.g.; Cosmos Ignite, Barefoot, SELCO, SEF) sold <100k units
  - Granted lamps programs (e.g., TERI) are expected to remain of a limited size
- **~ 2 years initial R&D investment** (incl. market research, prototyping and manufacturing)

Sources: Hystra analysis; Interviews with D.light Design Director of Communication and HR; www.dlightdesign.com

TOTAL
LPG Mobile Retail Dealers
Bangladesh

Executive Summary:

In 2005 TOTALGAZ in Bangladesh launched the Mobile Retail Dealers (MRDs) initiative. The objective of this program is to make new LPG connections and refill cylinders available at the door of consumers who use kerosene or wood to meet their cooking energy needs. This project engages MRDs from the BOP and empowers them as entrepreneurs. The MRDs are targeting urban SMEs as a market entry segment, but the model can be extended to households in peri-urban or rural areas. As of March 2009 there are 7 MRDs, 6 in Dhaka City and 1 in Jessore city. Their customer base is primarily small restaurants and tea kiosks. The project is economically viable for MRDs at about 120-140 cylinders per month. This can be scaled up in areas where there is shortage of natural gas grid connections.

Project basic information

- **Date of creation:** 2005
- **Products delivered:**
  - LPG connection including new cylinder, stove, regulator, hose pipe and refill
- **Pricing:**
  - Connection: from TK4000 / $58.82
  - Refills of 12kg at TK900 / $13.25
- **Sales**
  - On average MRD connects 2-3 clients/week and refills 130 cylinders/month
- **Team:** Initiative run by TOTALGAZ team in Bangladesh. This comprises of General Manager (Sales and Marketing), 5 Deputy Sales Manager and sales officers
- **Partners involved:**
  - Currently 6 distributors have deployed MRDs. TOTALGAZ has 146 distributors all over Bangladesh
- **Operational model:**
  - MRDs recruited by the distributors with the support from TOTALGAZ
  - They are equipped with a bicycle or tricycle for the delivery of LPG
  - Pick up 3-4 refill cylinders on credit from the distributor, sell, then pay back the distributor
  - They receive the same margin as a retailer margin of TK25 / $0.37 per refill cyclinder

MRD on a Bicycle

Small Restaurant user of LPG

Ability to solve the problem ★★☆

- **Problem and magnitude:**
  - There are 1.7m households connected to natural gas grids out of 30m households in Bangladesh.
  - Supply of natural gas for domestic, commercial and industrial use is 1,800m cubic feet per day against a demand of 2,200-2,400m cubic feet per day
  - 80% of the population live in rural areas and 80-85% of population use wood / biomass as primary source of cooking energy
- **Ability to target the poorest:**
  - Engages people from the lowest BOP segments as MRDs by empowering them as entrepreneurs
  - In its current limited scope in city it is not reaching individual consumers
  - With the current refill price and initial connection fee it will still be out of scope for BOP
  - TOTALGAZ in Bangladesh is designing a solution for introducing the concept of shared kitchen run on LPG in urban slums. This concept will be piloted in the near future and users can use the cooking facilities by paying per hour usage fee
- **Needs addressed:** cooking

Economic viability ★★★

- **Financials:**
  - **TOTALGAZ** has invested in the first few bicycles/tricycles to demonstrate the concept. On an ongoing basis it does not incur any additional incremental cost for MRDs as the existing team is supporting this initiative and the margin structure is the same as mainstream business
  - **Distributor:**
    - Invests in the bicycles/ tricycles on behalf of the MRD ($78 for cycles and $250 for tricycles).
    - Pays the same commission on sales to MRDs as to dealers. Not incurring any fixed costs on salary which makes it sustainable as MRDs are increasing sales volume by 3%
  - **MRD:**
    - Receives a commission of TK25 / $0.37 per refill
    - Also provides repair service and charges the end user directly
    - On an average he makes TK4000-5000 / $58 -73 per month including tips from consumers

Scalability ★★☆

- **Growth targets:**
  - TOTALGAZ aims to encourage more distributors to appoint MRDs through offering distributors a mix of incentives
- **Market environment:**
  - Estimated by TOTALGAZ Bangladesh that the demand for LPG in the next 3-5 years will increase to 100k tons p.a. from the current 50k tons p.a.
- **Replicability in other geographies:**
  - The MRD model will be successful in cities and towns where there is limited connection of grid natural gas
  - Can also work in rural villages for door to door service

TOTALGAZ Distributor

Sources: Hystra analysis; field visit

VIDAGAS

LGP for vaccines cold-chain and cooking needs

Mozambique

Executive Summary:

VidaGas is a for-profit company launched in 2002 to provide LPG for the Ministry of Health's cold chain in Cabo Delgado as part of a VillageReach initiative to strengthen rural health systems. Reliable LPG supply helped increase vaccination rates from 68% in 2003 to 95% in 2006. Now, 90% of VidaGas sales are for business and household cooking. With 2008 volume of 240 tons, VidaGas is the largest and only facilities-based LPG distributor in northern Mozambique. The 3,000km supply chain to reach its customers is the primary bottleneck to developing this still untapped market. Removing it will drive affordability for households, which are expected to account for 60% of VidaGas' sales.

Basic Project Information

- **Date of creation:** 2002
- **LPG-cylinders delivered:**
  - 5.5kg: deposit $12, refill $11
  - 11kg: deposit $16, refill $23
  - 45kg: deposit $100, refill $102
- **LPG-appliances delivered:**
  - Large stove for restaurants at $375
  - Full cooking kit (incl. 5.5kg cylinder): $34
- **Urban and rural customers**:
  - >251 clinics (10% of sales)
  - >100 businesses (60% of sales)
  - >1k households (30% of sales)
- **HR:** 15 local employees
- **Partners involved:**
  - Founders and shareholders: VillageReach (48%) and FDC (52%)
  - LPG importer: IMOPETRO
  - Initial client: Ministry of Health
- **Operational infrastructure:**
  - LPG imported by rail from South Africa
  - Cylinders filling station in Pemba
  - Domestic distribution by company trucks
- **Marketing & promotion scheme:**
  - B2B distribution: direct sales
  - B2C distribution: through small outlets

Vidagas was co-founded by VillageReach and FDC

Rural areas supplied by Vidagas

Project ability to solve the problem ★★☆

LPG-fridges keep vaccines between 2 and 8°C in rural clinics

A woman carrying a 5.5kg cylinder

VidaGas $34 cooking kit

- **Problem and magnitude:**
  - Low vaccination rates in northern Mozambique due to cold-chain issues
  - Environmental and health issues from wood / charcoal cooking habits
- **Needs addressed:**
  - Ensuring vaccines cold-chain (conservation between 2 and 8°C) over the "last mile" and in clinics facilities
  - Modern cooking for restaurants & households
- **Ability to serve the poorest:**
  - BOP500 benefits from vaccines supply
  - Only BOP3000+ can afford cooking on LPG ($34 cooking kit cost + ~$20 p.m.)
  - Financing options: 1-3 payments
- **Sustainability:**
  - VidaGas technicians service installations during lifetime of customer relationship
- **Impact:**
  - 27% increase in childhood vaccination
  - >1k households with improved cooking
  - B2C sales through 14 retailers

Project economic viability ★★☆

- **Financials:**
  - Positive cash flows projected in 2009 as volumes increase from 26 to 30t p.m.
  - Sales and profit expansion expected as LPG costs fall & sales of high-margin equipment (10% of sales) rise
- **B2B to B2C market entry strategy:**
  - Market entry via clinics, hotels, and restaurants (understand LPG benefits)
  - Expansion via household sector (micro- finance and retail network required)
- **Ability to attract funding:**
  - Initial funding from private and public foundations and bilaterals
  - $1.7m series A funding sought in 2009
- **No LPG subsidies in Mozambique**

Project scalability ★★☆

- **Supply-chain bottlenecks for scale-up:**
  - Difficulties transporting LPG from south to north. Poor infrastructure & services. Must use company trucks
  - Insufficient domestic LPG storage plants
- **Other local bottlenecks:**
  - Cultural preference for charcoal & wood
  - Inadequate training of retailers in LPG use and lack of consumer knowledge
- **Project potential for replication:**
  - Technology commonly available
  - Other geographies can offer a more favorable supply chain and regulatory environment

Sources: Hystra analysis; UNDP VidaGas study: "Powering Health Clinics and Households in Mozambique with Liquified Petroleum Gas", September 2007; Management interview

4.3 SOLAR HOME SYSTEMS

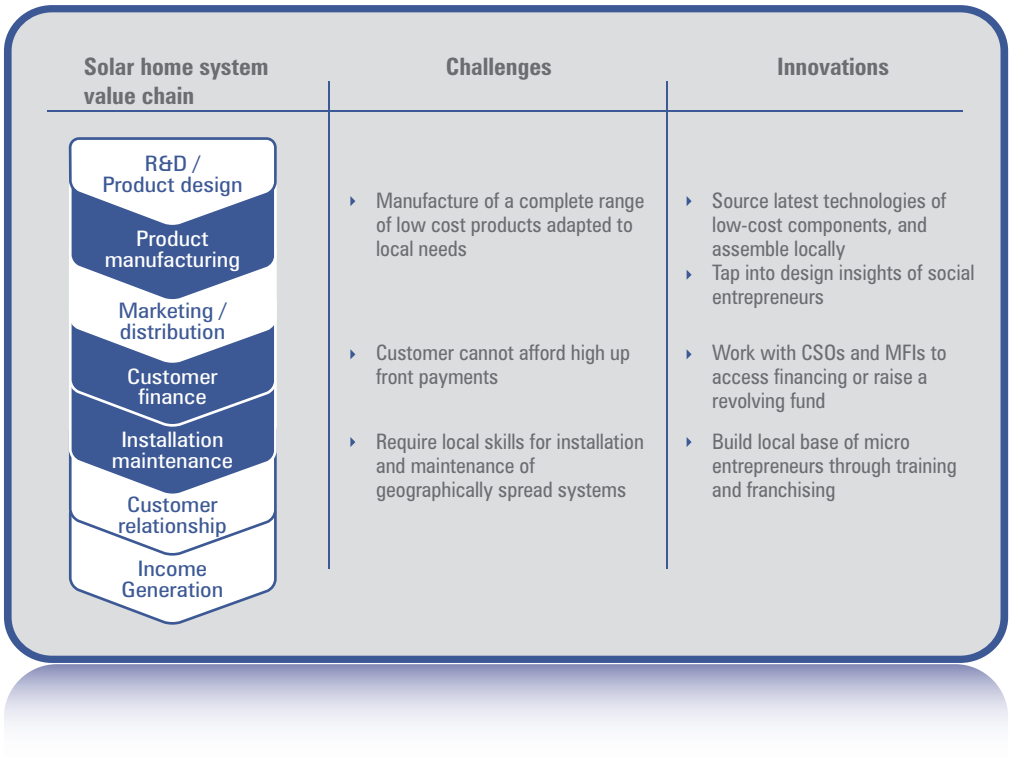
Lighting, communication and income generation through profitable but sophisticated business models

A novel sight is becoming increasingly common in low-income households around the world. Tired of waiting for a reliable grid connection, people are signing up for solar home systems (SHS). For rural communities without grid power and urban households with intermittent power, a solar home system provides safe, affordable energy.

Although solar photovoltaics[12] have been around for decades, recent developments in business models and technology mean the experiments are ready to turn into reality for millions of homes.

SHS have been slow to scale for low-income households due to a combination of challenges:

- Expensive material and inappropriate systems
- Market distortions due to subsidized or free systems
- Lack of financing for consumer purchases
- Need for trained technicians to install systems



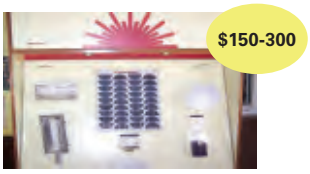
Solar PV components are expensive, especially solar-grade silicon. Developed country demand, driven by government subsidies, tax incentives, and a burgeoning desire of rich world households to reduce their impact, has absorbed the capacity of solar PV manufacturers. Solar PV manufacturers have focused on consumers in Germany and Spain. Even 60% of Tata BP Solar's panels from its plant in India is exported.[13] Panels are designed to be small and gather as much sunlight as possible in European conditions. Enterprises then have to pay top dollar for components and panels are over-designed for the Southern sun.

12 From US Department of Energy: "**Photovoltaic (PV) systems**…convert sunlight directly to electricity by means of PV cells made of semiconductor materials….When certain semiconducting materials, such as certain kinds of silicon, are exposed to sunlight, they release small amounts of electricity. This process is known as the **photoelectric effect**…A PV system is made up of different components. These include PV modules (groups of PV cells), which are commonly called **PV panels**; one or more **batteries**; a charge regulator or **controller** for a stand-alone system; an **inverter**;… **wiring**; and mounting hardware or a **framework**."

13 Tata BP Corporate profile : http://www.tatabpsolar.com/corporateprofile.html

A typical Solar Home System (SHS) contains:

- A solar panel (typically 10 to 50W)
- A battery to store the power
- A charge controller to protect the battery
- 2 to 6 lamps (LED or CFL)
- A 12V plug (mobile charging, radio and TV)



A SELCO display showing SHS components

Early model of Solar Home Systems:

Price:	$800
Payment:	Largely upfront, possibly from grants
Financing scheme:	Grants from multilaterals and governments, and household savings
Maintenance:	Rapid reduction in functionality of systems

Emerging model of Solar Home Systems:

Price:	$150 - $300
Payment:	~20% upfront, rest monthly fees
Financing scheme:	Microfinance or revolving funds, some household savings
Maintenance:	Designed for the life of the system, in original business model

Interview

Dr. Harald Schützeichel is a theologian, philosopher and musicologist, former CEO of a German solar company. He launched the Solar Energy Foundation, selling Solar Home Systems in Ethiopia since 2005.

Harald, do you think Solar Home Systems have the potential to become a mass-market product?

Yes, rural customers are very enthusiastic about it and they are pushing hard to get the product as soon as they see it somewhere. After we just launched our first pilot in Rema, Ethiopia, lots of people from surrounding villages asked us when we would be able to install products in their house. And many showed they would find the money for it.

What is missing to accelerate the spread of SHS?

In some rural areas, it is difficult for the poorest to finance it. When microfinance is not available we lose a lot of our poten-

SHS entrepreneurs have been stymied time and again by market distortions in the form of subsidized energy. In places such as Honduras and Sri Lanka, customers have been promised government or aid agency help. Entrepreneurs such as Soluz or the Solar Electric Light Fund found it difficult to compete with the promise of free help, no matter how inconsistent or inaccessible this aid would turn out to be. In some cases, such as rural Ethiopia, 99% of the population is not connected to the grid and does not expect to be so - this territory is ripe for SHS expansion. In general, the industry has been moving towards a combination of microfinance and social investment capital, as this allows more flexibility to respond to market opportunities.

SHS are an expensive outlay up front, and return the savings over time. This is the cash flow pattern least suited to low-income households, who have little savings at any one point and some cash flow over time. Consumer financing is required to spread out SHS payments to match the cash flow of low-income households.

However, microfinance is not well established amongst the majority of the BOP. Despite decades of microfinance, only 20% of the Bangladesh BOP has access to financial services; perhaps 1% to 10% of the BOP population in other countries can access microfinance. In order to provide financing to customers SELCO has developed relationships with

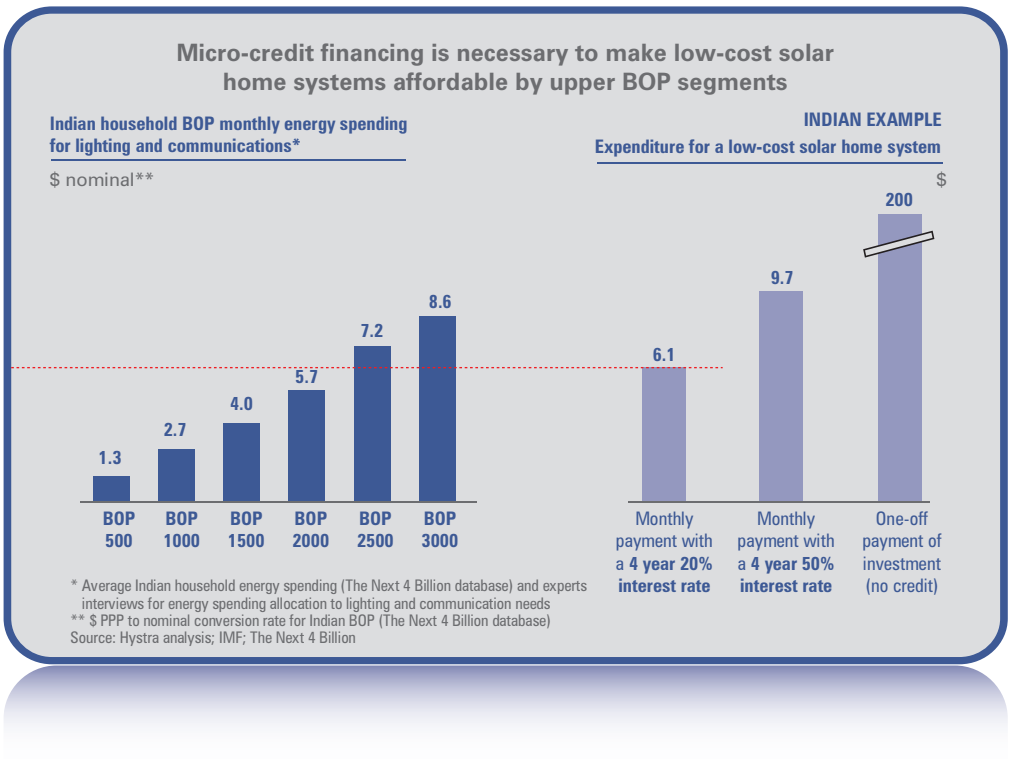


Figure 12 *Impact of microcredit on accessibility of solar home systems*

42 partner financial institutions, which charge ~13% interest. Microfinance significantly increases the market opportunity for SHS, so the gap in access is a serious impediment.

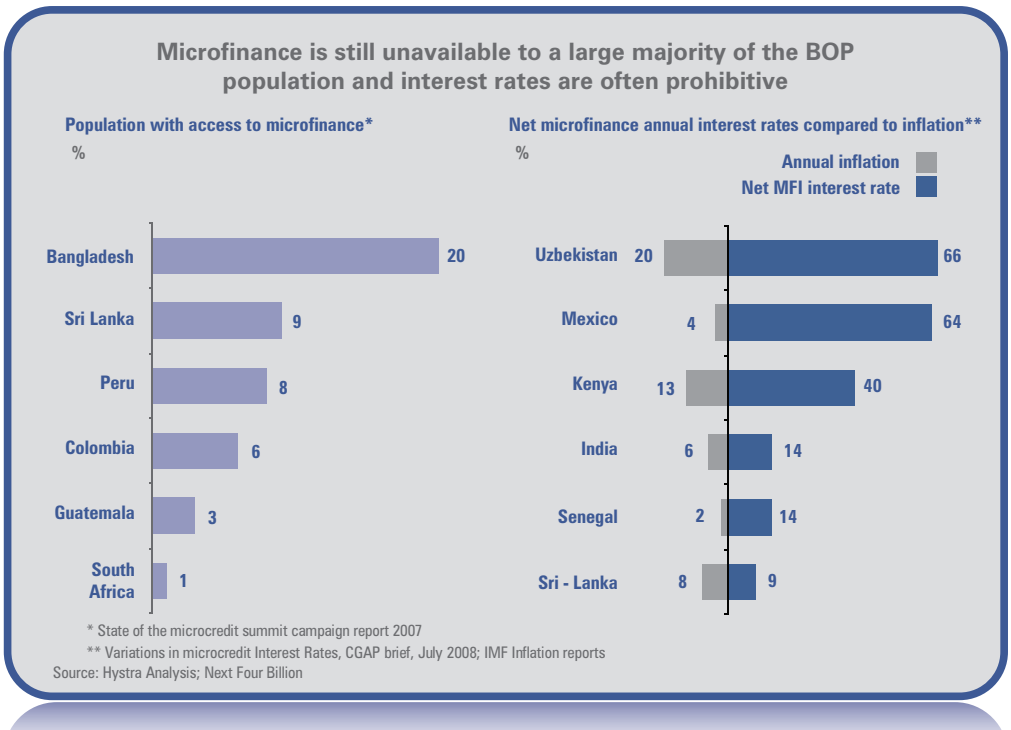


Figure 13 *Access to microfinance and rates in selected countries*

ASHOKA

HYSTRA hybrid strategies consulting

Finally, SHS have traditionally been installed by trained technicians. SHS are attached to rooftops or poles, anchored down, wired, and placed at the proper angle to the sun. Reliance on these technicians has slowed the expansion of SHS and increased the final cost to the consumer.

Pioneers such as SELCO overcome these challenges using time-tested designs, tailor-made installations and customer service. The Solar Energy Foundation adds to this model a training school for solar technicians, a revolving micro-finance fund, and RFID payment technology that facilitates payment and enables technicians to turn off households that are behind on monthly payments. In Bangladesh, Grameen Shakti has reached 38k villages and 215k households by taking advantage of the foundation laid by the Grameen Bank.

The ambitions are large. SELCO aims to triple installed systems in the next four years. Grameen Shakti plans to install 1m SHS by 2012. Around the world solar home systems are ready to go mainstream.

Lighting, communication and income generation for richer BOP households

In rural Ethiopia, only 1% are connected to the grid. The Solar Energy Foundation (SEF) installed 2.4k SHS in Ethiopia to enable households to work at night, light homes, and power communication devices. 50% of households in the Indian state of Karnataka have little or no electricity access. SELCO has reached 100k clients in Karnataka and Gujarat by focusing on similar needs.

SEF's system is sold for $80 upfront, and then $9 each month for three years. This replaces a $7.50 monthly spend on kerosene and dry cells. SELCO sells its 4-lamp system for approximately $60 upfront (15% of the total price) and $6 a month for the next five years. Though loans are usually provided by partner banks, SELCO has a guarantee fund to lend the initial 15% to customers who are not approved. Even with subsidies, microfinance and maintenance, SHS are only affordable by comparatively richer BOP households, those in the BOP2000 segment or above.

Figure 14 *A Temasol customer in Morocco*

Interview

Harish Hande is the co-founder of SELCO India, a leading SHS business

Harish, SELCO India has reached almost 100k customers and is one of the largest solar companies serving the BOP. Do you expect further growth?

Yes. We have just raised $1.4m from social investors with the objective of reaching 200k more families within four years.

Could such a growth be accelerated by new developments within the industry?

Yes. SHS cost could be significantly reduced through R&D, allowing us to reach more and poorer people. For instance, there is a lot to do about the batteries. We believe that a significant effort on batteries could reduce the life cycle cost of SHS by ~30%. On top of that, batteries could be lighter, which would allow rental business for those who cannot afford a full SHS. There is so much to do within the solar industry!

Because of this constraint, some SHS enterprises support income generation amongst their potential customer base. One way to do this is to design certain steps of the business model so that they can be performed by low-income people themselves. For example, Grameen Shakti's Technology Centers train local women to manufacture and repair SHS accessories. Fabio Rosa links solar technology to electrified fences, which allow Brazilian farmers to rotate their animals through the fields to increase agricultural yields.

In some early SHS initiatives, customers were unsure about how to maintain the systems. When the panels

got dirty or the batteries were not replaced regularly, the systems would fail. This caused general disillusionment with the potential of SHS. All of the SHS enterprises profiled for this study explicitly include maintenance in the price of their systems and in the ongoing operating model.

Profitable businesses, vulnerable to price of components

SHS businesses have demonstrated profitability and attracted financing. This financing has mainly been from agencies that will accept a modest return, such as E+Co or other social investors. The industry is moving away from subsidies, as these relationships can hinder growth by reducing flexibility to adjust fees, re-install systems, or expand to new regions or customer segments.

SELCO was one of the first SHS providers to become profitable. It broke even in 2000 and remained profitable until 2005. At that point SELCO started to experience losses due to a 45% increase in the price of panels. Regardless, SELCO made a $100k loss for $3.1m of revenue in 2008 and received financing in January 2009 from E+Co, Good Energies and other investors, indicating the viability of the model. Grameen Shakti, another established SHS company, has a gross margin of 4-5%. It benefits from a relationship with the Infrastructure Development Corporation (IDCOL), which provides a €34 subsidy per system of 20W and above, loans at an interest rate of 6%, and small grants. Newer entrants such as Sun Transfer, run by SEF, expect a positive net income from 2010 onwards. Payment systems such as SEF's RFID cards may make loan recovery even easier and more secure.

Profitability is threatened by high variability in the price of components. This means that the cost of the installed system or the replacement batteries and converters can change dramatically over time. This vulnerability is compounded by the fact that most BOP SHS companies are small players on the world stage, unable to lock in long-term contracts with suppliers.

No SHS entity has become profitable and remained so without any subsidies whatsoever. However, these subsidies are increasingly confined to the market development stage of the project. SEF used grants to test products, develop the curriculum for the training programs, and pilot the first solar centers. SELCO and Grameen enjoy low-cost financing from the government and social investors. However, ongoing operations can be independent; SEF expects that the €10m revolving microfinance fund and the solar service centers will pay for themselves. Going forward the profitability of SHS will depend on the existence of a supporting ecosystem including microfinance for customers, investor finance for the enterprises themselves, and favorable regulations from governments.

Pioneers ready to scale and help others to replicate

Solar home system enterprises are posed for aggressive growth. SELCO plans to triple its customer base in 4 years. Grameen Shakti is installing over 6k SHS a month and aims to reach 1m households by 2012. The companies profiled expect to scale up within their existing regions. The potential for replication, driven by entrepreneurs and supported by finance and shared learning, is immense.

The main threat to scale is grid extensions. Entrepreneurs tend to select areas where this is unlikely to happen. However, even in grid connected areas, SELCO sees urban households purchasing SHS to make up for inconsistent grid electricity. In Ethiopia SEF

Figure 15 *Farmer with silk worms and SELCO light*

expects that the growing force of trained solar entrepreneurs and technicians, linked with positive feedback from customers, will drive growth. When grid extension is unlikely, the greatest hindrance is availability of consumer finance.

SHS enterprises are focused on their current geographies for the time being, although they believe their models are replicable elsewhere. SELCO is currently focused on three states in India. The management believes that success lies in local roots, and so expects to remain in these geographies for the foreseeable future. In addition, SELCO is willing to set up a $3m fund to provide money and time to other entrepreneurs who want to replicate its model in other geographies. Similarly, SEF and Grameen Shakti expect to aggressively grow their customer base in Ethiopia and Bangladesh respectively in order to leverage existing infrastructure.

NAME	CURRENT SCALE	TARGET
Grameen Shakti	215k	1m in three years
SELCO	100k	300k in four years
SEF	4 solar services centers	100k in four years

Solar home systems are proving to be a profitable way to address the needs of lighting, working at night, and connecting small devices of BOP populations around the world. With the help of consumer finance and targeted assistance to replicate models, solar home systems could move into more countries and to lower-income populations.

See the following pages for detailed cases:

CASE STUDY	PRODUCT	PAGE
Grameen Shakti	Solar Home Systems	60
SELCO	Solar Home Systems	62
Solar Energy Foundation	Solar Home Systems	64
Temasol	Solar Home Systems	66

GRAMEEN SHAKTI
Solar Home Systems
Bangladesh

Executive Summary:

Grameen Shakti, a non-profit renewable energy company founded in 1996 is one of the fastest growing companies in this sector. It reaches 38k villages and has commissioned 215k Solar Home Systems (SHS) as of February 2009. It has also installed 6k biogas plants since 2005 and 20k improved cook stoves since 2006, but remains mainly a SHS company. Financial equilibrium is reached thanks to a €34 subsidy per solar system. Currently Grameen Shakti installs 6k-8k SHS per month and plans to reach 1m installations by 2012. Model is replicable but benefits from Grameen Bank's success and network.

Project basic information

- **Date of creation:** 1996
- **Products delivered:**
  - >95% of revenue from 10 to 130W SHS
  - Biogas plants from 1.6 to 4.8 cubic meters
  - Improved Cook Stoves (ICS)
- **Pricing:**
  - SHS priced at $140 for 10W system, $412 for 50W; $1,000 for 130W
  - Biogas Plants starting from USD 187 for a 1.6 cum plant to $422 for a 4.8m^2 plant
  - Improved Cook Stoves at $11.76
- **>215k SHS installations** in Bangladesh
- **Founders:** Co-founders of Grameen Bank, Mr. Dipal Barua is the Managing Director
- **HR:** 3,350 employees, 541 branches, 86 regional offices, 11 divisional offices, 41 Technology Centers
- **Partners involved:**
  - Infrastructure Development Company Limited (IDCOL), Kyocera Japan
- **Operational model:**
  - Part of the assembly of the tube lights is done in the villages (Technology Centers)
  - Customer finance - 2 options for SHS: down payments of 25% with 24 monthly installments 15% with 36 installments
  - A Branch becomes sustainable only if it acquires 350 customers over three years
  - Installation by trained technicians, checked every month by staff

SHS panel in rural Bangladesh

A 85W SHS can support seven 6W tube light like above and a 17" Black and white TV

Project ability to solve the problem ★★☆

Grameen Shakti has already built up 41 Grameen Technology Centers for distributed assembling and servicing of SHS. Currently they are training local technicians who can take on future servicing and installation of SHS at the village level

- **Problem and magnitude:**
  - 40% of the population of 155 million (July 2008 est.) in Bangladesh does not have access to power grid
  - 45% of the population lives below poverty line (2004 est.)
- **Ability to target the poorest:**
  - SHS independent systems reach BOP 2000
  - BOP500 customers addressed through Micro Utility systems where SMEs and poorer households share a system. It has 10k such installations.
  - BOP500 customers reached through improved cookstoves
- **Needs addressed:** lighting, cooking, entertainment, communication and income generation (working at night)
- **Sustainability:** The SHS system is well designed with a 5 year guarantee on battery and a 20 year guarantee on panel

Project economic viability ★★☆

- **Financials:**
  - Sustainable after receiving subsidies for SHS installation
  - 4-5% gross margin on SHS
  - €34 is received as subsidy from IDCOL for every installation of SHS on and above 20W capacity
- **Ability to attract funding:**
  - IDCOL is the key financing organization
  - It provides loans at an interest rate of 6% and small grants
  - The loan amount is about 80% of the sales value of SHS
  - Currently TK200 crore ($29.41m) loan outstanding with IDCOL
  - IDCOL also provides small grant funds from time to time

Project scalability ★★☆

- **Growth targets:**
  - By 2012
  - Total SHS: 1m
  - Biogas Plant construction: 500k
  - Improved Cook Stoves: 10m
- **Market environment:**
  - Minimum threat of grid expansion in the next 5 years
  - Power in grids in rural areas is erratic
  - Competitors are entering in this space but Grameen Shakti has already build its presence and reputation
- **Replicability:**
  - Grameen Shakti is already present in all the districts (64) of Bangladesh
  - Aggressively acquire customers leveraging their existing infrastructure
  - Promoting Grameen Technology Centers for a distributed model of assembling components and servicing
  - Growth in Bangladesh has been fuelled by the existence of Grameen Bank

Sources: Hystra analysis, UNC Kenan-Flager Business School, WBSCD, Field visit and management interviews

SELCO
Solar home systems and lanterns
India

Executive Summary:

SELCO, launched in India in 1995, is one of the most promising SHS (Solar Home Systems) companies, with almost 100k customers. Though its core business is SHS, the company also distributes lanterns and cookstoves, defining itself as a Rural Energy Service Provider. SELCO has demonstrated ability to break even and to attract social investors. Management identifies local roots, tailor made installation and customer service as key success factors, thus considering that replication in other geographies must be done by other local players.

Project basic information

- **Date of creation:** 1995
- **Products delivered:**
  - 80% of sales on households' products: SHS (panel, battery and charge controller for 2 to 4 lamps and a 12V plug) and individual solar lanterns. Currently piloting cookstoves distribution
  - 20% of sales on collective solar systems
- **Pricing:**
  - SHS sold ~$300, credit possible (15% upfront and then ~$6 over 5 years)
  - Lanterns: ~$12 (from $2 per month)
- **100k clients** in Karnataka and Gujurat
- **Founders:** Neville Williams and Harish Hande, a Senior Ashoka Fellow
- **HR:** 25 in HQ, 125 in 21 service centers
- **Partners involved:**
  - 42 banks and financial institutions
- **Operational model:**
  - Customer finance: provided by partner banks at 13% interest; SELCO has set up a guarantee fund to cover initial 15% for non bankable poorer customers
  - Installation and maintenance through 21 service centers. Maintenance free for the first year, all customers visited every 6 months
  - Marketing mainly by word of mouth, thanks to strong emphasis on customer service (e.g., free maintenance for poorest customers)

Typical solar installation in a rural home

Silk farmer using a SELCO light

Ability to solve the problem ★★☆

- **Problem and magnitude:**
  - 50% of 10m households in Karnataka lack grid connection or have erratic grid supply
- **Ability to target the poorest:**
  - SHS reach BOP2000 customers
  - BOP500 customers reached through lanterns
  - SELCO has also set up rental scheme for non bankable urban poor (vegetable vendors, street hawkers...) who can rent batteries on a daily basis (~$0.06 per day)
- **Needs addressed:** lighting, communication and income generation (working at night)
- **Sustainability:** battery replacement every 5 years; panel guaranteed for 10 years

Economic viability ★★★

- **Financials:**
  - $3.1m revenue in 2008
  - Profitable between 2000 and 2005
  - Small losses due to 45% price increase in panels since 2005, ~$100k loss in 2008
  - 27% gross margin on SHS (most common product)
- **Ability to attract funding:**
  - Demonstrated ability to attract grants (e.g., World Bank) and investors
  - Received funding from E+Co, Good Energies and other investors in mid-Jan 2009, indicating attractiveness of model
  - Investors are non-profit investors or agencies that accept below-market returns

Scalability ★★☆

- **Growth targets:**
  - Aiming for 200k more clients in 4 years, in current geographies
  - Currently focusing on Karnataka and Gujarat, looking at Maharashtra
- **Market environment:**
  - No grid expansion threat
- **Replicability in other geographies:**
  - Management believes that success lies in local roots and is not considering expanding in other geographies
  - Willing to set up a $3m fund and open its books to help entrepreneurs planning to replicate in other geographies

SELCO puts strong emphasis on tailor-made installation, for instance offering 4 types of lamps addressing different lighting needs

Sources: Hystra analysis; Ashden awards; management interviews

THE SOLAR ENERGY FOUNDATION (SEF)

Solar Home Systems

Ethiopia

Executive Summary:

Started in 2005, The Solar Energy foundation (SEF) is probably the most ambitious initiative to promote solar energy lighting in Africa with non-subsidized Solar Home Systems (SHS). Within 5 years, it aims to build an Ethiopian network of 50 franchised solar centers managed by entrepreneurs trained at the International Solar Energy School in Rema. Employed solar technicians will be able to install and maintain 50k new SHS per year. SEF brought critical innovations to help BOP solar industry scale-up: low-cost downsized systems, RFID-card payment schemes and revolving-fund microfinance.

Project basic information

- **Date of creation:** 2005
- **Main products delivered:**
  - ST10: 10 Wc, 4 LED + 12V plug ($400 incl. financing and maintenance)
  - ST2: portable solar LED + plug ($50)
- **2,4k rural households served,** targets +50k p.a. within 5 years
- **Leadership:** Dr. Harald Schützeichel (theologian, philosopher, musicologist), former CEO of a solar MNC
- **HR (2009):** Europe: 3; Ethiopia: 53
- **Partners involved:**
  - Funding: Good Energies, Conrad Electric, Hilti Foundation, ...
  - Teachers: Q-Cells, Phocos, Energiebau
  - Revolving fund design: E+Co and Arc Finance
- **Operational infrastructure:**
  - Strategic business development, revolving-fund raising and management: SEF (Europe)
  - International Solar Energy School (ISES), assembly & logistics, micro-finance and sales & maintenance (network of 50 "franchised solar centers" within 5 years): SEF (Ethiopia)
  - International sourcing: Sun Transfert
- **Marketing & promotion scheme:** teaching at school, mass-media & local advertising campaigns

Dr. Harald Schützeichel,
Founder and CEO

"I wanted to show to the world that even in the poorest and remotest parts of Africa it was possible to build a profitable solar industry. Anywhere else would have been too easy."

H. Schützeichel

Project ability to solve the problem ★★☆

Solar technicians installing a hut

ISES pupils in Rema

- **Problem and magnitude:** 1% of Ethiopian rural population is grid connected and the rest uses unhealthy kerosene and polluting dry-cells
- **BOP2500 targeted:**
  - ST10 financing: $80 upfront, then $9 per month for 3 years
  - ~$7.5 monthly households spending replaceable by ST10 power
- **Needs addressed:** household and classrooms lighting. Also addressing water pumping and cooling systems for medicine.
- **Sustainability:**
  - Affordable customer credit
  - RFID-card based monthly payment (up-to-date payment log registered at a solar center is required for using solar PV)
  - Maintenance done by "solar entrepreneurs"
- **Impact (end 2008):**
  - 2.4k solar PV installed
  - 4 operational solar centers + Rema pilot
  - 26 "solar entrepreneurs" graduated ISES

Project economic viability ★★☆

- **Financials:**
  - Sun Transfert expects a positive net income from 2010 onwards
  - Solar entrepreneurs cover investments and operating costs by a margin on product selling and maintenance fees
  - €10m revolving fund aims to be self-sustaining
- **NGO status** allows to reduce import taxes
- **Innovative Foundation subsidies policy:**
  - Initial dependence: investments covered by grants (launch of SEF Ethiopia, pilot, first 4 solar centers and fund-raising)
  - Independence aim: revolving-fund and solar centers target self-sustainability
- **Ability to attract funding:**
  - Enough grants / low-interest loans

Project scalability ★★☆

- **Favorable Ethiopian market environment:**
  - No risk of grid competition
  - Enthusiastic population with organized villages communities
  - Existing pool of technicians willing to learn
  - Estimated $65-130m p.a. HH market
- **Entrepreneurial business model:** ISES training of local entrepreneurs aims to build a self-sufficient and scalable solar economy
- **Access to technology:** commonly available (though sourcing of quality products and RFID-card is key)
- **Funding limits:** revolving fund size limits annual number of new customers
- **NGOs solar PV subsidies** could distort growth in market

Sources: Hystra analysis; Interviews and meetings with SEF CEO; Hystra energy workshop; www.stiftung-solarenergie.de

TEMASOL

Rural solar electrification public-private partnership

Morocco

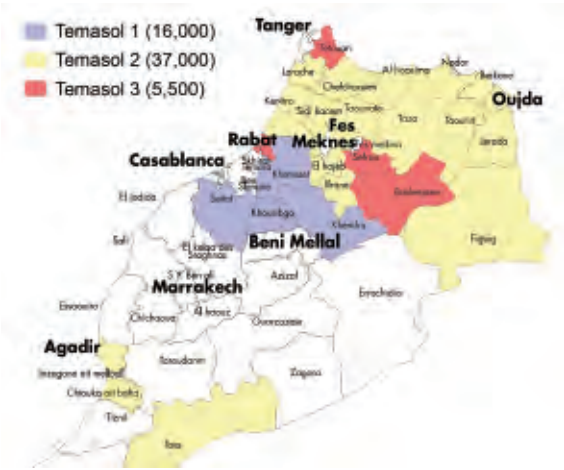
Executive Summary:

Temasol, a subsidiary of Tenesol is in charge of the largest rural solar electrification public-private partnership. Initiated by ONE (the national power utility in Morocco) the partnership made $800 solar home systems affordable to the upper BOP by subsidizing 80% of set-up costs. The success of Temasol 1, which connected all of the 16k households initially planned, is lessened by the operational and organizational difficulties Temasol 2 and 3 encountered with the public partner. Overall only 25k systems out of the 58.5k target were installed.

Project basic information

- **Date of creation:** RFP in 2000, launch in 2002
- **Service delivered:**
  - SHS (50-75 Wc, 4-8 lamps + 12V power-plug + optional fridge)
  - Installation + maintenance for 10 years.
- **Pricing:** From $97.2 installation fee + $7 rental fee per month
- **25k rural customers** (Temasol 1, 2 and 3)
- **Partners involved:**
  - Leadership / project initiator: ONE (national grid company)
  - Shareholding company: Tenesol (Total and EDF joint venture)
  - Financing: FFEM (Environment Fund), KfW (German development bank) and AFD (French development agency)
- **HR:** 88 employees (February 2009)
- **Public-Private partnership:**
  - ONE issues RFP, grants households eligibility and funds solar PV
  - Temasol sources and installs the SHS and then acts as a service operator (customer relationship, recovery, ...) through offices and representatives in local markets
- **Marketing & promotion:** Mass-media + local marketing

Temasol's multiple stakeholders



Rural areas targeted by Temasol 1 and 2

Project ability to solve the problem ★☆☆

"At the beginning, I was skeptical. Today, I trust in solar energy and I am very happy to have it. I have advised my neighbors and friends: now, they all have solar energy"

M. Mohamed ICHOU, Farmer

- **Problem and magnitude:** Need to provide electricity (mainly for lighting) in non-grid connected areas. ONE's several RFPs planned a 109k HH market in Morocco.
- **Ability to serve the poorest:**
  - Cheapest offer reaches BOP2500
  - Temasol 1: saturated market out of poorest areas
- **Needs addressed:** Mainly lighting and connecting small devices (<0.1% customers with fridge)
- **Payment scheme sustainability issues:**
  - Misunderstanding on the 10 years rental fee principle: 3k customers stopped paying or delayed payments
  - System design does not include a temporary service interruption mechanism to prevent payment delay
- **Impact:**
  - Number of HH connected vs. objectives:
    – 16k vs. 16k for Temasol 1
    – 9k vs. 42.5k for Temasol 2&3
  - Measurement through FFEM audit

Project economic viability ★☆☆

- **Financials:** Temasol 1 reached profitability in 2007 (approx. 3% profit margin) but had a negative operational income in 2008 (approx. -2% profit margin). Profitability mainly affected by:
  - Increase of highly volatile maintenance materials costs (batteries and inverters)
  - Impossibility to modify monthly fees consequently (fixed by ONE)
  - Payment defaults and churn increase
- **Dependence on subsidies:**
  - 80% of the ~$800 set-up cost granted by ONE (remaining 20% by customer through installation and rental fees)
  - FFEM granted support (advertising, trainings and SG&A tools)
- **Initial funding from public sources:** ONE supplied and now owns the solar PV

Project scalability ★☆☆

- **Public-private agreements scalability:**
  - RFP initially create large markets
  - But further scale up requires more grants
  - And scheme lacks flexibility:
    – Number of users per region is regulated
    – Each installation requires ONE's approval
    – Contract duration is limited
    – No cross-selling clearance
    – Impossible to reutilize material in another HH after contract end
- **Market environment scalability:**
  - Lack of coordination with grid expansion plans by ONE reduced solar PV attractiveness for end-customers
- **Access to resources & technology:** common availability of SHS components

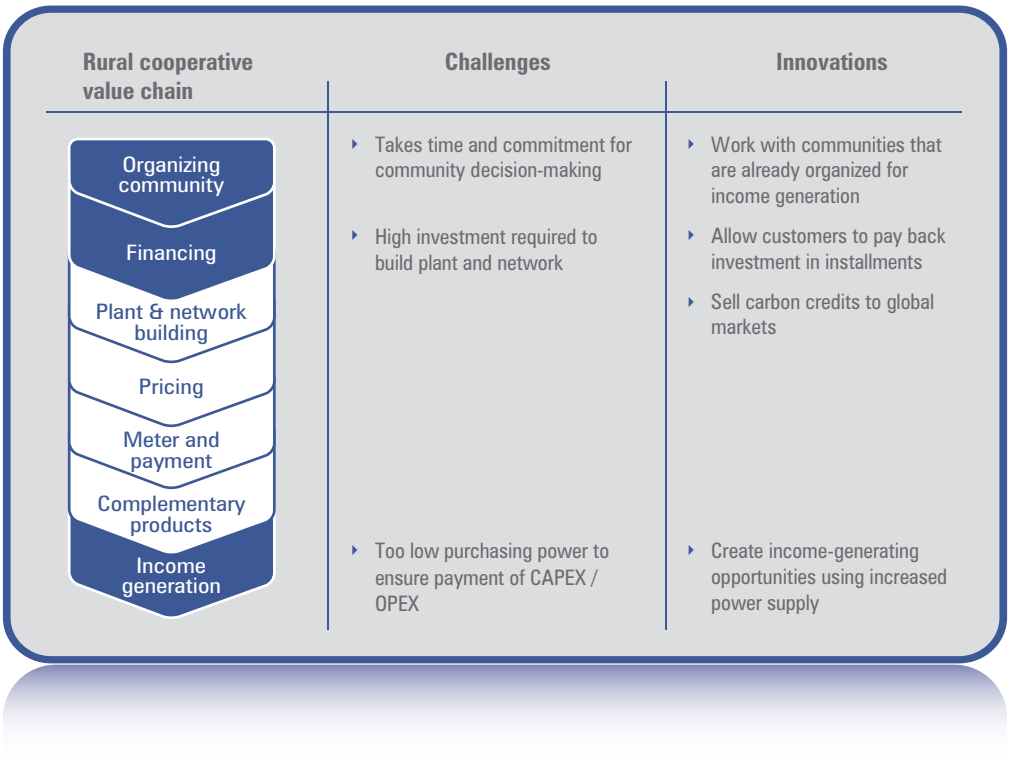
Sources: Hystra analysis; Fond Français pour l'Environement Mondial (FFEM) report: "TEMASOL: Evaluation retrospective et capitalisation", 2008

4.4 RURAL COOPERATIVES

Providing energy and income generation opportunities simultaneously

A rural cooperative is an enterprise at least partially owned and/or operated by a village, in this case for the purpose of turning the provision of electricity into an income-generating activity for the community. Rural cooperatives provide large power generation for income generation, water pumping, or other collective uses, and thus have a sound impact on local development. Decisions are usually taken by consensus, and the entire community is impacted by the outcomes of these decisions. Social entrepreneurs emphasize that building community decision-making into all steps of the process improves the quality and long-term sustainability of the cooperative.

The tradeoff is that rural cooperatives are complex to finance, set up and operate. This is due to the fact that large scale generation equipment requires higher investment and more maintenance, such as trained staff for hydro turbines. If there is not enough economic activity in the village, the rural cooperative has to build micro-enterprises to ensure its sufficient load. When it works it creates a virtuous cycle of value-added processes and energy generation, an ecosystem rather than an energy



offering. As a result, rural cooperatives take longer to scale and realize less efficiencies when doing so.

Rural cooperatives are agnostic regarding the choice of technology for energy generation. Most experts agree that there is no one best technology for clean energy, but rather that the preferred strategy depends on local conditions and resources. The most common technologies for rural cooperatives are:

- Biomass gasification: turning organic materials into biogas that can be burned for cooking or in an electricity plant. Successful models are based on agricultural or forestry waste
- Biofuel trees such as jatropha: many models are launching, but are struggling to be profitable
- Hydro: run-of-river installations where water resources are reliable
- Solar: an expensive option but still a part of the portfolio of rural cooperatives
- Wind: though this technology has shown potential, wind is irregularly available and expensive to harness

Interview

Hari Sharan, who founded Desipower, is an engineer with board-level corporate management experience and 50 years in the energy industry

Hari, why did you choose to dedicate yourself to setting up rural cooperatives?

They are such a powerful tool to eradicate poverty. We are talking about setting power capacity large enough to create jobs and income generation activities. I am not talking about handicraft, but larger scale activities like agro processing, energy services and new products. For that you need a real power plant.

Why should it be through cooperatives?

To ensure sustainability of the plant, you need to involve the local people in its ownership, management and maintenance. In addition, they have to take the responsibility for biomass supply. A cooperative also provides an opportunity to women to play an active role in village activities.

Is that the only condition for success?

Often, on top of that, you need to help the cooperative to emerge by helping local SMEs (who would be its key mem-

Providing income and energy to the poorest

Rural cooperatives solve two challenges at the same time - they provide the poorest families with access to energy, and they provide the entire community with income generating opportunities. They operate in places that are a long way from a grid - the 300k villages in India or 33k villages in Indonesia without electricity.

Clients of IBEKA's micro-hydro plants in Indonesia make about $1 or $2 a day, and sometimes less. When the community organizes its hydro plant, it determines the ability to pay of all the residents. Tri Mumpuni explains that perhaps two or three families in a village would pay nothing for an electricity connection, and most would pay the full price. Using a sliding scale the cooperative is able to serve the entire community in a viable manner. In India, Desipower's customers make around $20 a month. By connecting the entire village rural cooperatives are able to employ creative ways to include the very poorest.

The impact of rural cooperatives has been significant in terms of access to energy and income generation. IBEKA has built 60 micro hydro plants in Indonesia, which provide 300k people with clean electricity. These plants sell power back to the grid and return about $3.3k a month to the village to be invested in community projects such as scholarships for students, health care, or small business loans. Desipower has created 19 direct and 50 indirect jobs in a project area. Other rural cooperatives use hydro power for intensive agricultural processes such as coffee bean processing.

Going beyond energy and income generation, rural cooperatives are intentionally designed to support community decision-making, to increase the ability of villagers to organize and advocate for their own goals. This has the added impact of stemming rural emigration and setting the stage for further cooperative improvements.

Profitable in theory, but not accomplished yet

Installations large enough to serve a village start at $180k, in the case of Desipower, or around $250k - $300k for a 100kW hydro plant from IBEKA.

Desipower largely relied on grants so far but built a business plan where subsidies account for less than 10% of total investment. IBEKA combines 50% grants with local private investment. IBEKA expects that it could offer 8% interest on $1m, and pay back within eight years. However, Indonesian banks have been unwilling to lend below 17% a year, and unwilling to lend without collateral. IBEKA could be commercially viable for the right investor.

Figure 16 *Community planning for a hydro installation*

Additional investment is often required in addition to the power generation infrastructure. Desipower invests in local enterprises to provide biomass for the plants, and provides capacity building support. IBEKA provides engineers to train local people on operations of the hydro plant, and sets up a fund to invest in local enterprises using the revenue from power sold to the grid.

The Clean Development Mechanism of the Kyoto Protocol, which enables clean energy enterprises to sell certified emissions reduction credits (CER) in international markets, could help make the financials of rural cooperatives attractive to investors.[16] Credits sourced from biogas improve the IRR by 25% - 60%. However, political uncertainty about upcoming negotiations in 2012 makes it difficult to value future revenue streams from the CDM.

Scaling up is a challenge

The speed and extent of scaling up rural cooperatives is hindered by the complexity of their model. The model requires land for associated industries, local partners to build the cooperative, microfinance for small enterprises, and perhaps most difficult, skilled staff who will stay in the villages. By working with income-generating communities such as coffee farmers which are already organized, rural cooperatives may be easier to replicate.

Desipower aims to grow from three villages to 100 in the state of Bihar. IBEKA could build 10 new hydro plants a year, with appropriate funding. These goals are challenged by the hazards of working with governments and utilities, such as pressure to work with preferred contractors. However, as each rural cooperative is tailored to the community, less economies of scale are gained through expansion. IBEKA's engineers are experienced at training local staff, but other steps around organizing a community and arriving at a collective decision are hard to speed up.

Figure 17 *A biogas digestor plant*

See the following pages for detailed cases:

CASE STUDY		PRODUCT	PAGE
	Desipower	Rural cooperatives	73
IBEKA	People Centered Economic & Business Institute	Rural cooperatives	75

16 See pg. 76 for more information on the Clean Development Mechanism and carbon financing

DESIPOWER
Biomass gasification plants
India

Executive Summary:

Launched in India in 1996, Desipower operates 50-75kW biomass gasification plants for income generation activities and builds up micro entrepreneur cooperatives in order to stimulate rural development. Employees, cooperative members and beneficiaries all belong to the lowest income segment (~$20 a month) and the project has a sound impact (e.g., village income in Baharabri increased by >25% since 2002). The project attractiveness, as well as its complexity, lie in the link it builds between energy supply and income generation. The need to set up a plant and develop local enterprises at the same time requires additional investment and makes the business model complex and more difficult to replicate, even though extremely attractive.

Project basic information

- **Date of creation:** 1999
- **Service delivered:**
  - Operates 50 - 75kW biomass gasification plants for income generation
  - Simultaneously helps villagers to set up microenterprises and cooperatives ensuring biomass supply and plant load
- **Pricing:** 40% cheaper than diesel
- **Beneficiaries:** 3 villages, with ~8,000 people directly or indirectly impacted
- **Partners involved:** NETPRO (technology), World Bank, TechAward, Climate Funds, banks (financing)
- **Leadership:** funded by H. Sharan, an engineer with board level corporate management background and 50 years experience in energy industry
- **HR:** Currently employs 35 people
- **Operating model:**
  - Villagers provide biomass supply (collection / agro forestry / processing)
  - Factory load ensured by local SMEs (irrigation, crops processing, workshop)
  - Desipower is involved in cooperative early stages (set up and even training / financing of local entrepreneurs)
  - All the village is involved with decision making concerning the plant

One of Desipower biomass plants

Ganesh used to make $20 per month as a farmer and tripled his income through a rice processing business

Project ability to solve the problem ★★★

Hari Sharan, Founder

What makes your project so unique?

H. Sharan: We have a strong impact on the economy of our villages. Out of 5 Rs spent in energy, 3.5 go directly to the villagers: 2 for biomass collection and processing and 1.5 for the staff operating the plant. And the energy we supply allows job creation in farming and in the local market. It is also CO2 neutral.

Ours is thus a real Triple Bottom Line model which makes economic, social and ecological impacts locally and globally.

- **Problem and magnitude:** 300k villages (300-500m people) without electricity in India
- **Ability to serve the poorest:**
  - Employees are selected amongst the poorest of the villages
  - Micro entrepreneurs and customers are also from BOP500 in Bihar, one of the poorest region of India
  - Poor farmers are main beneficiaries, getting irrigation water more than 25% cheaper than before
- **Needs addressed:** Mainly income generation and energy services; a mini grid has been set up in one of the villages in 2009
- **Sustainability:**
  - First plants using the same technology are still operating after 40,000 hours
  - Biomass is renewable and CO_2 neutral
- **Impact:**
  - 19 direct jobs creation and over 50 indirect jobs in Baharbari (250 HH village)
  - An R&D institute in Madras is setting up indicators for impact measurement

Project economic viability ★★☆

- **Financials:**
  - €150k plants viability seems possible (after 3 years and with a 50% load) though not achieved yet
  - Each plant requires additional investment: ~€7k for training and cooperative building, ~€65k for microenterprises loans and/or equity
- **Reducing dependence on grants:**
  - Current plants have been largely financed with owners funds, CDM advance, grants/awards and one external equity investor
  - CDM could bring up to €160k of revenue per plant over 12 years
- **Ability to attract funding:**
  - CDM opportunity has attracted equity, local bank has agreed to give loans for future plants and social investors are interested in new projects

Project scalability ★★☆

- Management plan is to **scale up to 100** villages in the district of Bihar
- **Building clusters is key** to leverage local staff, provide extension services and create economic links between the villages
- **Regulation may be a bottleneck**
  - Sale of electricity by private entities is not allowed except to society members
  - This is solved if users own a share of the plant, creating a captive unit
- **Main constraints are due to the operational model that requires:**
  - Local partner to build the cooperative
  - Microfinance for SMEs
  - Skilled staff, hard to find in the villages and who may leave to cities once trained

Sources: Desipower; field visit; management interviews; Hystra energy workshop; Hystra analysis

PEOPLE CENTERED ECONOMIC & BUSINESS INSTITUTE

Micro Hydro Plants

Indonesia

IBEKA

Executive Summary:

People Centered Economic and Business Institute, an innovative establishment in Indonesia, is changing the way that rural villages get electricity. 105m people in Indonesia lack electricity. In the 60 villages that Tri Mumpuni works with, community cooperatives own and operate 100kW micro hydro plants. The set-up of the plants is subsidized 50% by grants. The community uses energy for value-added agricultural processes and sells power back to the grid, earning over $3.3k a month for education, health care, and business grants. The model could be commercially viable, and IBEKA is currently looking for social venture capital in the form of low-interest loans or patient equity to fund new installations.

Project basic information

- **Date of creation:** 2002
- **Service delivered:**
  - Micro hydro plants owned and managed by the community
- **Pricing:**
  - 100kW plant costs $250k - $300k to build
  - Each customer pays $0.10 per kWh, roughly $2 a month
- **Beneficiaries:** 60 villages; 300,000 people
- **Partners involved:** state-owned and subsidized electricity company, PLN, and UNESCAP
- **Leadership:** funded by Tri Mumpuni, an Ashoka Fellow
- **Operating model:**
  - Villagers are organized into cooperatives
  - These cooperatives plan and own the plant, as well as provide maintenance and manage billing
  - Expenses of the plant are paid by tariffs from villagers and revenue from selling to the grid
  - Remaining resources go to village development fund for school fees, health care, seed capital for businesses, and value-added agricultural processing

Community-managed hydro plants for tsunami reconstruction in Aceh

Community planning for hydro installation

ASHOKA

HYSTRA hybrid strategies consulting

Project ability to solve the problem ★★★

Tri Mumpuni, Founder

What is an example of the difference a hydro plant makes?

Tri Mumpuni: "In one village, the government was going to give $500K to build a school. Instead, we built a hydro plant with the money, and the money the village gets from selling electricity to the grid is used to fund the school in a sustainable fashion."

Project ability to solve the problem[1]

- **Problem and magnitude:** 33k villages (105m people) without electricity in Indonesia
- **Ability to serve the poorest:**
  - Average income approx. $1 - $2; some less than $1 a day (BOP500)
  - Everyone in the village is connected and pays the monthly tariff
- **Needs addressed:** electricity for household use and income generation (agricultural processing)
- **Sustainability:**
  - Maintenance cost included in monthly operating fee
- **Impact:**
  - Electricity for 60 villages
  - Each village receives a gross monthly income of about $3,300 from selling to the grid
  - Income from sales to the grid is invested in community projects

Project economic viability ★★☆

- **Financials:**
  - $250 - $300k 100kW plants are built with 50% grant money, 50% private investment from local enterprises
  - Monthly tariff covers operating cost
- **Dependence on subsidies:**
  - Current plants have been jointly financed with grants and some private-public partnerships
- **Ability to attract funding:**
  - Looking for social venture capital to expand
  - Strong demand from un-electrified villages in Indonesia, once awareness of hydro power has spread

Project scalability ★★☆

- **Regulation questions resolved**
  - As of 2004 government has committed to buy small scale and medium scale hydro power for the grid
  - Prices for power sold to the grid are locked in for 15 years
  - Difficult negotiations with government, which wants plants to be built by contractors who offer kickbacks
- **Main constraints are due to difficulty acquiring financing:**
  - Estimated financially viable, e.g., paying back a loan of 8% interest in 7 - 8 years, but banks are unwilling to loan without collateral or at interest rates below 17%
  - Buy-back rates from government utility are low

Sources: Hystra analysis; Interview and meetings with management (incl. Tri Mumpuni, Founder)

4.5 FINANCING

Facilitating the development of social enterprises

The four groups of business models discussed above describe the spectrum of opportunities that have shown promise in terms of access to energy for the BOP. However, these businesses will remain modest in their impact if they lack an enabling ecosystem. Primary among the gaps in this ecosystem is financing. Although other factors such as government relationships or skilled staff make a difference, access to financing is a strong determining factor in the growth of energy enterprises. Almost all energy enterprises profiled required grants or subsidized capital, at least in the early stages. The launch of access to energy enterprises targeting the BOP will depend on low-cost capital for the foreseeable future.

Sources of financing and financial intermediaries for this market are becoming increasingly more available; the diversity of these financial actors indicates a well-fought maturity in the access to energy market and a readiness to support new entrants. Unfortunately, high hopes for carbon markets that serve low-income people have failed to materialize. Significant barriers remain for small clean energy enterprises that wish to access carbon finance, and most do so in the end through voluntary markets rather than the UN-regulated system.

Financing for access to energy can be split into three categories:

1. Grant-based support to build the market
2. Patient capital with energy expertise
3. Carbon markets designed to serve low-income communities

Figure 18 *E + Co's portfolio around the world*

Grant-based support to build the market

Building a new market involves an immense amount of uncertainty, and an expensive outlay for research, development of regulation, and educating consumers, among other things. For example, solar home system entrepreneurs first had to help households gain confidence that it is possible to get electricity from the sun. Cookstove enterprises had to test their stoves and teach people about the dangers of indoor air pollution. Provivienda worked out a new arrangement that would allow households without formal land title to receive a gas connection. These are time-consuming endeavors that will be beneficial for all subsequent enterprises. In a sense, they are market-building public goods. Purely commercial enterprises are poorly suited to take on this role. The access to energy market benefits from dedicated foundations such as Winrock International and dedicated multilateral programs at the World Bank and IFC.

In September 2007 the World Bank and the IFC announced the Lighting Africa program, dedicated to bringing clean lighting to 250m people in Africa.[17] Initial programs include a design competition, market research, and a business-to-business web portal. Although the IFC had struggled to dispense the funds allocated to its solar PV market-building funds, financiers are learning from the past.[18] For example, the African Rural Energy Enterprise Development (AREED) program has invested $4.3m in clean energy enterprises in Africa, generating a 2% - 6% risk adjusted return. The program has been replicated in Brazil and China.

17 Other sponsors include Global Environment Facility, the Energy Sector Management Assistance Programme, Public Private Infrastructure Advisory Facility, the European Commission, Governments of Norway, Luxembourg and Sweden, Good Energies Inc., and the Renewable Energy and Energy Efficiency Partnership

18 Selling Solar Part I; IFC

Patient capital with energy sector expertise

Once some elements of an energy market are in place, the next level of financing is found from patient investors with energy sector expertise. Perhaps the first and most influential social investor is E+Co. Since 1994, E+Co has been providing business development support and technical assistance to clean energy enterprises. They have invested $15m in capital for 200 companies. These portfolio companies have mobilized $183m in capital and provided clean energy to 4.3m people. At the same time, E+Co has returned 7.9% to investors after write-offs.

Patient capital is more effective when combined with market-building resources. The Acumen Fund, which has an energy portfolio of $2.4m, partners with strategic services providers to ensure cost-effective resources for investees. This includes MIS software providers, HR requirement firms, debt financing from local banks, carbon credit consultants, and pro-bono and low-bono legal services. Acumen also links energy enterprises with other portfolio companies, for example those with rural distribution infrastructure, to increase the reach of energy enterprises.

Figure 19 *Access Energie, an E+Co company, provides solar-powered telephone service in Senegal*

The importance of the accumulation of expertise after 14 years should not be underestimated. Soluz, one of the very earliest SHS pioneers in Latin America, once worried that they spent $100,000 to educate a potential investor, only to have the deal fall through at the end.[19] As E+Co and others become sophisticated investors in the energy space, they reduce the transaction costs for enterprises and increase the quality of their own portfolio. For example, E+Co has shared their expertise with the AREED initiatives, and advised the Solar Energy Foundation how to set up their revolving fund. Triodos Bank in the Netherlands has financed many types of clean energy projects, and knows how to effectively evaluate a potential investee. The existence of financiers who know the market and can teach others is an immense resource to the next generation of access to energy entrepreneurs.

Carbon markets designed to serve low-income communities

One of the most powerful developments for the access to energy market has been the introduction of the Clean Development Mechanism of the Kyoto Protocol, known as CDM. A clean energy project based in low-income countries can sell Certified Emission Reduction credits based on the release of greenhouse gases the project has prevented. These credits are sold on global markets at an agreed price per ton to entities in rich countries that need to reduce their carbon footprint. In this way, carbon reduction strategies such as the EU's cap and trade system directly contribute to funding clean energy enterprises in low-income communities.

CDM credits can have a significant impact on the viability of a project - for biogas, CDM brings an incremental IRR of 25% - 60%. The availability of

19 Innovation in Rural Energy Delivery; Soluz and Navigant Consulting, 2006, p. 20

20 Waste Concern, available at : http://www.wasteconcern.org/

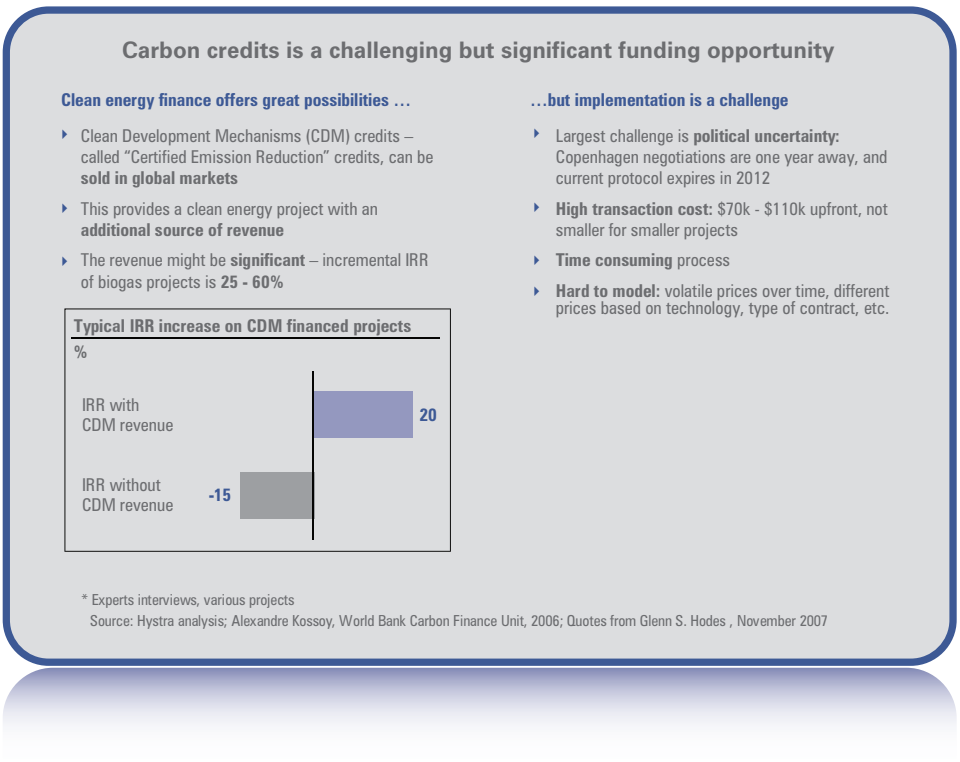


Figure 20 *Explanation of carbon credits market*

CDM has also been credited with making viable entire new classes of projects, such as Waste Concern's urban composting plant in Dhaka, which will reduce 89,000 tCO_2e.[20]

Carbon markets are still under construction, and have been criticized for being difficult to access. Transaction costs are high, it is a time consuming process, and the price per ton fluctuates on the global markets, making it

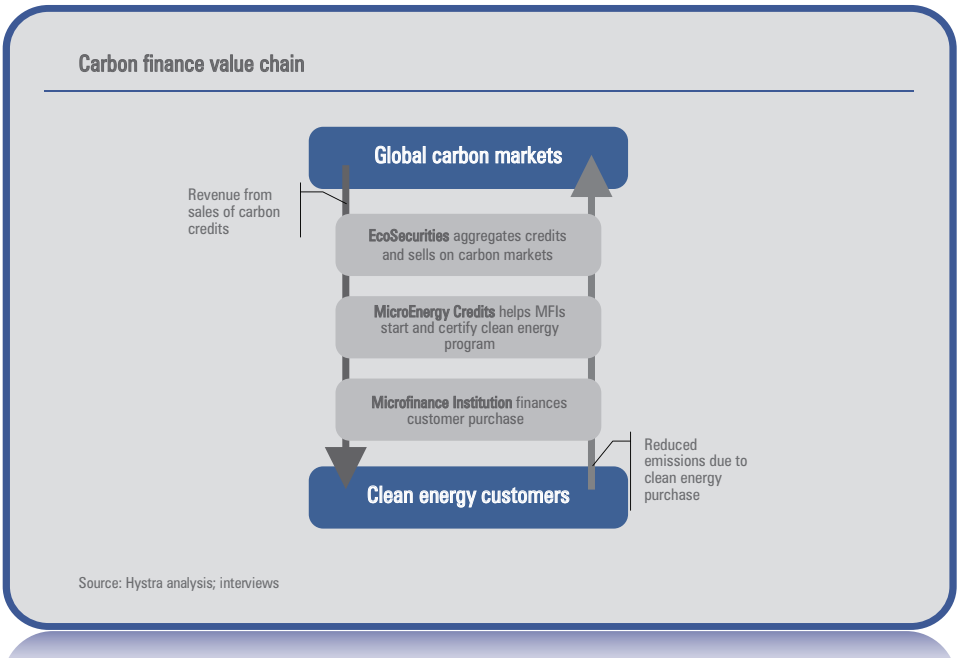


Figure 21 *EcoSecurities / MicroEnergy Credits example*

ASHOKA

HYSTRA hybrid strategies consulting

difficult to predict revenue streams. However, the greatest challenge to this financing mechanism is political uncertainty. The current protocol expires in 2012, and energy entrepreneurs are waiting to see the outcomes of upcoming negotiations.

Although the CDM system is inconvenient in some respects, financial intermediaries exist to match energy entrepreneurs and global markets, thereby helping to realize the market potential.

For example, EcoSecurities is a company which sources, develops and trades emission reduction credits. It buys credits sourced from MicroEnergy Credits, a company which helps microfinance institutions move into the clean energy microfinance field using revenue from emission reduction credits.[21] The presence of specialized intermediaries all along the value chain indicates the maturity of the clean energy finance market.

See the following pages for detailed cases:

CASE STUDY	PRODUCT	PAGE
African Rural Energy Enterprise Development	Clean Energy Finance	82
E + Co	Clean Energy Finance	84

21 Source: interview with April Allderdice, MEC founder: http://microenergycredits.com

AFRICAN RURAL ENERGY ENTERPRISE DEVELOPMENT

Clean Energy Finance

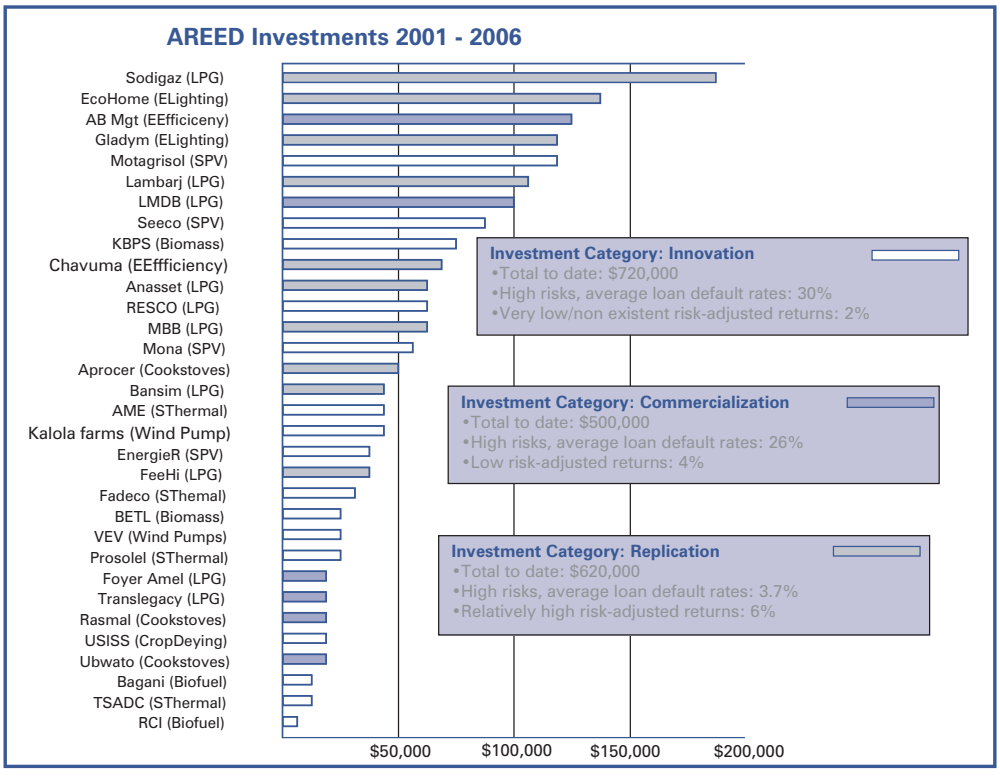
Africa

Executive Summary:

The African Rural Energy Enterprise Development (AREED) investment facility was launched in 2000 by the United Nations Environment Program and the UN Foundation. It benefited from E+Co's experience with energy finance, and took a progressive approach to building a market - first starting with loans to create business plans, and moving on to bigger and bigger investments. Although customers were not subsidized, the energy enterprises benefited from patient capital at a below-market rate. AREED portfolio offered 2% - 6% risk adjusted returns from 2001 - 2006 on an investment of $4.3m.

Project basic information

- **Date of creation:** 2000
- **Service delivered:**
  - Enterprise development services
  - Start-up capital
- **Geography:** Africa
- **Customers / beneficiaries:** 44 sustainable energy enterprises since launch
- **Leadership:** Initiative of United Nations Environment Program, UN Foundation
- **Partners involved:** Worked with E+Co to design strategy
- **Operational infrastructure and mechanisms:**
  - Begins by offering small loans to create business plans
  - Then moves onto investments from $50 K - $120 K
  - Returns from enterprises go back into fund to support next investments



AREED's portfolio, 2001 - 2006

ASHOKA

HYSTRA hybrid strategies consulting

Project ability to solve the problem ★★☆

Enhanced cookstove project in Tanzania

- **Market need:** Energy entrepreneurs in Africa are unable to access business development services or capital. The AREED project is different from previous aid efforts because it offers patient capital, not donations, and helps entrepreneurs run successful businesses. The returns are used to help more enterprises
- **Ability to serve the poorest:** The enterprises supported by AREED target poor customers
- **Needs addressed:** water pumping, water heating, cooking, solar crop drying, biodiesel-powered multifunction platforms, energy efficiency technology
- **Impact:**
  - Served more than 30,000 customers per year
  - Trained more than 500 entrepreneurs
  - Provided enterprise development services to 100 entrepreneurs

Project economic viability ★★☆

- **2007 Financials:**
  - **$4.3m** dedicated to AREED
  - **2% - 6% risk adjusted returns** from 2000 to 2006
- **Dependence on subsidies:**
  - AREED investors are the UNF, UNEP and are accepting a less than market return
  - Business models of investee enterprises do not rely on subsidies
  - Intention is for investees to attract other sources of capital as AREED exits
- **Ability to attract funding:**
  - AREED selected in 2005 as a potential beneficiary of Domini Social Investments (DSI) special fund to support selected projects

Project scalability ★★☆

- **Market environment:** Favorable environment has been found in other geographies where funds have been set up (e.g., Brazil and China)
- **Partners:**
  - E+Co is a global partner
  - Local partners have been found in several African countries, China, and Brazil indicating strong possibility of replication
- **Funding:**
  - Requires 'patient capital' from social investors, which exists, but not to the same extent as commercial capital.
  - Also requires extensive negotiation and due diligence, which slows down funding process

Sources: AREED reports; Hystra analysis

E+CO
Clean Energy Finance
Global

Executive Summary:

Back in 1994, E+Co started building a portfolio in the clean energy industry by raising funds among foundations and development agencies. Since then, 1,000 energy enterprises in Asia, Africa and South America were supported with business development or technical assistance and 200 benefited from a loan or equity investment. E+Co's $15.4m mobilized assets are invested in a technology agnostic portfolio that achieves a "balanced scorecard" performance along a triple bottom line based on environmental, social and financial returns. In 2007, investee companies provided clean and modern energy to 4.3m people, supported 4,000 jobs and mobilized $183m capital, therefore ensuring E+Co's sustainable impact. In 2008, the Financial Times rewarded E+Co for its achievements as a sustainable investor.

Project basic information

- **Date of creation:** 1994
- **Service delivered to clean energy firms:**
  - Debt and equity investing
  - Assistance and support for:
    - Fund raising
    - Microfinance revolving fund set-up
    - Business development and strategy
- **Portfolio footprint:**
  - Methodological support to 1,000 firms
  - Invested in 200 firms in 28 developing countries
  - 2007 approved investment: $13.6m benefiting 57 firms
- **HR:** 49 staff in 10 offices
- **Leadership:** Phil LaRocco (20 years experience in clean energy in developing countries, teacher at Columbia University School of International and Public Affairs)
- **Partners involved:**
  - Original sponsor: the Rockefeller Foundation
  - Working closely with social investors, foundations and multilateral organizations
- **Remarkable brand recognition** due to early role funding clean energy enterprises

Map of E+Co's main investments around the world

LaEsparanza hydroelectric plant, Nicaragua
E+Co supported growth from 485kW to 13MW

E+Co was rewarded in 2008 for its achievements as a sustainable investor

ASHOKA

HYSTRA
hybrid strategies consulting

Project ability to solve the problem ★★★

Philip LaRocco, *Founder and CEO*

What should MNCs do to have the largest impact possible on access to energy for the BOP?

Phil LaRocco: They should select one or two markets and facilitate social entrepreneurs to grow distribution channels for SHS, LED devices and cookstoves. This would include providing enterprise and customer microfinance, training programs and sourcing of quality products at the lowest price possible using economies of scale. It is a low-cost, low-risk approach with rapid impact.

- **Issues faced by clean energy start-up firms in developing countries:**
  - Few available sources of capital (investors perceive too high transaction cost compared to funding needs)
  - Dependence on unreliable and non sustainable subsidies
  - Difficult access to methodological support on financing topics
- **Needs addressed by E+Co:** firms initial, grow-up and working capital, business development services and strategy advices
- **Down to BOP500 end-customers served by E+Co's investee enterprises, e.g.,:**
  - Toyola efficient cookstoves
  - Wilkin Solar LED lanterns
- **2007 triple bottom line (social, environmental and financial) impact of E+Co's investee enterprises:**
  - Provided modern energy to 4.3m people
  - > 4,000 jobs supported ($10m payroll)
  - CO_2 offset 3.4 million tons
  - Reforested land 280 ha
  - $183m mobilized capital (8% from E+Co)

Project economic viability ★★☆

- **E+Co 2007 financials:**
  - $5.4m revenue (covering costs)
  - $15.4m mobilized capital in energy projects (12% equity, 88% loans)
- **Dependence on subsidies:**
  - Part of E+Co liabilities from investors accepting below market returns
  - Part of E+Co assets were granted from partner organizations
- **Ability to attract funding:**
  - Over 40 foundations / development agencies supported E+Co funding
  - Goldman Sachs committed to buy E+Co carbon offsets

Project scalability ★★★

- **E+Co operates on 3 continents:**
  - Main countries of operation covered by its network of offices
  - Leverages branches and skills of partner organizations as much as possible to extend its footprint
- **Market environment:** E+Co invests on markets with rule of law to ensure contracts enforcement
- **Regulation:** E+Co works with agencies like UNEP and national governments to create favorable regulatory environments
- **Fund-raising is still a bottleneck** especially to invest in enterprises' second stage of growth

Sources: Interviews with E+Co Founder and CEO; E+Co 2007 Annual Report; www.eandco.net

5 Recommendations

The focus on access to energy for low-income people arises from pressures seemingly at odds with each other. Access to energy is a development imperative, as it increases income, by enabling households to work at night. It protects health, by reducing indoor air pollution due to smoky fires. It has a disproportionate benefit for women and girls, who bear the largest burden from unsafe or inaccessible energy. The environmental imperative is no less acute; access to clean energy accomplishes development goals without advancing climate change. Finally, access to energy for low income people is a $500b market. Market-based solutions are sorely needed to provide a better alternative to the unhealthy, environmentally destructive and expensive options the poor already pay for.

We hope our investigation has made a convincing case for action.

Though our work was sponsored by three corporations, we know that all key players in development have a role to play: Aid agencies, Governments, Strategic social investors and foundations, Social entrepreneurs, Citizen Sector Organizations and Multinational companies.

The following pages attempt to draw the implications of our investigation for each of these categories of players.

* * *

Aid agencies

Market-based solutions are a powerful tool, but as the cases demonstrate, this tool will not reach the poorest or replicate as fast as is required without the type of targeted support that aid agencies are uniquely qualified to provide.

Aid agencies have an instrumental role to play in ensuring market-based solutions reach the poorest of the BOP. For example, solar home systems currently reach the BOP2000 at best, failing to serve half of the world population. Targeted interventions are needed to extend lower in the pyramid. In addition, the spread of even the most successful of these initiatives has been worryingly slow. Aid agencies can play an important role in advancing replication and scaling up.

In order to **extend energy solutions lower in the BOP** pyramid, aid agencies can:

1. **Design targeted subsidies** for the poorest customers. Even with low-cost funds grid connections only reach the BOP1000. In the near future this circumstance is unlikely to change. Aid agencies can play a role through vouchers or incentives to MFIs to help extend energy solutions lower in the pyramid. Such direct subsidy systems risk to create market confusion and the two following options are probably better.
2. **Support social entrepreneurs** with grants or low-cost financing. Nearly all the cases highlighted here employed grants or low-cost financing, at least at the start. At this stage of market development, such assistance is an indispensible asset to energy entrepreneurs and an important service to low-income people. Most social (non profit) enterprises will use these additional resources to penetrate lower income segments, actually many of them are already engaged in some forms of cross subsidization of the poorest customers by the (relatively) wealthier.
3. **Finance ecosystem for poorest customers,** especially MFIs. For the more complex solutions, microfinance is essential to reduce the upfront price burden on low income people and allow them to pay back over time. Aid agencies can continue to support the spread of microfinance in geographies were lowest-income people are over-represented.

In order to **accelerate replication** and scaling up, aid agencies can:

4. **Invest in programs designed to create the required "infrastructure" for the energy initiatives.** Aid agencies have an important role to play in improving the ability of entrepreneurs to grow energy enterprises with a combination of capability building and financing for small entrepreneurs. Other targeted interventions could address bottlenecks such as the lack of skilled staff as technicians.

5. **Support favourable energy regulation.** Working with governments on economic policy and regulation, aid agencies can help develop the frameworks that support market-based solutions. Primary among this is regulation that mellows the monopoly of national energy utilities, encourages renewable energy providers, and sets standards such as electricity buy-back rates into the grid.
6. **Avoid market distortions such as the promise of free help.** Ask any social entrepreneur what his or her biggest fear is and the answer is loud and clear: promises of free distribution of solar systems or of connection to the grid. Imbued by the expectation of free help households are unwilling to invest themselves. More often than not, the uncertainty about when or if this aid will arrive makes it difficult for households and entrepreneurs to make a decision. Giving clear direction about where and when grid connections will be built helps everyone to plan.
7. **Build tools for the market of ideas and money.** Aid agencies, through their global reach, can share best practices from region to region, while energy entrepreneurs often are tempted to reinvent the wheel. Would be investors in energy project are often deterred by the complexity of evaluating projects and the costs required to find and evaluate often very small projects. Aid agencies can support the development of metrics, and fund the measurement of impact. They can also build investment pipelines, reducing the great lengths investors and entrepreneurs have to go to in finding each other in a fragmented market.

Governments

Many of the roles for governments overlap with those of aid agencies. Governments would be involved with everything except the learning or metrics (7 above). In addition, governments have a unique role to play:

1. **Design tax incentives and duty rules to support energy enterprises.** These include the standard government toolbox of tax incentives for preferred industries, such as advanced depreciation. The government can also reconcile duty policies. For example, Ethiopia charges 50% duties on solar home system parts.
2. **Set quality standards to weed out sub-standard products**. Access to energy enterprises are undermined by myriad shoddy products. Standards ratings can help high quality enterprises distinguish themselves, and protect consumers.
3. **Solidify relationships between public utilities and energy enterprises.** For rural cooperatives and solar home systems, clarity around buy-back rates for energy fed into the grid helps entrepreneurs plan their business and helps households make decisions.

Strategic Social Investors and Foundations

Strategic social investors (SSI) and foundations have been described as "free agents", able to use their resources without having to be accountable and as a result to take more risks than other investors in development. As a result, SSIs and foundations need to use their very precious moneys in ways that other development players cannot.

Our work suggests an exciting array of initiatives: to offer a creative range of financial instruments, to examine their portfolio and orient towards market-based solutions, to take on orphan strategies and prod other natural owners, and to actively build the pipeline of energy enterprises. In addition, strategic social investors and foundations can act as aid agencies do (3, 4 and 6 above), building the finance ecosystem, investing in complementary programs, and avoiding market distortions.

1. **Provide a range of financial instruments including grants, loans and equity at reduced returns, and loan guarantees.** It is hard to over-estimate the impact that targeted, flexible financial instruments can have on the access to energy market. Over the course of the study, access to

low-cost financing was one of the most frequent requests from entrepreneurs. Working with the more mature enterprises, SSI and foundations can expect to recoup their investments while building social businesses.

2. **Build investment pipelines.** It is difficult for entrepreneurs and potential investors to move along the path towards collaboration for a number of reasons. SSI and foundations could have significant impact by creating portals for each to learn about opportunities. Incubation laboratories, mentoring, development of due diligence metrics and processes, and aggregation of potential projects are activities that expand the possible investment field and support the success of access to energy enterprises. They are also uniquely suited to the skills of SSIs and foundations.
3. **Examine portfolio and reduce market distortions**. In the same fashion as governments and aid agencies, SSI and foundations should examine their portfolios and reduce activities that make it difficult for households and entrepreneurs to invest, due to the expectation of free help.
4. **Take on orphan strategies and support natural owners**. SSI and foundations should examine their positioning in relation to other access to energy actors, and bow out of roles not suited. For strategies that no one is taking on, SSI and foundations could take a leading role. For example, run a competition with a prize for the first entrepreneur to design solar home systems at under $150 each.

Citizen Sector Organizations

Citizen Sector Organizations (CSOs) with on the ground presence can have significant impact on access to energy. Many of the case studies discussed involved CSOs at some stage of a hybrid value chain - as distribution partners, designers, microfinance partners, and social marketers. Especially when considering distributing energy products, CSOs should carefully consider whether this can be done without corrupting their core mission by mission drift, insufficient financial controls to manage the flows of money or destroying the social capital built up over years.

1. **Distribute energy products.** If the three conditions above can be met, CSOs should consider distributing energy products directly, such as solar LED lanterns, cookstoves, or solar home systems. This role utilizes the often unparalleled understanding and access CSOs have in low-income communities. It also enables CSOs to expand their social impact while earning unrestricted revenue.
2. **Organize local communities for grid connection** in slum communities. The grid connections cases provide a strong indication of the importance of CSOs in slums. CSOs played an essential role in organizing local communities, creating equitable and sustainable payment models, and creating relationships with businesses, government, and utilities. CSOs in slums should consider whether grid connections would be helpful to their communities, and whether they could perform the roles highlighted here.
3. **Provide microcredit** for clean energy purchases. Given the upfront cost of SHS, microcredit is essential to extend access to low-income people. CSOs with microfinance arms can extend credit for these systems, and at the same time sell associated CDM credits to increase revenue and expand access.[22]
4. **Train micro entrepreneurs** for access to energy businesses. For the Solar Energy Foundation, a lack of trained technicians is one of the primary impediments to SHS in Ethiopia. There are numerous businesses that a solar panel can enable,

22 See MicroEnergy Credits at www.microenergycredits.com for further explanation of how MFIs can finance clean energy purchases through carbon credits.

such as charging mobiles for a small fee. CSOs can help their clients learn about these opportunities and get ready to take advantage of new energy opportunities.

5. **Social marketing and awareness building** especially around health and safety benefits. For example, CSOs focused on health may want to take a leading role educating their communities about the dangers of indoor air pollution. CSOs working in slums have helped communities understand how moving to legal grid connections will enable street lighting and improve neighbourhood safety.

Energy social entrepreneurs

Social entrepreneurs active in the energy space are at an interesting point of transition. Some are moving to a for-profit model, as SELCO did years ago, and some are creating hybrid value chains with companies, as Muthu Velayutham has done with BP Oorja in India. It is a moment of choice for social entrepreneurs, as they look to expand products, promote their unique IP, and focus on their best value-add.

1. **Expand range of products.** Distribution channels focused on one product are historically expensive to build and difficult to maintain. For example, Grameen Shakti has promoted more than solar systems, and benefits from the diverse family of Grameen offerings.
2. **Promote IP** if distinctive and leverageable. Over the years social entrepreneurs have built unique capabilities that can help others replicate and perhaps bring revenue or recognition to the CSO. For example, SEF's training curriculum for SHS technicians could be licensed to other SHS providers, saving everyone time and money.
3. **Examine best value-add** as new entrants emerge. One of the outcomes of innovation from social entrepreneurs is that others enter the field, excited by the new possibilities. Some of these new entrants will take on parts of the value chain that social entrepreneurs used to do. For example, distributing devices such as solar LED lanterns or cookstoves may be rolled into other commercial distribution systems.

Multinational companies

Multinational companies are already active in the access to energy field. The cases highlighted here reveal a number of roles that MNCs can play in reaching poorer customers and replicating in more regions. These include working with individual social entrepreneurs, building a portfolio of social entrepreneurs, launching a project around a key installation, and building a business in a key segment. The strategy that an MNC chooses depends on its objectives and capabilities.

1. **Support a social entrepreneur.** Social entrepreneurs in the energy field have deep familiarity of the needs and desires of low-income communities, trust networks within these communities, and a commitment to make seemingly impossible models come to life.

   An MNC may chose to work with social entrepreneurs if it hopes to learn about the BOP for business development, and involve its staff in hands-on work. In turn, social entrepreneurs can use assistance with financing, technical competencies such as R&D facilities, and managerial competencies such as setting up a franchise system or managing inventory.
2. **Build a portfolio of social entrepreneurs.** Over 130 projects were profiled for this investigation, and each had something to teach about access to energy for low-income people. In light of this diversity, one strategy is to fund a portfolio of social entrepreneurs.

   An MNC may build a portfolio of social entrepreneurs if it prioritizes having stories to communicate externally, as well as learning about the BOP for business development and involving its staff (which could be accomplished with fewer social entrepreneurs).

   The portfolio of social entrepreneurs could use shared services such as web-hosting or bulk

purchasing, relationships with universities to measure impact, and assistance to replicate in other geographies or sell carbon credits on international markets.

A portfolio of social entrepreneurs that are learning, collaborating, and challenging each other could result in new and more powerful strategies. It is an especially interesting role for MNCs, as social entrepreneurs may have difficulty changing a small, nimble organization into a large, structured one, or may be personally uninspired by the prospect of running such an institution.

3. **Launch a project around a key installation**. Corporate social responsibility is employed to increase a company's license to operate, often by donating money to build local roads, schools, or clinics. An MNC may focus on the area around a key installation in order to reduce the risk of disrupted operations and increase the government amenability to new concessions. It may also want to learn about the BOP, and to a lesser extent involve staff in the local community.

   While still reinforcing a license to operate, enterprises could use allocated funds to start sustainable access to energy enterprises along the lines of the models highlighted in this report. For example, IBEKA convinced a donor that $500,000 given to a rural school would run out eventually, but $500,000 invested in a hydro plant attached to the school would provide revenue for school expenses in perpetuity.[23]

4. **Build a BOP business in a priority segment.** The market-based solutions discussed in this report have demonstrated ability to solve the problem, financial viability, and scalability.

   MNCs may build a business in one or more of the segments discussed in Chapter 4. Building a business could fulfill many objectives - it enables the company to learn about the BOP, it involves staff, it increases local acceptability, and it provides a good story to communicate externally. Most importantly, this strategy contains the hope to make a profit. It is also the most complex and risky strategy. However, new BOP businesses benefit from the decades of experience of entrepreneurs all around the world, many of whom are ready to help the next generation.

* * *

This report has attempted to demonstrate that market-based solutions for access to energy are powerful, necessary, and are ready to scale up. Entrepreneurs are in urban and rural areas, serving the needs of low-income people for cooking, lighting, communications, and income generation. The analysis and examples included here will assist the next round of entrepreneurs and their backers to continue the endeavour.

Figure 22 *Slum community in Sao Paulo, Brazil*

23 See page 71 in this report for more details on IBEKA in Indonesia

6 Appendix

The Hystra / Ashoka team

Our team was led by Olivier Kayser, with Laurent Liautaud as day-to-day project manager. Aileen Nowlan and Jean-Elie Aron worked full time on this project.

- **Olivier Kayser - HYSTRA** *Founder and Managing Director*. From 2003 to 2008, Olivier was a Vice-President of Ashoka, launching its France and UK operations, creating the global Ashoka Support Network and advising its Full Economic Citizenship Initiative. He was a senior partner at McKinsey, serving for 18 years leading multinationals in Europe, the US and Asia. He had founded TER in 1980, serving French public sector clients. He also lived a year in a small village in Belize. He is a member of several for profit and nonprofit boards, including the Global Alliance for Improved Nutrition (GAIN) and Danone's Social Innovation Advisory Board.
- **Laurent Liautaud - HYSTRA** *Project manager*. Laurent has lived 15 years in developing countries, including working a year in Cuba and two years with hands-on experience in launching a BoP project for Unilever in Mozambique. He worked for two years as a strategy consultant with Bain.
- **Aileen Nowlan - ASHOKA** *Consultant*. Aileen was a consultant for McKinsey & Company in New York before joining Ashoka's Full Economic Citizenship initiative in New Delhi. Before that, Aileen worked at the Wharton School's Zicklin Center, partnering with the World Bank Institute and the UN Global Compact. She has lived and worked in Asia, India, Canada and the U.S.
- **Jean-Elie Aron - HYSTRA** *Consultant*. Jean-Elie was an intern with McKinsey and CapGemini in Paris and Shanghai.

The team also benefited from the involvement of Ashoka experts and Hystra Network partners:

- **Valeria Budinich - ASHOKA** *Vice-President, leader of FEC initiative*, Washington DC
- **Stephanie Schmidt - ASHOKA** *FEC Change Leader,* Mexico
- **Beth Jenkins - ASHOKA** *FEC Change Leader,* Washington DC
- **David Green - ASHOKA** *Vice President and Fellow*, San Francisco
- **Gabriel Lanfranchi - HYSTRA** *Network Partner*, Buenos Aires. An architect and urban planner by training, Gabriel has been Planning Manager of Fundacion Provivienda Social since 2002. He leads innovative projects to improve the livelihood of the poorest communities in Buenos Aires.
- **Raman Nanda - HYSTRA** Network Partner, Mumbai. After 5 years with McKinsey in New York and Europe, Raman spent 3 years with the Acumen Fund, managing the performance of its $50m nonprofit portfolio of social entrepreneurs. He is turning around a health care social business in India.
- **Avik Roy - HYSTRA** *Network Partner*, Kolkata. Avik founded Re-emerging World Business Advisory Services, specializing in BoP strategies. He worked in India as an engineer with ICI, with TATA Consultancy Services and CK Prahalad. He also founded Access, a new distribution model in rural Maharashtra.

BOP income figures explanation

We evaluated the ability of the projects to reach the base of the pyramid in a sustainable way. This evaluation has been based on:

- The BOP market segmentation made by "**The Next Four Billion**"[24]. This remarkable report defines the BOP as the four billion customers living on an annual per capita income that is less than $3000 in purchasing power parity (PPP),

24 Available from the World Resources Institute at http://www.wri.org/publication/the-next-4-billion

which corresponds to a daily income in current U.S. dollars of $3.35 a day in Brazil, $2.11 in China, $1.89 in Ghana, and $1.56 in India. The BOP is further divided in 6 income level groups. The lowest segment groups those with an annual revenue per capita below $500PPP (BOP500) and the highest one those with a revenue comprised between $2500 and 3000PPP (BOP3000).

- The energy spend per income level and per country as calculated by The Next Four Billion. On average, BOP households devote 7% of their expenditures to energy, but this figure can vary significantly from a country to another as an Indian BOP3000 household spend $1100PPP per year on energy and its South African counterpart only $500PPP.
- The split between energy spending allocated to different needs (lighting and communication, cooking and income generation) based on Hystra research and experts interviews. Approximately 75% of BOP energy spend covers domestic needs and 25% covers collective activities (e.g., hospitals) and income generation (e.g., crop processing). Dealing with domestic use, we assumed that 80% of the energy spend of the poorest (BOP500) goes to cooking, vs. 20% for lighting and communication and that this percentage drops to 50% for BOP 3000.
- For each project, we used those hypotheses to assess the ability of end-customers to purchase the product or service without modification for the need covered.

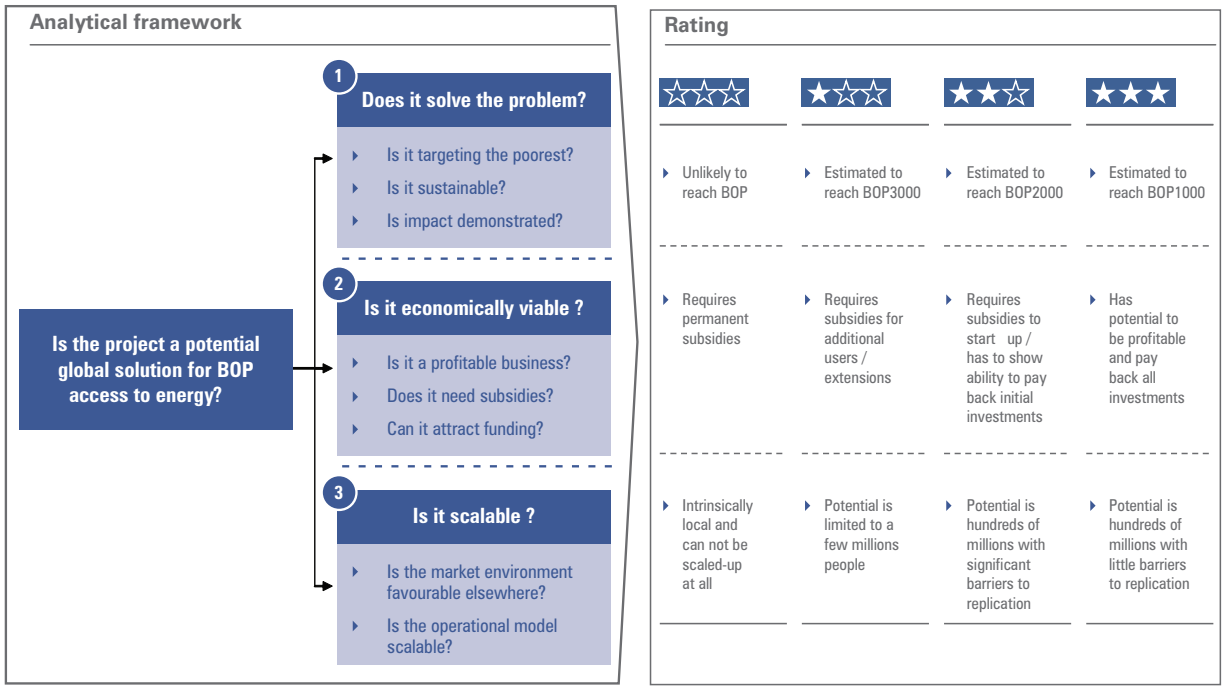
N.B.: unless otherwise specified nominal international dollars are used throughout this report

Case rating methodology

The case studies outlined above have been ranked according to three criteria:

1. Ability to solve the problem
2. Economic viability
3. Scalability

The best rating is three stars; the worst is zero star. Stars have been assigned according to the following rating criteria:



Laurent Liautaud
lliautaud@hystra.com

Valeria Budinich
vbudinich@ashoka.org

Bernard Saincy
bernard.saincy@gdfsuez.com

Gilles Vermot Desroches
gilles.vermot-desroches@schneider-electric.com

Damien Desjonquères
damien.desjonqueres@total.com