



# Access to Energy for the Base of the Pyramid

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A JOINT PROJECT OF



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## 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.

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# 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.

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# 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.

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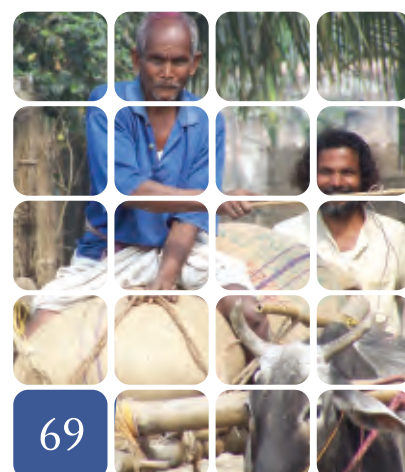
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# 1. ABOUT THIS PROJECT

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).<sup>1</sup> The BOP as defined by "The Next 4 Billion"<sup>2</sup> 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:<sup>3</sup>

Does it solve the problem?	Is it economically viable?	Is it scalable?
<ul style="list-style-type: none"> <li>▶ Is it targeting the poorest?</li> <li>▶ Is it sustainable?</li> <li>▶ Is impact demonstrated?</li> </ul>	<ul style="list-style-type: none"> <li>▶ Is it a profitable business?</li> <li>▶ Does it require subsidies?</li> </ul>	<ul style="list-style-type: none"> <li>▶ Is the market environment favourable elsewhere?</li> <li>▶ Is the operational model scalable?</li> </ul>
<p>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.</p>	<p>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.</p>	<p>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.</p>

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](http://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](http://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.



## 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 scarce 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.<sup>4</sup>

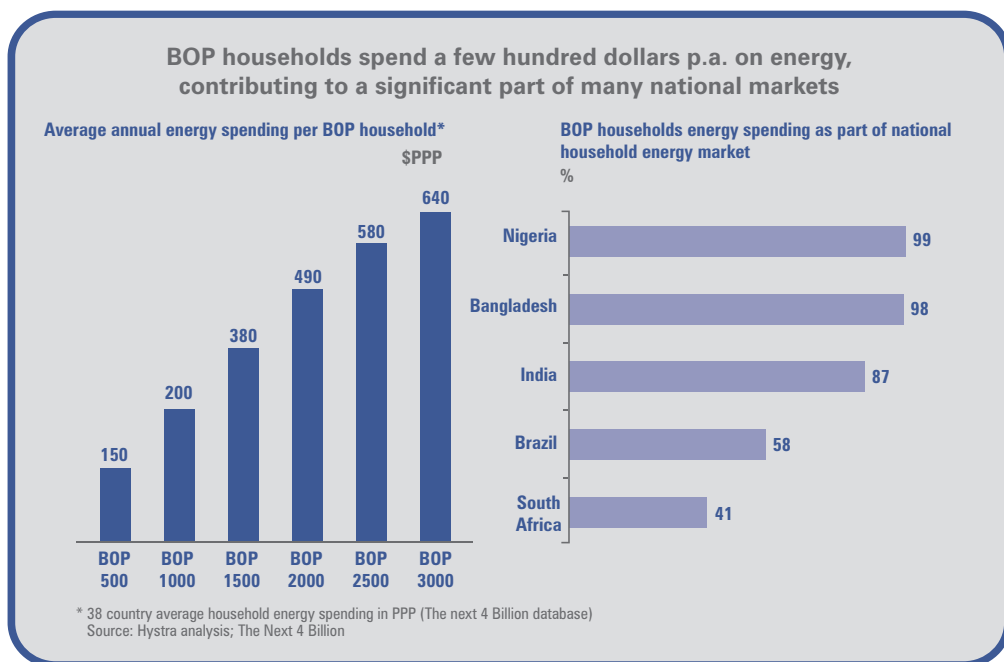


Figure 1: Size and distribution of access to energy market

4 Opportunity size based on current expenditure data

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.<sup>5</sup>

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 regroupped 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.

<sup>5</sup> 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.

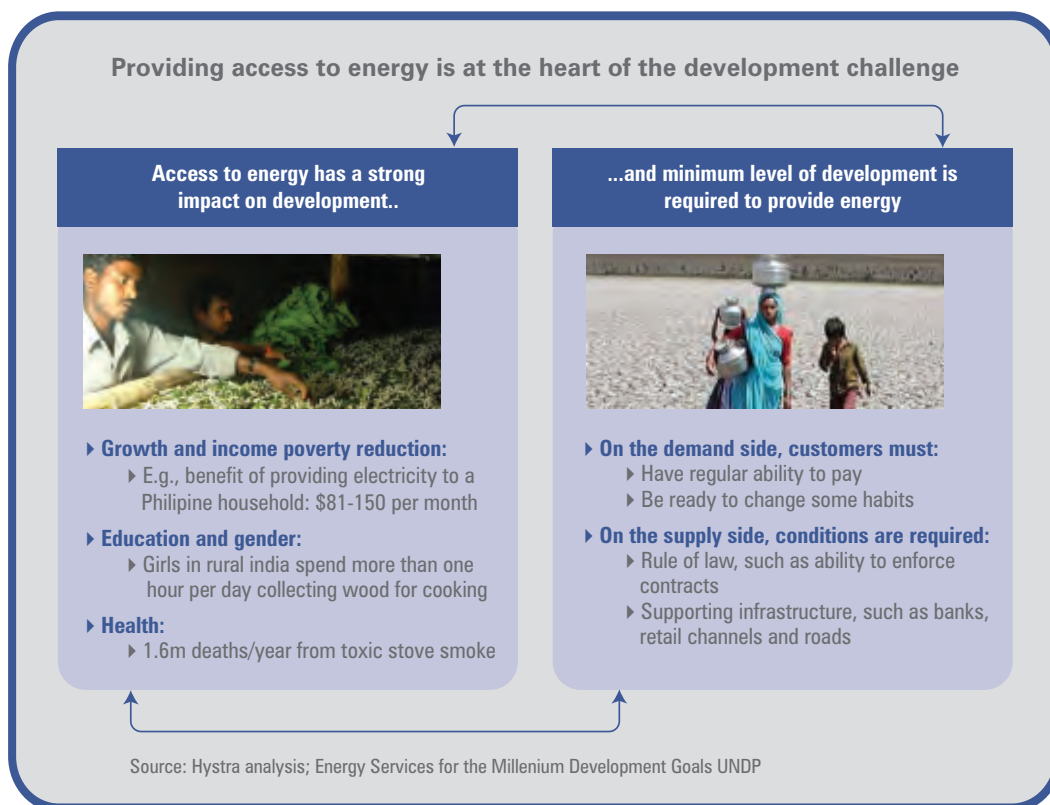


### 3. STATEMENT OF THE PROBLEM

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".<sup>6</sup> 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.<sup>7</sup> 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.<sup>8</sup> 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](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.

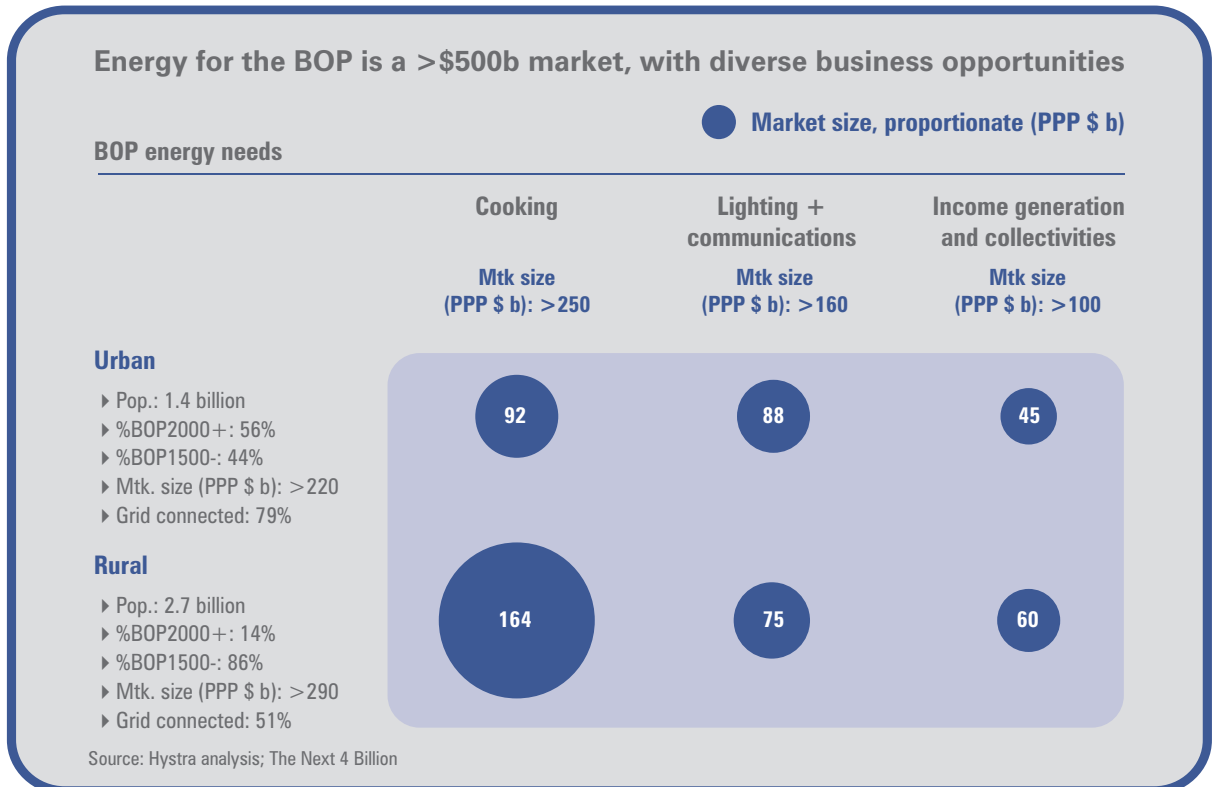


Figure 3 Energy market for BOP customers

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.

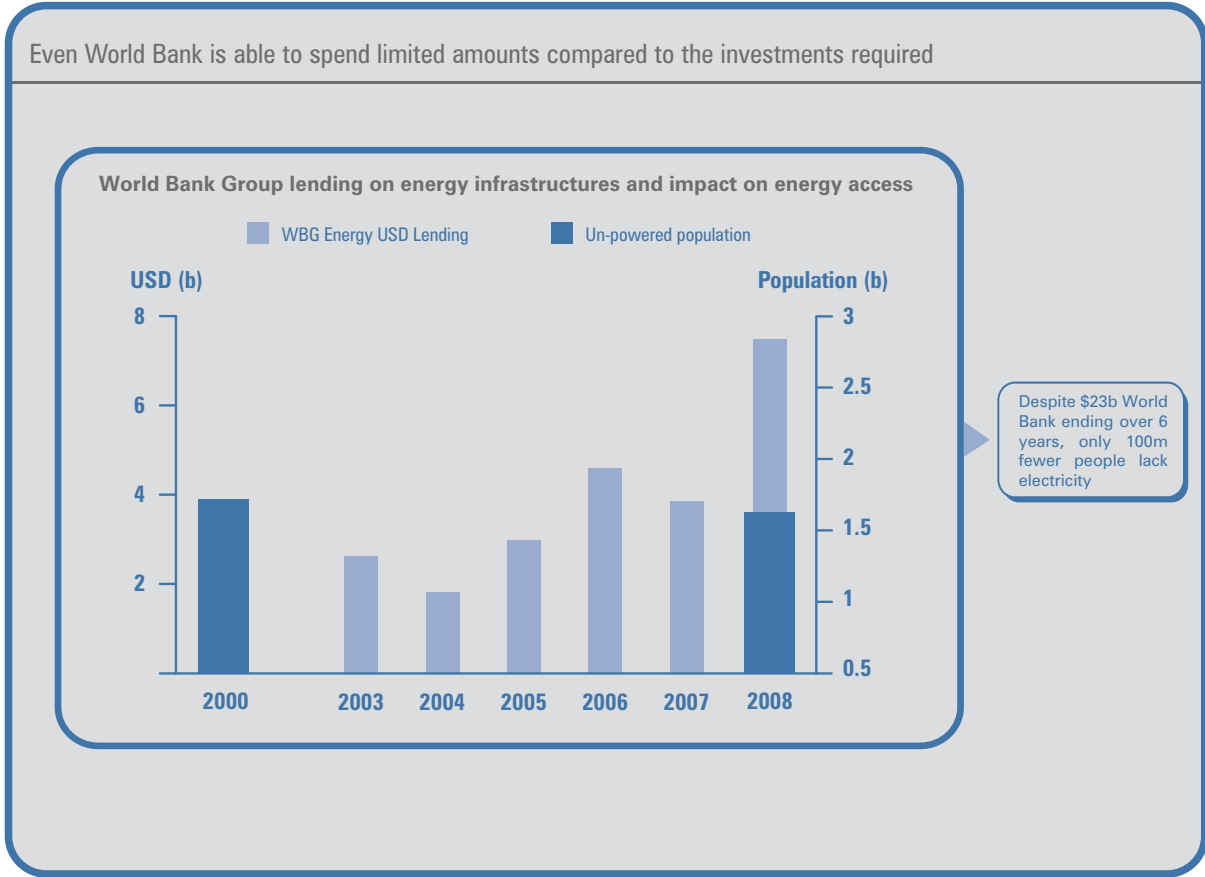


Figure 4 World Bank Group lending compared to number of people without electricity

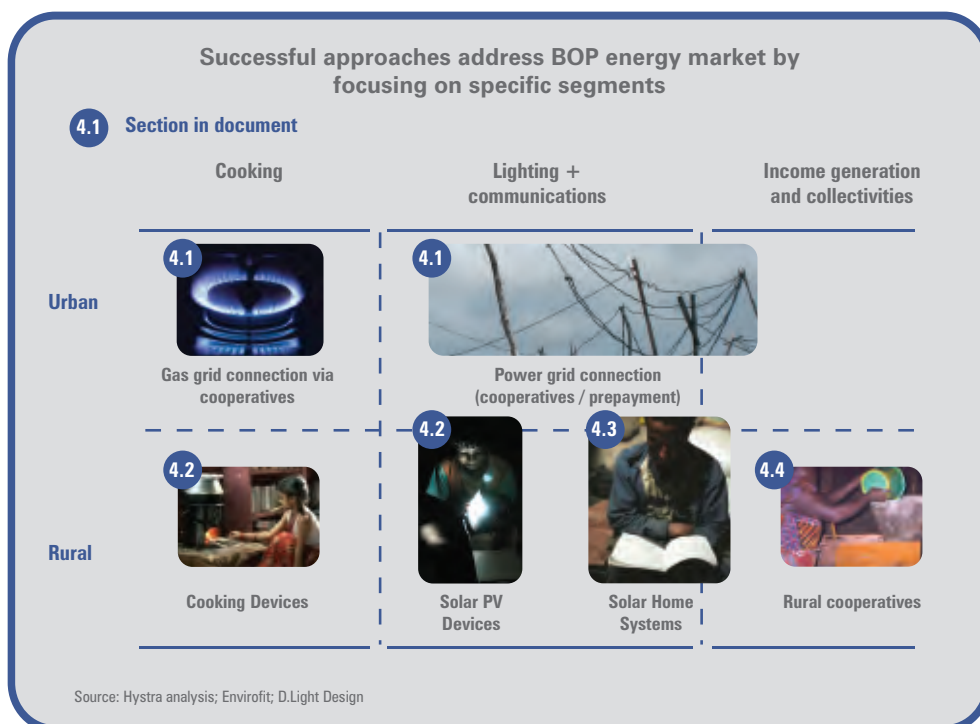


## 4. PROMISING MARKET BASED APPROACHES FOR ACCESS TO ENERGY TO THE BOP

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.



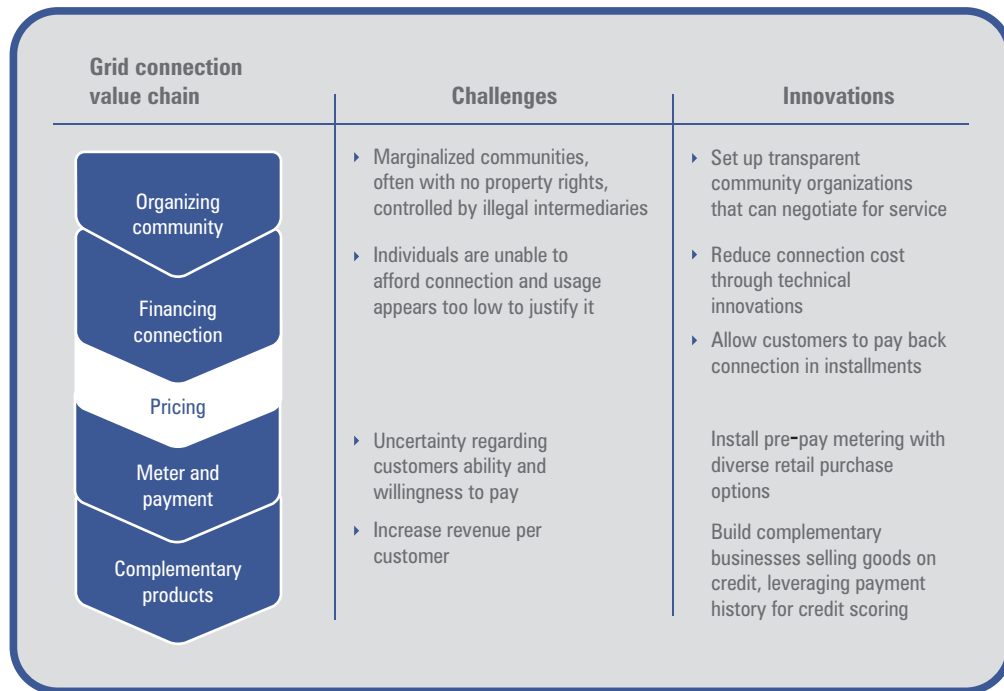
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## GRID CONNECTIONS

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.<sup>9</sup> This number grows by 500k a week.<sup>10</sup> The solution to grid

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

<sup>10</sup> 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.

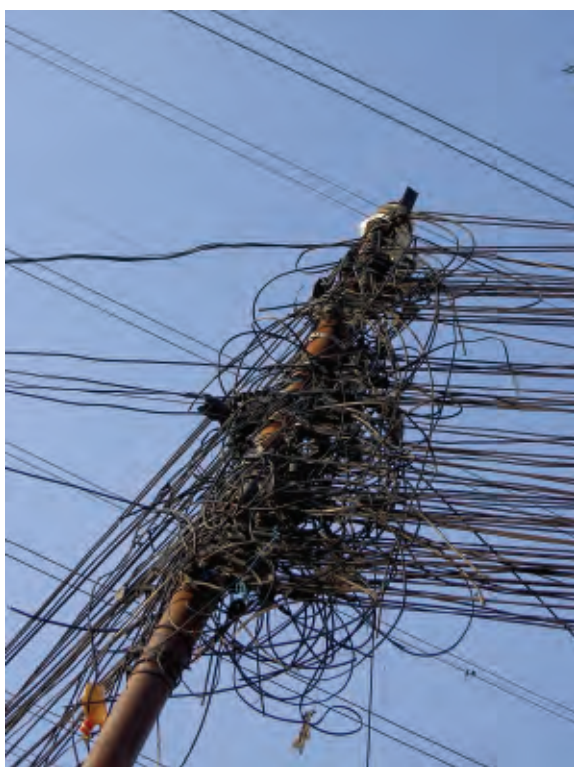


Figure 5 Electricity pole in Colinas, Sao Paolo, Brazil



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 6 Crew working outside Buenos Aires

bill. Prevented from growing its customer base, 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. Provienda'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 Provienda, and increased revenue from existing customers, in the case of Codensa.

### Interview



Gabriel Lanfranchi runs the Fundación Provienda 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. Provienda 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. Provienda 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
 <b>LYDEC</b>	Gas grid connection	23
 <b>Provienda</b>	Electricity grid connection	25
<b>Slum Electricity Cooperative</b>	Electricity grid connection	27
 <b>Conlog</b>	Pre-pay electricity meters	29
 <b>Codensa</b>	Consumer credit through electricity bill	31



## LYDEC

### Legal slum grid connection in Casablanca Morocco

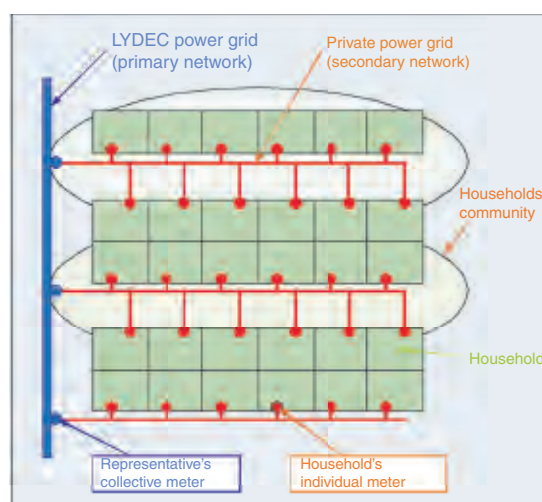


#### Executive Summary:

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



### Project scalability



- **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
- **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, Fundación 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



*Provienda 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



## Project scalability



- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>• <b>Viable trust-fund financing:</b> <ul style="list-style-type: none"> <li>• Net investment of \$1.7m (loan from FONCAP and World Bank)</li> <li>• &gt;1.2k families finished reimbursement</li> <li>• &gt;0 net value of trust fund from 2013 onwards will benefit to the community</li> </ul> </li> <li>• <b>No dependence on subsidies:</b> <ul style="list-style-type: none"> <li>• Banks will be refunded for their loan</li> <li>• FPVS OPEX repaid on gas spending</li> </ul> </li> <li>• <b>Ability to attract funding:</b> <ul style="list-style-type: none"> <li>• IDB and a local bank are considering to finance \$7m for scale-up</li> <li>• Ferrum/FV (leader in bathroom and kitchen fixtures in Argentina) is taking over technical office management to sell home improvements</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>• <b>Specific area eligible for LNG grid connection</b> (relevant for many South-American metropolitan areas): <ul style="list-style-type: none"> <li>• Excess domestic supply of LNG</li> <li>• Proximity to existing main LNG line</li> <li>• Urban area with roads and delimited properties required for grid construction (technical reasons, excluding slums)</li> </ul> </li> <li>• <b>Regulation:</b> permitted in Argentina; works as long as residents can receive LNG without property title</li> <li>• <b>Required partnerships:</b> <ul style="list-style-type: none"> <li>• Strong community organization</li> <li>• Coordination of multiple stakeholders (investors, LNG utility, ...)</li> </ul> </li> <li>• <b>No special technology required</b></li> </ul> |
|---|--|

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*

## 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



## Project scalability



- **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

- **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

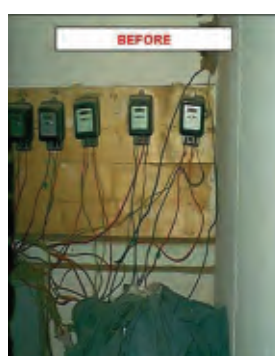


#### Executive Summary:

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**



## 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 ★★★

## Project scalability ★★★

- **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
- **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

★★★

## Project scalability

★★★

- **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
- **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

