SUSTAINABLE ENERGY DISTRIBUTION IN LATIN AMERICA

STUDY ON INCLUSIVE DISTRIBUTION NETWORKS

itd UPM Innovation and Technology for Development Centre

POLITÉCNICA

IDB Inter-American Development Bank

FOMIN Multilateral Investment Fund Member of the IDB Group

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This study establishes the foundation for the development and scaling up of models led by private entrepreneurs committed to providing electricity to the "last mile" population in Latin America. This ideal scenario is strengthened by the recent Paris climate change agreement which seeks to increase international aid to support the transfer of sustainable technologies and the generation of resilience tools for climate change. It seems as if all the years of effort and experimentation to benefit isolated communities are finally to be rewarded.

In addition, as mentioned in the study, another great opportunity for these entrepreneurs is offered by a growing market that seeks energy reconversion in Latin American cities through the leveraging of urban incomes. In this way, an economic balance is achieved that enables coverage in difficult to access areas without having to burden low-income users with the costs for this.

In spite of this great market opportunity, however, aspects such as distribution, finance, technology and public policy influence still represent important obstacles to overcome. Key changes in energy and market policies are needed that, over and above randomly applied traditional state subsidies, have an impact on the exponential growth of this type of initiative.

The MIF, as the innovation laboratory for the Inter-American Development Bank and using opportunities such as those outlined in this study, aims to support the development of high-risk models that inspire and commit the private sector to assist in solving the problems faced by Latin America and the Caribbean. In addition, it also seeks to generate learning capable of scaling up their impact to improve living standards in the region. This is why our doors are open to collaboration with the private sector. With them we can identify, reinforce and scale up innovative models of sustainable energy distribution as they enter and establish new markets, both in rural and urban areas, and contribute to decisions on issues relating to climate change adaptation.

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Brigit Helms, General Manager MIF - IDB

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itdUPM forms part of the Technical University of Madrid and is focused on technology-based sustainability and innovation. With a clear interdisciplinary agenda, itdUPM is made up of a network of researchers, teachers and professionals from non-academic organizations. The training, research and innovation programs and activities of itdUPM promote collaboration between diverse entities, including companies, public agencies, universities, research centres, entrepreneurs and NGOs.

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The Multilateral Investment Fund is the innovation lab for the Inter-American Development Bank Group. It conducts high-risk experiments to test new models for engaging and inspiring the private sector to solve economic development problems in Latin America and the Caribbean. MIF addresses poverty and vulnerability by focusing on emerging businesses and smallholder farmers with the capacity to grow and create economic opportunities.

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INTRODUCTION AND OBJECTIVES

In spite of economic and social progress in the Latin American region and the fact that programs for universal energy access have provided electricity to millions of Latin Americans, the World Bank (2012) calculates that over 20 million people do not yet have **access to electricity** in Latin America. Around 90 million people are still dependent on solid fuels, mainly biomass and kerosene, to cover needs such as heating and cooking. In Latin America this situation particularly affects **rural areas** where 78% of the population is concentrated and where 66% of the population have no access to electricity or gas. In Mexico alone, 18 million people only have access to solid fuel and in Guatemala 63% of the population suffer this problem. In the case of Bolivia, 20% of the low income population has no access to electricity. Wider concerns about the **environmental impact** of this lack of access include the estimated 102.4 millions of tonnes per year of CO_2 emissions from traditional cookstoves used in the region[1]. This is therefore a problem of multiple dimensions: lack of access to energy, the predominance of sources of energy with high carbon levels, and significant environmental impact.

The United Nations has agreed to "ensure access to affordable, reliable, sustainable and modern energy for all"[2] in **Sustainable Development Goal** (SDG) number 7. One of the targets of this Goal is to guarantee universal access to affordable, reliable and modern energy services by 2030. Currently one in five people in the world do not yet have access to electricity services. Numerous donors, companies and civil society organizations are aware of the need for collaboration to achieve this objective and are working towards it through multi-actor partnerships such as "Sustainable Energy for All"[3].

To further address this situation, a number of initiatives are being developed in the region that have been designed to offer solutions to improving the provision and quality of basic products and services for the most vulnerable populations in isolated rural areas known as the "last mile" population. Many of these solutions are based on the development of **inclusive distribution networks** which have been adapted to local contexts and are capable of enhancing and leveraging existing resources and capabilities. These networks include the "last mile" population as actors in value chains by "co-creating" economic opportunities and enterprises, and increasing their empowerment and capacity for social organization[4].

The Multilateral Investment Fund (MIF), an innovation lab for the Inter-American Development Bank (IDB), has promoted more inclusive access to energy through projects and initiatives such as **SCALA** -which promotes economic empowerment of the poor through distribution networks based on micro-franchising (RG-M1234) –, the **"Ecomicro" Regional Program of Green Micro-franchising** (RG-M1205) and **MIF's strategies for inclusive cities and sustainable agriculture.**

Within this context, and through this study, MIF supports the analysis, systematization and dissemination of inclusive distribution energy initiatives as a tool to promote their expansion and growth in the region.

1 http://perusolar.org/17-spes-ponencias/11-pactoSocial/TorresMuroHugoAlfredo/Torres_Muro_Hugo_Alfredo.pdf

2 http://www.un.org/sustainabledevelopment/es/energy/

3 http://www.se4all.org/

4 http://scalaid.org/wp-content/uploads/2015/12/The-Power-of-Downstream-SCALA-ESP.pdf

OBJECTIVES OF THE STUDY

This study has been undertaken by the **Innovation and Technology for Development Centre at the Technical University of Madrid** (itdUPM). It was commissioned by MIF in collaboration with experts from several of their units. In order to carry out a thematic analysis of energy distribution networks in Latin America a selection of six model initiatives in the region was undertaken. In-depth analysis of these models has enabled the identification of innovations and good practices that could be adopted by other current and future inclusive distribution initiatives. The research has also assisted in detecting challenges and opportunities related to issues such as funding, technology and enabling public policy. Additionally, this paper provides useful input for the events that MIF is organizing for the launching of the **SCALA**Energy Lab project to promote the expansion and scaling up of energy distribution systems.

The structure of this document is as follows: the methodological basis for the study is outlined after the introductory section. This summarizes the selection process for the initiatives studied. This began with the identification of 21 cases from which six were chosen based on their importance, excellence and representation. Two non Latin American initiatives were added to this list to serve as a contrast. The document then offers a summary description of the selected initiatives which aims to reflect the key models in the region and related findings and recommendations. The last part of the document summarizes the main findings of the study and provides a set of recommendations for promoting inclusive energy distribution networks in the region.

The six Latin American initiatives selected represent different approaches and solutions to the problem of access to energy suffered by the "last mile" of the population. The initiatives have been promoted by international donors such as **EnDev Peru**, or public-private consortiums such as **Guascor/Eletrobras Amazonas Energia**, to provide access to energy in isolated areas; companies such as **Tecnosol**, that have found a market space for the distribution of systems to the "last mile" population or **Ilumexico**, that have been created to provide services to unattended communities. The study also reflects the successful integration of end users in the energy supply chain, including **Energética and PHOCOS Latin America** in Bolivia and the **ACCIONA Microenergia Foundation** in Oaxaca, Mexico, through micro-franchising and involvement in systems maintenance. The six cases capture relevant experiences of using diverse technologies (sun lamps, improved cookstoves, mini-grid systems), business models (institutional partnerships, external distribution or micro-franchising) and user financing (micro-credit, hire purchase).

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METHODOLOGY

The aim of this study is to identify the key challenges faced by initiatives invoked in the distribution of sustainable energy products and services in Latin America. It aims to offer solutions and measures for facilitating an increase in both their size and expansion to other regions without adequate, reliable and sustainable access to energy.

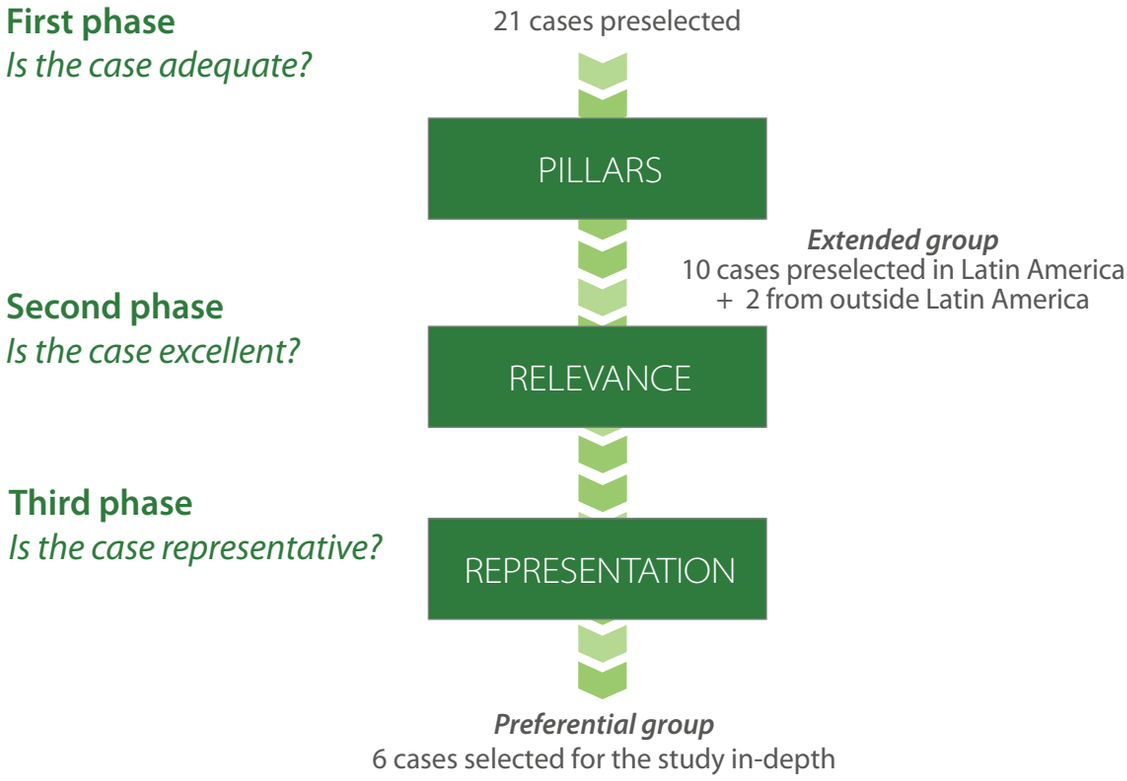
To address this purpose the study is structured in the stages outlined in the image below.

STAGES OF THE WORK

The case study selection process took place in three phases:

- **First phase: Refining the selection scope**. In this phase the most relevant regional experiences for the objectives of the study were determined. This began with an analysis of 21 cases that met the basic pre-selection criteria or "pillars", including: being an inclusive distribution model; having a financing system in place; and using a minimum of two different technologies.
- **Second phase: Relevance of each case**. In this phase quantitative and qualitative relevance criteria were applied in order to determine which cases stood out in the following areas of analysis: sustainability of the business model, impact, innovation, participation of actors and roles, replication and scale-up.
- **Third phase: Representativeness of the "preferential group"**. A final filter was carried out to ensure that the cases, besides being suitable and excellent, represented a wide range of experiences.

The application of these three filters resulted in the selection of six experiences for detailed analysis. This analysis, in addition to drawing on relevant literature, enabled extraction of key findings and recommendations.



Although the bulk of the analysis is focused on the six cases selected for the study, the 21 experiences – which are very diverse in their approach and implementation – were also taken into consideration. Two other relevant experiences from outside the region (SunnyMoney in Africa and IDCOL in Asia) were also used in order to offer comparisons with the Latin American initiatives.

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SUMMARY OF CASES STUDIED

- ACCIONA MICROENERGIA MEXICO
- ENDEV PERU
- ENERGETICA BOLIVIA
- ILUMEXICO MEXICO
- GUASCOR/ELETROBRAS AMAZONAS ENERGIA BRASIL
- TECNOSOL NICARAGUA
- SUNNYMONEY TANZANIA
- IDCOL BANGLADESH

ACCIONA MICROENERGIA
MEXICO

Charging a cell phone in La Libertad, Municipality of San Pedro Pochutla

3.1. ACCIONA MICROENERGIA - MEXICO

MODEL LED BY A PRIVATE COMPANY FOUNDATION WITH HIGH LEVEL OF GOVERNMENT PARTICIPATION (50% SUBSIDED)

ACCIONA Microenergia Mexico (hereafter AMM) is a social enterprise that was created in April 2012 by the ACCIONA Microenergia Foundation (FUNDAME). AMM's aim is to facilitate access to electricity through Third Generation Residential Photovoltaic Systems (SFD3G) for households in populations with less than 100 inhabitants that have no access to the electric grid.

AMM is the second initiative led by FUNDAME for access to energy services. It follows in the wake of ACCIONA Microenergia Peru, a social enterprise with identical aims based in the Peruvian region of Cajamarca.

These systems are intended to cover lighting and communication needs in the poorest communities of the State of Oaxaca which has one of the lowest percentages of households with access to electricity (94.7%). According to figures provided by the National Institute for Statistics, Geography and Information Technology (INEGI), in 2010 there were 9,500 homes (approximately 25,000 people) in Oaxaca without electricity. The majority of these people are concentrated in 808 communities with less than 100 inhabitants.

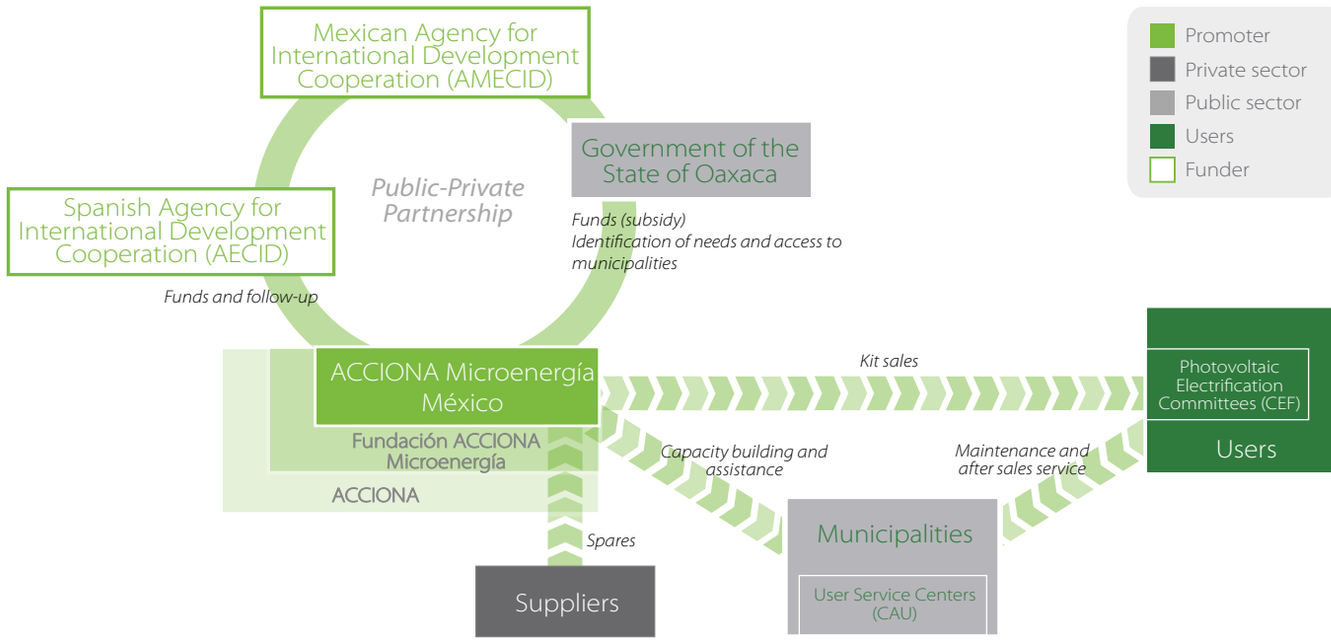
The key pillars of the business model are:

- A collaboration model based on a Public-Private Partnership for Development5 (PPPD) where several actors have joined to contribute resources and skills: the Oaxaca Government and different local municipalities, the Spanish Agency for International Development Cooperation (AECID), the Mexican Agency for International Development Cooperation (AMECID) and ACCIONA.
- Provision of a unique and standardized service composed of a 25W system to provide basic home lighting and electricity supply. The system is simple to install, environmentally friendly (it uses lithium-based batteries which do not generate heavy metal waste), easy to handle and light, weighing less than 10k. It has "plug & play" ("jack" type) connectors so that the installing and uninstalling can be carried out by users.
- The Government of Oaxaca subsidizes 50% of the program to ensure that the solar systems are affordable to those families suffering from energy poverty.
- The after sales and maintenance service is mainly carried out by User Service Centres (CAU). These are offices located in priority zones for state activities that promote rural electrification and are in a key area within the micro-region. The centres have emerged as a result of agreements with AMM which stipulate the supply of systems and spare parts, sales follow-up and problem-solving, and provision of technical training with municipalities. The latter contribute by providing premises and municipal officials for coordination and management.
- The beneficiary community is organized through Photovoltaic Electrification Committees (CEF) in which users and community members are able to actively participate and become actors in their activities. This representative body liaises with the company and its members are selected by the community with equal representation of men and women.
- To date the initiative has managed to install 3,602 systems and they expect to have 7,500 systems installed by 2016, thus providing services to 30,000 people (0.7% of Oaxaca's population).

CAU Manager and field operator from AMM at the Sola de Vega User Service Centre

5 According to the IDB, a Public-Private Partnership (PPP) is a long term contract between a private party and a governmental entity for the purpose of providing a public utility or service in which the private party assumes a significant risk and management responsibilities and whose remuneration will depend on performance. For more information, see: http://www.fomin.org/es-es/portada/proyectos/accesoaserviciosb%C3%A1sicos/asociaci%C3%B3np%C3%BAblicoprivada.aspx

MAP OF ACTORS AND RELATIONSHIPS



FINDINGS AND GOOD PRACTICES

- **Inclusive distribution:** the maintenance service is designed so that the community takes ownership of the program in two ways. Firstly, if there are problems with their systems, users can dismantle them – they are trained to be able to do this– and get them serviced at the CAU. This means that responsibility for maintaining the system lies with the user who thus takes ownership and responsibility for the initiative. Secondly, as the CAU are managed by municipal officers, local entrepreneurs are encouraged by AMM to train as technicians and offer this service in future. Technicians are normally trained in local universities and technology centres with support from ACCIONA Microenergia Mexico and other actors.

- **Funding**: the importance of subsidizing 50% of the price of the systems to make them available to users is worth noting. The cost of the system is 3,756 pesos in total, of which the user pays 50%, 1,878 pesos (USD 104), from their savings and the Government of Oaxaca covers the remaining 50%. Should a user be unable to pay in cash some support is available through the micro-financing platform Kiva. The rest of the cost of the program is covered by AMM and AECID at 50% each approximately. These financing mechanisms are fundamental to the scaling up the initiative. With some effort, users are able to cover the payment of 50% of the system but not 100% of it. The payment is made in cash as there is not yet a micro-financing mechanism in place.

- **Technology:** state-of-the-art technology is used with lithium based batteries that offer better features than conventional ones (they can store energy in less space,

Residential Photovoltaic System in La Tallera community, Municipality of San Pedro y San Pablo Ayutla, Sierra Mixe

have deeper discharge cycles and are more efficient). The system is easy to install and use, and its design is based on "jack" connectors which are easy to uninstall during maintenance.

AMM manager at the Tierra Blanca community school, Sola de Vega

- **Public policy**: the Private-Public Partnership for Development is a very solid model for this type of rural area electrification program. It combines elements such as the knowledge and technical experience from a private company with public agency networks and capacity. The solidity of the agreement is reinforced by allocating responsibilities so that risks are mutually shared and there is transparency in cost monitoring and budget allocation. Resources from the different actors are brought together with support from subsidies due to the low purchasing power of the population and general lack of interest from the private sector. The Government of Oaxaca plays a crucial partnering role. It facilitates the identification of needs (providing information, identifying vulnerable groups and areas for prioritization) as well as access to municipalities and communities. At the same time, a 50% subsidy in the price helps users to pay for their systems (the subsequent maintenance of equipment is supported by users). The Government also enables coordination between actors such as AMM and Ilumexico (this latter case is explored below). It thus plays a key role in providing transparency, legitimacy and public visibility.

ENDEV
PERU

Improved cookstove in the Municipality of Chinao

3.2. ENDEV – PERU

MODEL LED BY INTERNATIONAL COOPERATION AGENCIES FOR MARKET DEVELOPMENT OF ENERGY PRODUCTS

"Energising Development" (EnDev) is a partnership that promotes access to basic energy services for 18 million people around the world by 2019. It is financed by six donor countries: Germany, Netherlands, Norway, United Kingdom, Sweden and Switzerland. It is currently being implemented by the German cooperation agency (GIZ) in 26 countries in Africa, Asia and Latin America. This publication analyzes the case of Peru where the EnDev program began in 2007. Of the 30 million inhabitants in the country, around three million people still lack access to electricity and one and a half million to clean cooking devices. A high percentage of the population without modern energy services is concentrated in the rural areas which are difficult to access and, in many cases, impossible to connect to the conventional electricity grid.

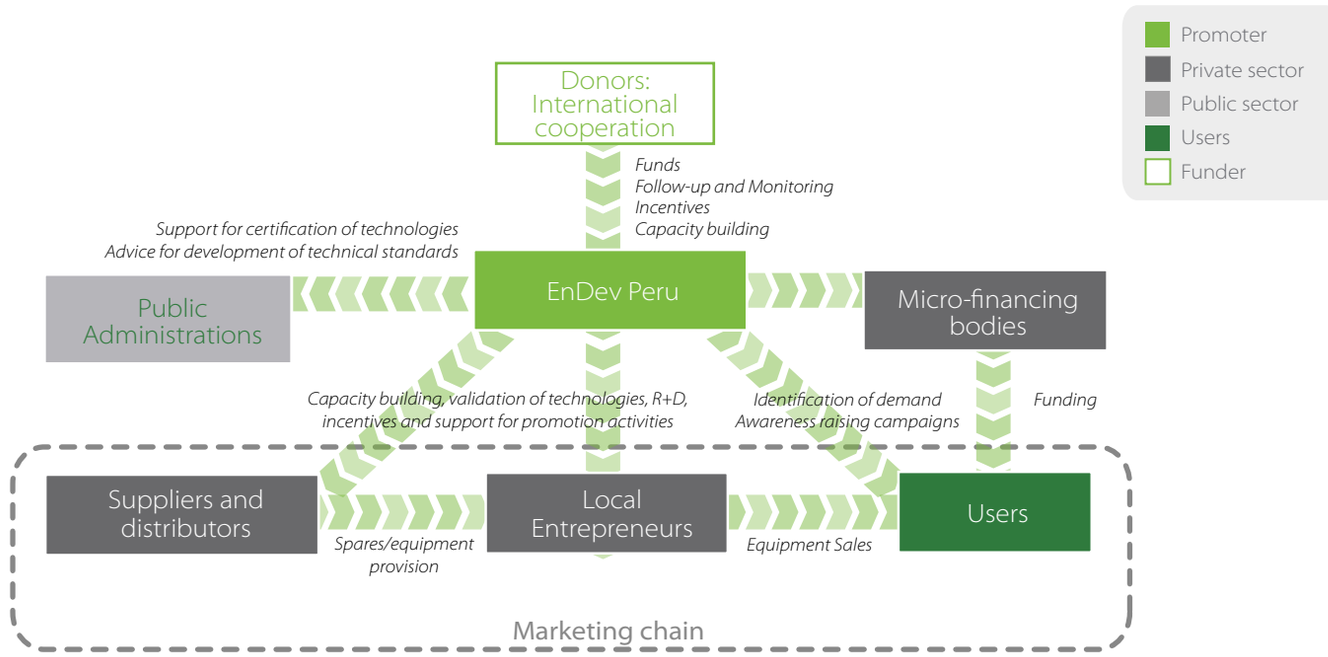
In order to address these challenges, EnDev Peru has focused on promoting the development of a market of different energy services by adopting a coordinating role between the public administration, private bidders and potential users. EnDev Peru's approach prioritizes a series of activities for each of these actors: technical advice for the development of public policy and regulation; collaborating in awareness campaigns using public administration technologies; capacity building and strengthening for micro-entrepreneurs; and support for promotion and awareness-raising campaigns among users. This report focuses on documenting the working approach for the two main products supported by EnDev: improved cookstoves and solar products.

The improved cookstove field is the oldest and largest area of the EnDev program with around 206,000 systems distributed in total). It has had particularly strong public support, through the "Peru sin humo" (Smoke-free Peru) program and the regular tenders carried out by various public institutions. In collaboration with public programs EnDev aims to boost the launch of the improved cookstove market by raising user awareness, training entrepreneurs and certification of cookstove models. As a result of EnDev's work, at the end of 2015 there were around 20 entrepreneurs in the improved cookstove field, some of whom employ up to 20 people and make several thousand dollars per month. EnDev has also made important efforts to try and incorporate micro-financing institutions into this line of activity so that users can access loans that lower the initial cost of the cookstove.

EnDev's second area of work is to reinforce the market in solar lamps (PicoPV) from both the offer and demand sides. EnDev's approach addresses the entire value chain and identifies those aspects that are of particular relevance. EnDev Peru also undertakes technological surveillance tasks which include the testing and selection of systems, consulting for regional importers and distributors, and identifying and reinforcing retail outlets. That means that EnDev does not sell directly to the final consumer but supports reinforcement of the distribution network and its different actors. Of particular note is their collaboration with the social enterprise Powermundo which started importing solar lamps into Peru in 2011 and has focused its distribution activity in the rural areas of the San Martin District, selling around 9,000 solar lamps by the end of 2015. This initiative is based on a distribution system that uses local agents (who frequently own a small business) and medium-sized distributors operating at regional level.

Solar lamp seller in Pucalpillo

MAP OF ACTORS AND RELATIONSHIPS



FINDINGS AND GOOD PRACTICES

- **Inclusive distribution**: micro-entrepreneurs for both improved cookstoves and solar products are employed for marketing and maintenance purposes. In the case of the improved cookstoves the market offer was developed through capacity building, supporting the entrepreneurs who manufacture them and providing jobs to the local population as their businesses grew. In the case of solar lamps, the market offer is structured through distribution companies such as Powermundo which draws on existing local outlets or street vendors. It is important to note that in the case of solar lamps, the advances achieved in electric grid coverage have led to a reduction in the size of the potential market making it more geographically disperse. This may result in some difficulties for the sustainability and scaling up of the initiative.

Catimor, outlet for different solar products

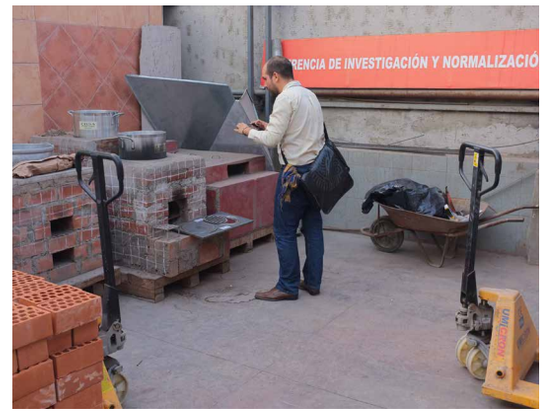
- **Funding**: as an innovator in the financing field, EnDev has introduced a Pay for Performance[6] system to incentivize two micro-financing entities. This system is based on the number of loans contracted to buy products promoted by the program. In spite of this, the participation of the micro-financing entities is still limited. Some of the constraints appear to be the geographical dispersion of the users, the high transaction costs of the small loans (the average cost of a micro-credit in Peru is around USD2.000, well above the cost of the equipment needed); and the almost total absence of previous banking activity among the population.

6 The program with Caja Arequipa is fully explained here: http://www.cajaarequipa.pe/noticias-y-eventos/?_m=01&_y=2016#Caja-Arequipa-implementa-y-ejecuta-el-proyecto-"Dinamización-del-Mercado-de-Calentadores-Solares-en-el-Perú"-3408

- **Technology**: as a prerequisite for supporting the creation of a market for photovoltaic energy, EnDev carried out a verification campaign for 11 solar systems which included lab and durability tests in the field. This enabled identification of more appropriate markets using the following criteria: durability, robustness and luminosity/price based performance. This analysis was particularly important in a market where very poor quality products reduce client trust. For instance, battery powered flashlights on sale in the market do not usually last more than six months.

- **Public policy**: support from public policy institutions remains essential in the Peruvian case, both to facilitate the affordability of the products and services as well as to convince users of their advantages. EnDev's work with public institutions to develop quality standards that certify the equipment on sale is of particular interest here. More generally, the importance of coordinating all these activities adequately is also crucial. Without this there would be a risk of generating market distortions and inaccurate expectations among users.

Improved cookstove maker in Tarapoto



Certification laboratory for cookstoves (SENCICO) in Lima

ENERGETICA
BOLIVIA

Visit to a client with a solar system installation, Municipality of Mizque

3.3. ENERGETICA - BOLIVIA

MICRO-FRANCHISING-BASED MODEL LED BY AN NGO WITH FUNDING CONTRIBUTIONS FROM MIF

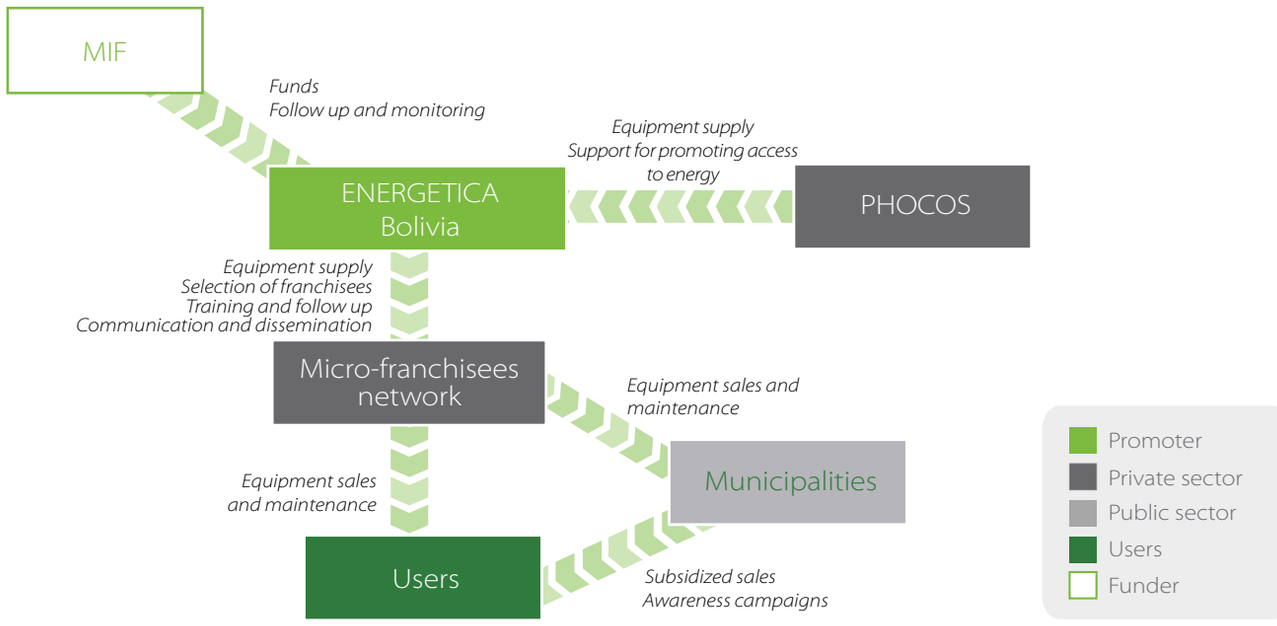
Energetica is a non-for-profit Bolivian organization which was founded in 1991. Its mission is to contribute to sustainable development by enabling access to energy for the most disadvantaged segments of the population. PHOCOS, meanwhile, is a Bolivian-based solar energy systems manufacturer that contributes to promoting access to energy agenda through various initiatives.

Since 2013, thanks to support from MIF, Energetica has been promoting the creation of a network of micro-franchisees dedicated to selling access to energy systems, mainly through solar lamps and other residential solar systems. The aim of this project is to generate 100 micro-franchisees and ensure annual sales of around 10,000 solar lamps. According to studies carried out by Energetica there are around 300-400,000 families in Bolivia for whom the extension of the electrical grid is not an economically viable option and who will need off-grid solutions.

The products sold through the micro-franchising network, solar lamps and larger size solar kits, are mainly provided by PHOCOS. This has created a close relationship between Energetica and PHOCOS which enables the adaptation of technical features to local needs. The development of the actual micro-franchising network necessitates identifying areas of the population without access, finding candidates for franchising and providing them with the training to undertake the management of stocks and sales.

There are two different ways of marketing through the micro-franchising network: direct sale to the user in which Energetica supports micro-franchisees by setting up awareness campaigns and assisting at trade fairs in order to stimulate sales, and institutional sales through agreements with those municipalities subsidizing part of the costs of a lamp and identifying people interested in purchasing them. In this case, the work of the micro-franchise operator, with support from Energetica, is focused on establishing a relationship with the authorities that assist the purchasing process at institutional level. In the second option it is worth noting that, although the financial assistance provided by the municipality is limited, users seem keener to buy when campaigns are organized by local institutions.

MAP OF ACTORS AND RELATIONSHIPS



Sale of solar equipment at El Puente trade fair

Stocks of solar lamps at PHOCOS premises

Meeting at the head offices of Energetica

- **Inclusive distribution**: micro-franchisees play a crucial role in marketing, maintenance of equipment and after sale services. These services may include selling spare parts, managing product guarantees and advising users when they wish to renew or upgrade their equipment. A minority group of micro-franchisees leads the sales, indicating that proactive leadership capacities are key to success or failure. Energetica now faces the challenge of how to standardize and evaluate the activity of the franchisees. There are currently around 40 franchisees with an income of 15% of the actual sales which number 300 systems and products a month. A medium term challenge is how to diversify the offer of products and services which, by drawing on the distribution network created, may offer higher income to the micro-franchisees and contribute to the sustainability of Energetica itself.

- **Funding**: micro-finance does not really play a role within the Energetica model as nearly all the sales are made in cash. Due to high transaction costs no micro-financing institutions appear to be interested in offering loans for less than USD100. Should the offer of the micro-franchisees succeed in expanding to cover higher cost products such as household appliances or manufacturing technologies, greater interest may be encouraged among micro-financing institutions. At present Energetica does not have a scheme for payment by instalments. The possibility of paying for purchases in two instalments is only offered for sales of larger size equipment.

- **Technology**: although Energetica does not develop in-house technology, it is deeply interested in ensuring that the quality of the solution selected is able to meet the needs and context in which it is to be used. The existence of a close relationship with the supplier, PHOCOS Latin America in the case of solar lamps, has allowed the introduction of changes to the product design to better meet market needs. Users have a two-year warranty and can contact the franchisee in case of problems. However, the relatively high price (USD90) makes wider use difficult and people appear to prefer purchasing battery-powered flashlights of lower quality and service life at much less cost.

- **Public policy**: coordination with public institutions is considered a key success factor. At local level, support from municipalities facilitates public awareness and reinforcement of user trust, reducing reluctance to spend a significant amount of money on solar products. Furthermore, in the case of Bolivia, municipalities and districts possess the legal capacity and resources to encourage or subsidize access to electrification systems, thus making their purchase cheaper. Both Energetica and PHOCOS consider that the development of an energy access strategy at national level is crucial. Given that "Agenda 2025"[7] endorses access to energy for the entire Bolivian population among its objectives, there is an opportunity to collaborate with the administration in the identification of appropriate technologies and the development of the requisite public policy and legal frameworks for these.

7 The "Agenda Patriótica del Bicentenario 2025" [2025 Bicentennial Patriotic Agenda] lists a total of 13 major objectives at national level, including universal access to basic services.

ILUMEXICO
MEXICO

Community meeting around a sample solar panel installed by Ilumexico in the Guayabal Community, Cordoba (Veracruz)

3.4. ILUMEXICO - MEXICO

MICRO-FRANCHISING MODEL LED BY A SOCIAL ENTERPRISE

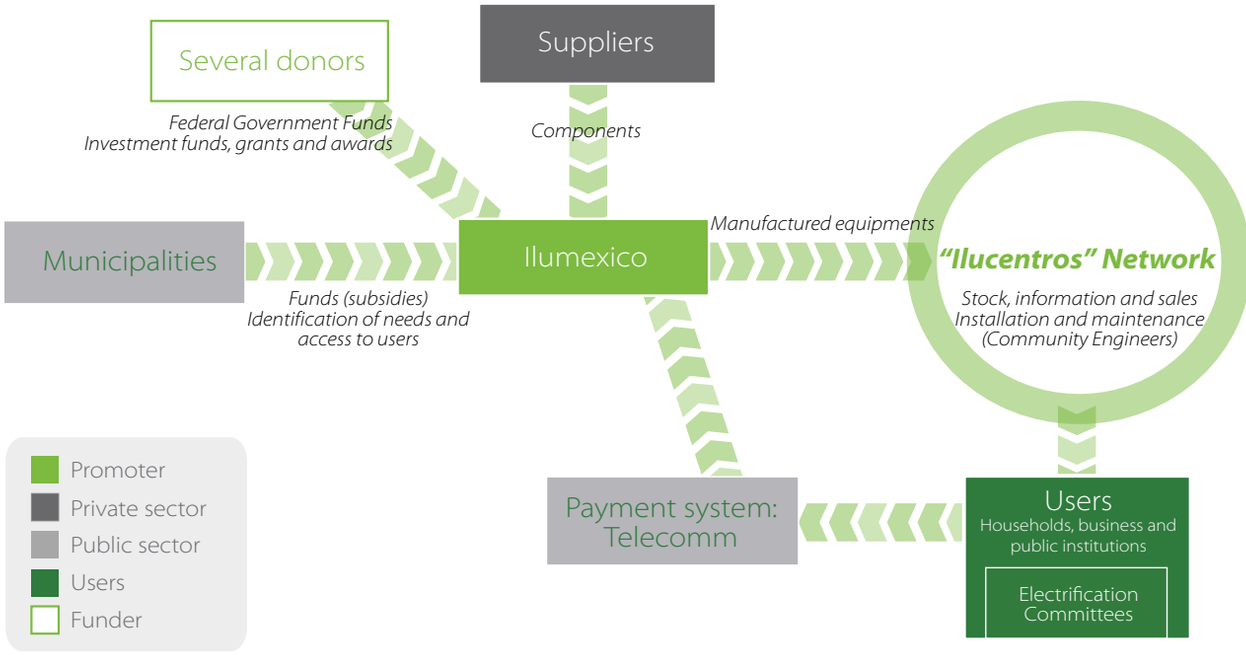
Ilumexico is Mexican social enterprise which was founded in 2010. Its mission is to provide solar technology products and services to rural and urban communities in Mexico, enabling access to energy for those not connected to the electric grid. With installations of 197Kw of power, Ilumexico currently provides access to energy for 5,600 rural households in highly dispersed and isolated areas with less than 100 inhabitants across the country. As well as providing services to these remote and marginalized communities, Ilumexico has found an important market among other segments of the population: communities with intermittent or poor quality access who need agricultural inputs (solar pumps, electric fences), and previous beneficiaries of solar energy programs (where equipment does not work properly due to lack of basic maintenance and/or training). This enterprise also carries out interventions in schools and primary healthcare centres.

The most important pillars of the business model are:

- Different energy solutions are offered at domestic, business and public levels (schools, healthcare centres and street lighting). Turnkey system based products are equipped with everything necessary for correct installation and may be implemented in accordance with the individual needs of community members.
- The organization manufactures the central element of the system (the charge controller), enabling them to adapt this to the rural environment in terms of robustness, easy handling and price.
- The possibility of selling equipment in instalments so users with less purchasing power can buy equipment in instalments by adjusting the initial payment, instalments and payment periods.
- Inclusion of a 2-year maintenance service package which ensures correct use by users.
- A decentralized system of "Ilucentros" or rural service operation centres designed to provide services to rural communities. 43 Community Engineers currently operate the nine existing "Ilucentros" which act as logistical distribution outlets and customer support centres. In order to reach the most isolated communities, often non-Spanish speakers, the organization is supported by Electrification Committees and "ambassadors". The latter are generally young individuals from these communities who assist with communication and the generation of trust. Community Engineers are technical staff allocated to the "Ilucentros" who live in these areas and are in charge of providing installation and maintenance services.
- Collaboration with different public bodies fulfils a fundamental role in both identifying those communities in need of electrification in isolated rural areas and providing subsidies.

The sustainability of the initiative is closely linked to the opening of new centres. Each "Ilucentro" owned by Ilumexico requires an investment of around 720.000 pesos (USD 40,000) to start operating. This is followed by a few months of commercial activity and, after approximately six - eight months of operation, the centre becomes sustainable. This is when the sales volume (of new equipment and maintenance) enables them to cover their operating costs. From then on the centre receives an operating margin of 12-15% which also contributes to the sustainability of central services at the head office in Mexico City. The opening of new "Ilucentros" is thus fundamental to the model. The organization's target is to have 50 "Ilucentros" across the country by 2020, providing services to 50,000 families from a population of around 3 million who currently lack access to energy.

MAP OF ACTORS AND RELATIONSHIPS



FINDINGS AND GOOD PRACTICES

- **Inclusive Distribution**: the distribution network based on "Ilucentros" (from which one or more Community Engineers operate) has been integrated over the years and now constitutes an excellent access and distribution platform for other products and services. Access to isolated communities in Mexico is complex because they are widely dispersed geographically. Once the logistics have been established and reliable human connections put in place, the network of centres has a very high value. Ilumexico is currently designing mechanisms to use in their distribution network for creating social impact, for example through the distribution of water filters (with Cantaro Azul) and building materials (with Cemex) to improve the quality of life in marginalized communities by bringing in other essential products and services.

Ilumexico Community Engineers with a client at her home in Guayabal community, Cordoba, Veracruz

- **Funding**: sales of equipment in instalments are adapted to the user by offering three variable parameters: initial payment, monthly instalments and period of payment. The organization adapts the payment to the client. Without this the client would not be able to afford the equipment (80% of clients choose this option). This practice, however, has some constraints for the organization: it increases the complexity of internal processes (managing payments, travel, etc.); it entails a great financial risk (assumed in its totality by the organization); and it affects their cash flows. The economic risk could be reduced if it was possible to collaborate with a microfinance entity but, due to the low income of clients who live in remote areas and the fact that these activities are not productive, the organization has had problems in getting microfinance entities to lend.

- **Technology**: the systems are simple, easy to use, installed by users themselves and well adapted. By offering modular systems all the different needs of the users are covered. The aim is for clients to upgrade their equipment gradually while covering different needs such as lighting, utilization of small

appliances and other domestic uses. Furthermore, all the components of the system are purchased from national suppliers to encourage the growth of national industry. A fundamental component of the system is also the fact that the controller is designed and manufactured by the organization itself.

- **Public policy**: for many users state subsidies are fundamental as they cover a large part of the cost (in Oaxaca, for example, 50% is subsidized). Public organisms also facilitate access to communities by providing information to identify those users without electricity and access for the organization within the community. It is important for public agencies to continue to provide this support in order to generate a favourable environment that enables the initiative to scale up. Additionally, as economic resources represent a limitation for the model, participation of public agencies is needed.

Wood-fired oven in a house in Joya Sola community, Santa Maria Chilchotla District, Oaxaca

Meeting between the community and Ilumexico Community Engineers at Cordoba, Veracruz

GUASCOR/
ELETROBRAS AMAZONAS ENERGIA
BRASIL

Technical maintenance of photovoltaic mini-power plants

3.5. GUASCOR/ELETROBRAS AMAZONAS ENERGIA - BRASIL

PUBLIC COMPANY WITH PRIVATE SECTOR SUPPORT MODEL.

The Minirredes Project is a "pilot" public initiative designed to provide electricity through photovoltaic mini-power plants to difficult to reach communities in the Amazonas region of Brazil[8]. The two main innovative elements of the solution implemented by the private consortium Guascor/Kyocera are:

- Decentralized photovoltaic generation and distribution through mini-power plants[9] and mini-networks respectively.
- Energy marketing through prepayment systems managed by micro-entrepreneurs.

There are currently 3,314 communities without access to electricity in the Amazonas province. This deficit makes universal access to energy a challenge, particularly for local distribution companies such as Eletrobras Amazonas Energia which, in line with their mandate, have responsibility for offering a service to the entire population.

Guascor, a member of the Siemens Group, is a company of Spanish origin that manufactures power generating equipment. Along with the multinational Kyocera, it has developed technology that is suitable for providing communities with access to energy. The Minirredes Project is based on mini-networks for electricity using photovoltaic technology and a flexible management system for emerging problems[10]. In order to reduce operational costs, prepayment cards have been developed similar to those used for cell phones. Remote management systems for the mini-networks have also been put in place in order to reduce the number of visits by technicians from the city of Manaus. To implement the project and liaise with communities, Guascor was supported by the NGO Vaga Lume which builds libraries and develops educational initiatives for vulnerable communities in the Amazonas region.

The implementation of the project has also received resources from the "Luz para Todos" Program (Light for All), which promotes universal access to energy in Brazil. Eletrobras Amazonas Energia, the public company that holds the electric power service concession in the region, played a fundamental role in this process and is currently responsible for management of the program. The project involved introducing micro-entrepreneurs charged with selling prepayment systems and other associated services along the distribution chain. Today, following a successful learning process from the pilot project, new plans are being developed to implement larger scale projects serving other communities in the Amazon region.

Installation of a photovoltaic mini-engine in a riparian community in Amazonia

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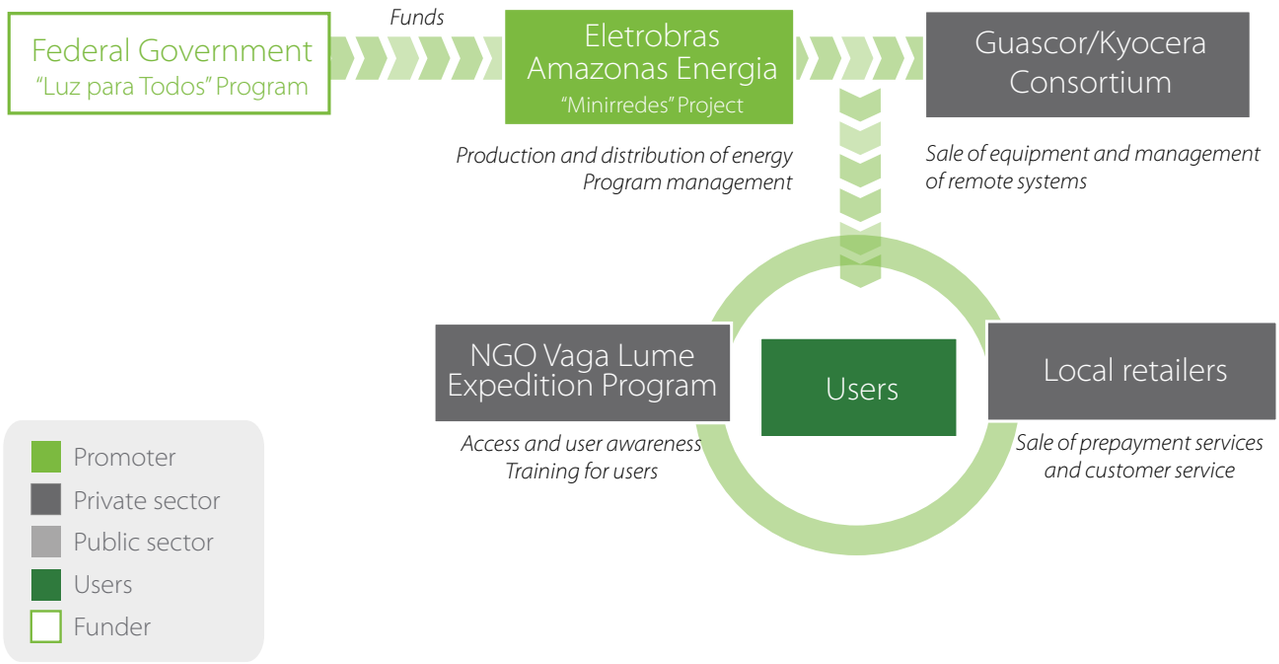
8 Mini-networks: small plants that produce electricity in a centralized way through photovoltaic, wind and/or hydroelectric generation assisted by a local distribution network and a back-up Diesel generator.

9 In order to differentiate, distributed micro-generation refers to a central generator for electric energy with an installed capacity below or equal to 100 kilowatts (kW), while distributed mini-generation refers to central generators with an installed capacity of above 100 kW and below or equal to 1 megawatt (MW). http://www.aneel.gov.br/biblioteca/downloads/livros/caderno-tematico-microeminigeracao.pdf

10 Should a controller or inverter suffer damage, the system retains the service at a rate of 75% of its capacity thanks to its four power generating units. The system is modular: should demand increase, a new generating unit could be installed next to the system distribution busbars.

MAP OF ACTORS AND RELATIONSHIPS



FINDINGS AND GOOD PRACTICES

- **Inclusive distribution**: prepayment services have provided an opportunity for the development of micro-entrepreneurs. The micro-entrepreneurs are community leaders in charge of selling prepayment cards, training the community in the use of the technology and acting as mediators with the company. In addition to sales training, there are plans to provide user training on how to manage and maintain the mini-networks and involve the community in the selling phase, as well as in marketing and maintenance. The involvement of Vaga Lume, a local NGO, was central to enabling dialogue with the communities, a skill that Guascor and Electrobras did not have. This NGO helped to generate a sense of community around access to energy. In the mini-networks, both management and a sense of community acquire are more important than in individual home systems. The NGO provided training for two people from each community on how to use the systems. The trainees did not necessarily have to be local entrepreneurs. For this latter group cooperation agreements were made with the Municipalities so that one employee with basic knowledge could be trained in marketing with the addition of an added percentage to their salary. As communities are limited in size and there is a great distance between them, the project's capacity for expansion is based on it being extended to other communities covered by Electrobras.

Implantación de caja de medición en hogar de comunidad ribereña de la Amazonia

- **Funding**: the prepayment system (which had not been previously been used in energy distribution programs in Brazil) allows responsible consumption at the same time as promoting energy inclusion and community awareness about the use of this resource. The payment system works as follows: families can buy a card with a code from a selling point in the communities. At home they can insert the code directly into the meter. This is a similar process to buying credit for cell phones. The consumer buys a ticket with a numerical code which provides them 30Kw/h at 5.70 Brazilian Reales (approximately USD 1.50). This

system is administered remotely at the company's office in Manaos. Within the community, however, management is the responsibility of local entrepreneurs.

Power house for the photovoltaic mini-engine in the riparian community of Aracari, Amazonia

- **Technology**: a consortium led by Guascor, along with Eletrobras Amazonas Energia, faced the challenge of making this operation viable in a remote and difficult to access environment with low population density. The idea was to provide the only source of energy for the communities covered and to substitute old fossil-fuel driven systems. In order to do this, a system composed of four photovoltaic generators, set up in parallel, and a power house fitted with control and maintenance equipment was planned. Different electric and climate parameters are sent via satellite to the operations centre for the photovoltaic mini-units in Manaos. The photovoltaic systems are designed to last up to two days without sunlight and rely upon a flexible network so that the functioning of the entire system is unaffected should one of their components be damaged. The prepayment system also represents a technological innovation linked to the conservation and appropriate use of the system by the community. This solution demonstrates that the different roles played by technology – consistency, control of parameters, flexibility and appropriate use by users – may be fundamental aspects for providing energy to remote areas.

- **Public policy**: the State Program "Luz para Todos" provided resources from the Federal Government for the implementation of up to 85% of the program. Prior to this, technical studies were required, as well as some public policy adjustment to incorporate the operational and maintenance costs of these systems within the cross-subsidy mechanisms by which consumers from the National Interconnected System (NIS) finance energy provision in isolated areas. This case demonstrates the importance of public policy coordination for the success of universal access to energy programs, especially in those regions where there is no interest from private sector investors. This initiative, besides providing 12 riparian communities with access to energy, also represents a cost-effective solution in collaboration with the private sector that has enabled a deeper learning process with users. Such a process has supported the expansion of service coverage in a region that is critical for the provision of basic services.

TECNOSOL
NICARAGUA

Communal photovoltaic panels in Mata de Caña Community, Chinadega District

3.6. TECNOSOL - NICARAGUA

A PRIVATE COMPANY IN PARTNERSHIP WITH MICRO-FINANCE INSTITUTIONS AND OTHER ACTORS

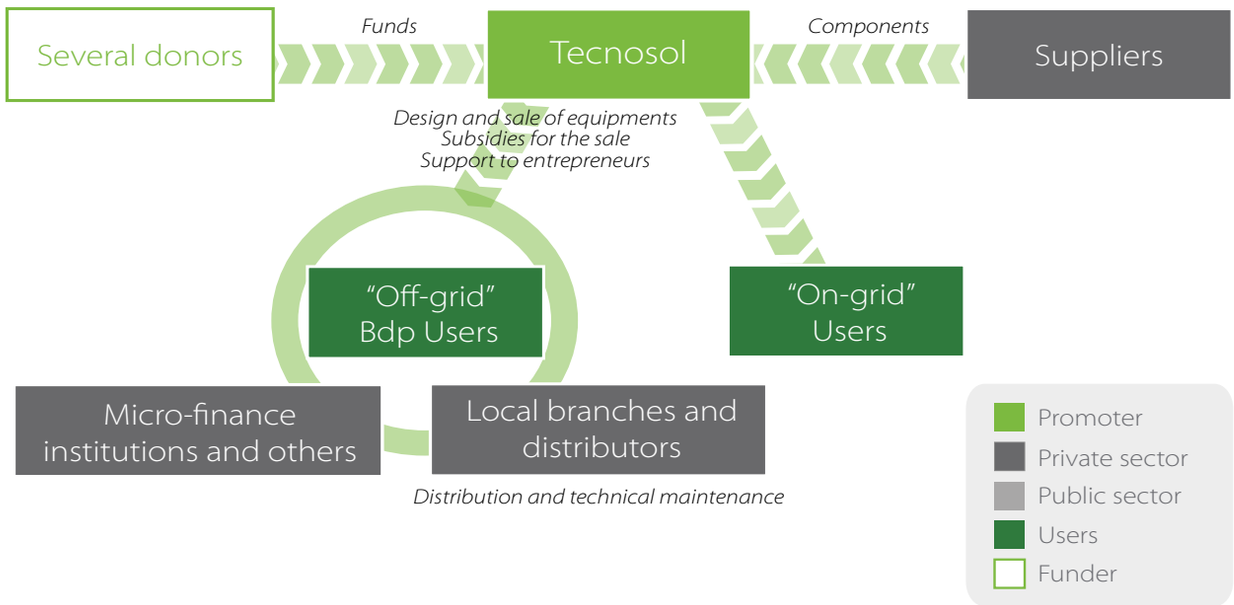
Tecnosol is a Nicaraguan company with a business model that includes designing, supplying, consulting, capacity building and installing renewable energy systems for any kind of energy consumption or application. Although it currently offers diversified solutions, the company began with a focus on residential photovoltaic systems, expanding their activities across the country and into Panama, El Salvador and Honduras. The company realized that there was a great business opportunity in this area due to the energy challenges faced in Nicaragua and thus worked to provide solar energy to rural and peri-urban communities. Today 80,000 systems have been installed that benefit around 400,000 people.

Communal photovoltaic panels in Mata de Caña community, Chinandega District

In order to ensure the investment is affordable to clients, Tecnosol offers financing through loans that are defrayed in micro-payments of USD15 a month over a period of roughly five years, using their own resources as well as through agreements with microfinance institutions. In parallel to their core business they also support new businesses developed by community entrepreneurs. These entrepreneurs complement product distribution activities by becoming micro-distributors able to undertake technical maintenance services. Community leaders, different company branches and micro-entrepreneurs have managed to achieve a high level of interaction. This collaboration is fundamental for reaching remote areas with low population density. To launch and refine their business model Tecnosol has also collaborated skilfully with different international cooperation organizations such as the Inter-American Development Bank and the World Bank.

As a result of these activities the company has been able to face the enormous contextual challenges of providing energy access to the "last mile" population of Nicaragua: the distribution of products and services in remote areas; financing for users; and making operations cost-effective.

MAP OF ACTORS AND RELATIONSHIPS



- **Inclusive distribution**: the difficulty of distributing products and services has been increased by the very success of the business model and the country's advances in terms of access to energy. The evolution of businesses for the "last mile" population increasingly depends on large commercial efforts to reach remote areas due to either the advance of the conventional energy distribution grid or to the saturation of markets with easier access to Tecnosol. From the company's point of view, it is not economically or geographically feasible to retain branches that serve potential consumers in remote areas with low population density. To address this challenge Tecnosol has found that working with networks of micro-distributors is important. In parallel, the company has also grown in a new area where there are greater financial returns: large savings and "on-grid" energy efficiency projects. Given this second development, and in order to continue providing service to their "last mile" clients, Tecnosol has created a not-for-profit institute linked to the company which acts as a social branch by combining private resources derived from corporate revenues with subsidies and cooperation with international agencies.

A meeting with Tecnosol branch managers

- **Funding**: in order to finance "last mile" projects a set of different solutions is necessary. Solutions that are strictly market-based, although supported by micro-financing strategies, are inadequate for two reasons: (i) there are not enough resources in the local capital market to overcome issues relating to access to basic services, and (ii) the majority of the "last mile" population do not have enough income to pay micro-credits back. Tecnosol has addressed the first issue through agreements with micro-finance institutions and innovations in its cooperation with international organizations, including a "crowd funding" scheme with KIVA and grants derived from the sale of carbon credits with the Netherlands Development Organisation (SNV).

- **Technology**: apart from offering an energy generation solution, the company also sells imported peripheral products that are adjusted to the features of their equipment such as TV sets, radios and lamps. Its wide variety of products range from LED lamps (PicoPV) to biodigesters, cooling units, water pumps, electric fences for pastoralist use and energy-efficient household appliances capable of functioning within the energy availability limits of beneficiaries. This combination of technologies limits risks and allows different products and services to be offered as user income and sophistication increase.

- **Public policy**: in order to serve the least profitable segments of the population Tecnosol works hand in hand with international cooperation organizations, including PROSOL, a World Bank project. This collaboration is carried out in a structured manner at state level where support is given via VAT exemption for solar panels and batteries. Although other components do not enjoy this benefit, the measure has enabled better competitiveness for solar systems in comparison to other alternatives. In this case the government assumes the role of facilitator, something that could be complemented by higher impact activities in the dissemination of this technology, for example network metering which has not yet been addressed by national legislation.

Tecnosol branch in Matagalpa City, Matagalpa District

SUNNYMONEY

TANZANIA

3.7. SUNNYMONEY - TANZANIA

SOCIAL ENTERPRISE MARKET APPROACH MODEL THAT BELONGS TO A CHARITY ORGANIZATION

SunnyMoney is a social enterprise that belongs entirely to SolarAid, a British charity organization whose aim is to fight poverty and climate change from a market perspective. SunnyMoney intends to eradicate kerosene lamps in Africa by 2020. Since its creation in 2009 it has expanded rapidly. It now operates in six Eastern African countries and in 2015 sold around 1.7 million solar lamps with an impact among over 10 million people, 90% of whom live below the poverty line. The case below offers an analysis of the model in Tanzania, one of the initiative's first markets. Here the company has sold more than 900,000 solar lamps and improved access to clean and safe energy for over 5 million people.

The SunnyMoney approach is mentioned as one of the sector's best practices by organizations such as UNEP, UNDP or UNICEF. It consists of creating energy markets in the countries where the organization operates. This is done by assuming the costs of generating trust in the solar products and promoting demand for them in rural communities where for-profit companies cannot operate, at least not until the market is mature enough for traditional companies to enter.

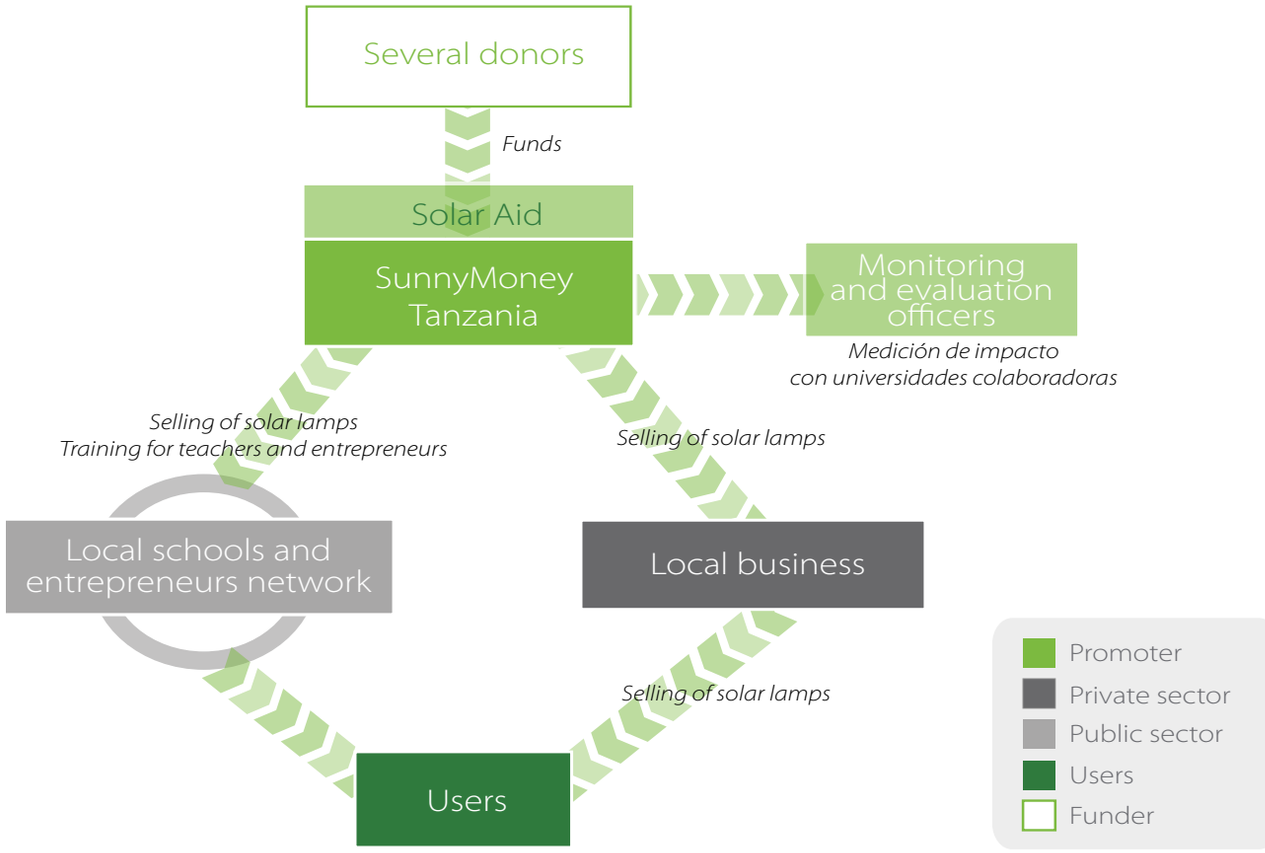
The way that the initiative operates is through schools. SunnyMoney organizes seminars for teachers who are respected members of their respective communities, turning them into solar ambassadors and first distributors for their products. The teachers sell basic versions of solar lamps to their pupils for around USD10. The lamps, designed to help them study, have a battery life of four hours without a mobile charging option.

Through its teams and with the help of teachers, SunnyMoney encourages entrepreneurs and graduates to sell a wider range of solar products as micro-franchisees (receiving a discount on purchases to improve their profit margin). The company also sells products through established businesses in order to make them available in as many regions as possible.

An important part of this model is the integration in the value chain of an important team of "research, monitoring and evaluation officers" who form a central part of the company's activity. Through collaboration with institutions such as the University of California, Berkeley, Stanford University, Edinburgh University, GOGLA[11] or ETH Zurich, studies have been undertaken on energy access services and their impact on SunnyMoney's area of activity. As well as providing knowledge to other initiatives, these studies have provided SunnyMoney with the most complete impact measurement in the sector, offering annual country reports with data on: the economic savings of families by products; the extra hours children have been able to study; carbon footprints; and health-related statistics. The data collected encourages teachers to participate in this initiative and donors to invest in it. All the profits obtained from the selling of equipment are reinvested in the carrying out of activities.

11 http://global-off-grid-lighting-association.org/

MAP OF ACTORS AND RELATIONSHIPS



FINDINGS AND GOOD PRACTICES

- **Inclusive distribution**: this innovative way of creating a market through a school network has paid off. More than 15,000 Tanzanian teachers have attended seminars organized by SunnyMoney and more than 1 billion extra hours of study have been provided to their pupils. Supporting entrepreneurs promotes employment in the communities where the company is present. Collaboration with academic institutions and research is essential for measuring the impact derived from these activities. The company also collaborates with different NGOs such as Neema Crafts which provides training for people with disabilities to become solar entrepreneurs and aims to be the first solar distributor to recycle their products.

- **Funding**: selling products is not enough to maintain this initiative. The average loss for every lamp sold is around USD4. The economic sustainability of the model therefore depends on donations channelled through SolarAid. Donors are varied and include international initiatives as well as manufacturers of solar lamps and individual donors. It is worth remembering that SunnyMoney's intention is to create a market for solar lamps, not to obtain control of the market. This is why they cooperate with other companies and why, in the case of Tanzania (an already mature market), they are beginning to reduce their sales force to facilitate and focus on the development of markets in other countries. Financing of clients is not a widespread practice due to the low selling price of their products. They do, however, collaborate with micro-financing institutions and have carried out pilot tests on prepayment via cell phones in other countries.

- **Technology**: the social enterprise does not show preference for any product in particular. Instead, it is focused on solving the needs of different types of clients and selling a great variety of third generation solar lamps from different distributors. This helps in the scaling up of both the company and the country's industry. Every lamp has been tested and approved by "Lighting Africa" (a World Bank initiative), comes with a warranty (normally for two-years) and is designed to last a minimum of five years. The company is

working to gather feedback from their clients with the aim of using this information to help manufacturers improve their products and standards.

- **Public policy**: collaboration with the educational authorities in Tanzania is fundamental for the model. While SunnyMoney products are not directly subsidized, they do benefit from a tax exemption approved by the Government of Tanzania which means that imported solar products do not pay customs duties or VAT. The social enterprise is lobbying the government to retain this measure and to create others in order to develop a favourable framework for solar products. It is currently focusing on establishing stricter quality standards and regulations to restrict low quality products that prevent market development by undermining potential customer confidence.

IDCOL

BANGLADESH

3.8. IDCOL - BANGLADESH

PUBLIC ENTERPRISE MODEL PROVIDING LARGE-SCALE ACCESS TO ENERGY IN PARTNERSHIP WITH PRIVATE COMPANIES AND NGOs

The "Infrastructure Development Company Limited" (IDCOL) is owned by the Government of Bangladesh and was created in 1997 to provide financial support to medium and large scale renewable energy projects in Bangladesh. The company, whose Board of Directors is formed by independent actors from the private sector and officers from different relevant ministries, began its "Solar Home System Program" in 2003. The program that is the subject of this case study is a large scale initiative that has managed to install over 3.5 million systems to provide access to electricity for around 16 million people. In 2006, IDCOL launched another domestic program with similar features that has managed to install 36,000 biogas plants.

This public enterprise draws from a dense network of funders among including, as well as the Government of Bangladesh itself, the World Bank, German and Japanese Cooperation (GIZ and KfW) and Japanese (JICA) respectively, the Asian Development Bank (ADB) and the Islamic Development Bank (IDB) among others. In addition to funding the initiative, these donors also provide support and technical advice.

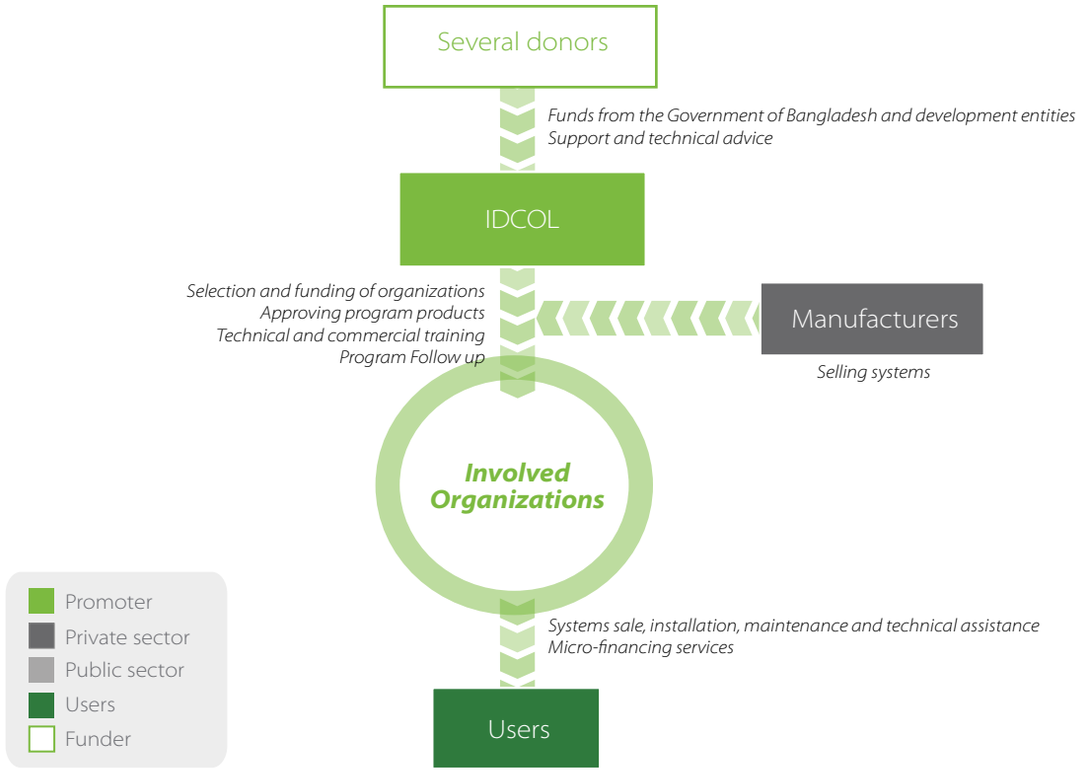
IDCOL does not distribute systems directly but is in charge of selecting and financing "participating organizations", selected by a committee, with which they form the partnership. Among these organizations are micro-financing entities, NGOs and private companies, numbering u to 47 in total and including Grameen Shakti. These organizations receive devices from manufacturers accredited by IDCOL's technical standards committee. Their job is to select sub-projects and areas, provide micro-credits, sell and install the systems, monitor their performance and provide technical assistance and maintenance.

The organizational structure of the partnership is completed by IDCOL's operations committee which is responsible for implementing and evaluating the program. IDCOL also provides training in systems installation, maintenance, market development, awareness raising and marketing, and cover up to 75% of the training costs for the organizations involved.

Systems are paid for diligently by clients through micro credits. According to reports from the organizations involved, the loan repayment rate is 96% and IDCOL has experienced no non-payment from these organizations throughout the program.

IDCOL has easily surpassed all its objectives so far and intends to achieve the installation of six million home systems by 2018. It also aims to build 100,000 home biogas plants and replicate the model with mini-networks, solar lamps, improved cookstoves and solar pumps, among other projects

MAP OF ACTORS AND RELATIONSHIPS



FINDINGS AND GOOD PRACTICES

- **Inclusive distribution**: the success of this program rests upon the solid partnership between IDCOL and the organizations involved. This is based on a clear definition of their responsibilities, a system of separation of powers, shared risks, adequate incentives and mutual trust. IDCOL covers the bulk of the funding (70-80%) which allows distributors to focus their economic resources on offering a good technical service. The variety of organizations involved provides interaction across the distribution network and, depending on the participating organization, combines selling from micro-financing offices, outlets and micro-entrepreneurs. The program has had a significant impact on job creation in manufacturing and after sales services. It also provides training to over 17,000 local technicians, 1,000 of whom are women.

- **Funding**: the organizations involved can provide micro-financing to the client so that initially they only have to pay around 10% of the cost (including installation costs) and this is the main reason why IDCOL exists. The company is actively seeking to keep the price of these products as stable as possible and even offers clients the possibility of returning the systems should they find themselves in economic difficulty.

- **Technology**: particular emphasis is placed on the reliability and quality of the systems and in the maintenance and warranty services (offering a generous return policy). The solar panels, with a price range of between USD80 - 590, come with a broad warranty service. The battery manufacturers are ISO 14001 certified and are audited every six months by IDCOL. Challenges include the recycling of devices and the proliferation of organizations outside the program that offer poor quality systems at a lower price.

- **Public policy**: the systems are subsidized indirectly by IDCOL and the organizations involved receive up to 12% of the cost of the 30Wp systems, or less, progressively. Less powerful systems are more highly subsidized so that poorer clients can benefit from them. The program would not have been possible without clear and strong commitment from the Government of Bangladesh and important support from international development actors. The fact that it is led by a combination of public officers and independent directors from the private sector facilitates the governance of the initiative and, although it depends on the economic and development policies of the Government of Bangladesh, it keeps the initiative free from political interference in operations and decisions. In addition, central Government policies on renewable energy systems and the necessary components for manufacturing them are, remarkably, sales tax exempt.

KEY FEATURES OF THE CASES STUDIED

Case	Country	Size Families served	Main technology	Distribution model	Finance to the user	Public policy
ACCIONA Microenergia Mexico	Mexico	3,600	Residential Photovoltaic Systems (SFD)	Own agents, institutional partnerships	Spot purchase and forward, micro-financing platform	Subsidized by Oaxaca Government
EnDev	Peru	9,000 (solar lamps)	Solar lamps, improved cookstoves	Existing sales channels	Spot purchase & purchase in instalments, loans from micro-finance entities	Subsidies for improved cookstoves, regional support for dissemination of solar lamps
Energetica	Bolivia	4,000	Solar lamps	Micro-franchises	Spot purchase	Collaboration with local and regional institutions
Ilumexico	Mexico	3,300	Residential Photovoltaic Systems (SFD)	Internal network	Purchase in instalments	Subsidized by Oaxaca Government
Guascor/ Eletrobras Amazonas Energia	Brazil	222	Mini-networks	Institutional partnerships	Prepayment tariff	Subsidies from "Luz para Todos" Program. Involvement of Ministry of Mines and Energy
Tecnosol	Nicaragua	70,000	Residential Photovoltaic Systems	Internal network, existing sales channels	Purchase in instalments	VAT exemption for solar panels and batteries
SunnyMoney	Tanzania	900,000	Solar lamps	Institutional partnerships, micro-franchisees and existing sales channels	Spot purchase	Support to schools network. VAT exemption for solar panels and batteries
IDCOL	Bangladesh	3,500,000	Residential Photovoltaic Systems	Institutional partnerships	Purchase in instalments, loans from micro-financing entity	Public program managed as a private company. Progressive subsidies. VAT exemption for solar panels and batteries

4

FINDINGS

↘ BACKGROUND TO THE FINDINGS

This section presents the key findings from the initiatives studied and from literature on experiences related to inclusive energy distribution, in and outside of the Latin American region.

As explained in the methodology section for this research work, the six case studies were selected using criteria related to relevance and representativeness. In this regard, the initiatives represent some of the most innovative practices for the creation of inclusive distribution networks for energy products and services in Latin America. They also offer guidance and advances in addressing existing challenges and opportunities.

Due to the variety of technological options and distribution models employed, these cases also allow for the identification of specific advantages and difficulties in each geographical context. The following table offers a summary of the characteristics of the initiatives studied.

As has been shown, these initiatives take place in rural areas in five Latin American countries. With mixed market schemes and public support the majority of them have managed to reach between 3,000 -10,000 families. Tecnosol, for example, has installed more than 70,000 systems. In five of the six cases, electrification has been based on residential solutions, either through small solar lamps or by Residential Photovoltaic Systems. Guascor is the only initiative that has used mini-networks to provide energy to a whole community. Different strategies have also been used for the distribution networks of products and services; from direct selling by the promoter organization to building on existing networks through the creation of micro-franchises and institutional partnerships.

Using the analysis from these initiatives, the following sections outline a series of general findings and then provide a deeper examination of specific findings relating to inclusive distribution, finance, technology and public policy issues.

GOOD PRACTICES IN THE CASE STUDIES

Case	Inclusive distribution	Finance	Technology	Public policy
ACCIONA Microenergia Mexico	Maintenance as a way to create local employment	Equipments 50% subsidized	Latest lithium-based batteries. Easy to install and maintain equipment	Public-Private Partnership with regional Government
EnDev	Support to entrepreneurs for marketing and maintenance of devices. Building on existing distribution networks	Pay for performance mechanism to encourage micro-financing institutions. Pay through cell phone (pay as you go) in testing phase	Systems testing and validation campaign prior to marketing. Locally adapted systems (cookstoves)	Collaboration with public institutions for the development of quality standards to strengthen other aspects of the model
Energetica	Micro-franchises network for marketing and maintenance of devices	Sale in instalments adapted to the user	Close relationship with main supplier allowing adjusts in product design to better meet market needs	Support from municipalities for awareness and strengthening of user trust
Ilumexico	Own network of distribution centres for products and services. Building on existing distribution networks	Sale on instalments adapted to user	Simple systems, easy to use, adapted, installable by users. Set in modules to progressively extend use of devices	Authorities provide information to identify off-grid users and access to communities
Guascor/ Eletrobras Amazonas Energia	Development of local retailers thanks to prepayment schemes. Collaboration with local NGO to facilitate dialogue with communities	Public funding with cross subsidies	Flexible network. Centralized electric and climate data for all systems	Joint learning process between company and regional and central government. Public funding for universalizing access in remote areas
Tecnosol	Micro-distributors network. Creation of a non-for-profit institute linked to company	Agreements with micro-financing entities and innovations in cooperation with international organizations	Marketing of peripheral equipment adapted to core features for generating solutions (TV, radios, lamps...)	VAT exemption for solar panels and batteries
SunnyMoney	Use of public schools for awareness raising and distribution purposes	Uptake of losses in order to create market in the long term	Use of quality standards approved by international initiatives. Transfer of information from clients to suppliers to improve products	Tax exemptions for solar products. Pressure on government for development of enabling policies
IDCOL	Defined partnership between all actors	Efforts to facilitate clients paying for systems	Emphasis on quality, warranty and maintenance services	Progressive subsidies to benefit poorest and tax exemptions for solar products. Commitment from Government. Diversification of donors. Political independence of initiative

↘ GENERAL FINDINGS

It can be affirmed that the initiatives studied have had a positive effect on access to energy for the "last mile" population. Access is provided through distribution of quality products together with essential complementary services such as installation and maintenance. The **positive effects** of these initiatives are not limited to simply obtaining access to modern sources of energy but also to their influence on the **economy, security and health** of users and impact on the **environmental quality** of their surroundings. These impacts are apparent in the solar lamp distribution programs which reduce expenditure on kerosene, oil and batteries, and eliminate indoor pollution in households, thus reducing the risk of fires[12].

These initiatives, however, also face important challenges which demonstrate their fragility and may represent a threat to their sustainability in the long run. **One of the key challenges is associated with geography**. Latin America is a large region that combines high urban concentration and vast rural areas with low population density. The international initiatives explored, such as the IDCOL Program in Bangladesh or SunnyMoney in Kenya and Tanzania, have been developed in areas with a much higher density of off-grid populations. In these cases, more concentrated and larger markets have been formed, something that has not occurred in Latin America except in certain regions of Central America (which could help to explain the success of Tecnosol).

In this regard, the high levels of electrification in Latin American countries (often higher than 90%) disguise the fact that around **20 million people without energy access in the region** are primarily located in isolated rural areas[13] with high levels of poverty. Furthermore, a large percentage of the region's population, **around 90 million people**, remains dependent on **biomass or kerosene** with serious implications for their health and security. This is why, even though coverage is higher than in Africa and many regions of Asia, access to energy in Latin America remains unsafe and unaffordable for millions of Latin Americans.

Access to energy could open the door to other types of products such as computers or telephones

The initiatives outlined in this report have sought to develop innovative solutions to overcome some of these difficulties. In spite of their notable achievements, however, the costs of providing a service to geographically dispersed clients with low payment capacity impede the development of economically sustainable business models. For this reason the initiatives have frequently turned to public and international cooperation programs for funding. Therefore, one of the great challenges these initiatives face is the **difficulty of finding business models** that allow the generation of enough income for their sustainability in the medium and long term.

As a result of these economic and operational difficulties, it is especially important to identify the best strategies for distribution of their products and services. The case studies have assessed a series of alternative approaches, from selling through a **locally owned distribution network to the use of micro-franchises**. Additionally, an opportunity has been detected for building on the distribution networks created with complementary products such as household appliances or building materials, as in the case of Ilumexico. In this way, access to energy can open the door to other types of products such as computers or telephones which could attract the interest of other actors such as micro-financing entities or services and telecommunication companies.

Apart from technical and financial difficulties, **cultural and social barriers** are also to be taken into account. Proposals made by these initiatives need to be adapted to cultural and social contexts. Failure to adapt them may frustrate technical and entrepreneurially valid interventions. Furthermore, access to energy by communities may change cultural dynamics within these groups and create problematic situations such as tensions in access to energy or ruptures with traditional ways of communal living.

In spite of the difficulties described, the experiences outlined **have demonstrated a capacity to increase their scale and replicate** in other towns, regions or countries. Tecnosol has had a degree of success in their scalability by extending their business into Honduras, Panamá or El Salvador. It is true, however, that Tecnosol's business model is the selling of standardized products and does not exclusively address the "last mile" market. Thanks to the growth of their "Ilucentros", Ilumexico, has managed to expand into different Mexican states

12 United Nations Environment Programme (2014). "Light for Life: Identifying and Reducing the Health and Safety Impacts of Fuel-Based Lighting".

13 Sustainable Energy for All (2015). "Global Tracking Framework 2015".

through a single model, although each centre has a certain level of autonomy to adapt to their respective geographical context.

In the case of other initiatives, where a long process was necessary to establish coordinating mechanisms with different public and private actors, replication processes have been carried out by adapting different elements of the model to the local context. For example, in the case of ACCIONA Microenergia the foundation began their first initiative in Peru with very positive results after important efforts had been made in confidence-building and collaboration among actors. When ACCIONA Microenergia decided to start their operations in Mexico they did not reproduce what they had done in Peru but adapted the initiative to a different context, even introducing technological innovations that were not available at the time the Peru program started. They were therefore **building on the lessons learned in one country by transferring them to another and adapting them to a particular and unique context**. A similar conclusion can be drawn from the Guascor case where the experience has been partially replicated because the lessons learned from the project have helped to improve similar initiatives in the Brazilian Amazon region by taking the developments and technologies of the Minirredes Project as a starting point. In order to support the expansion of these models it is therefore important to determine whether this is a model that can be replicated directly – such as the Tecnosol case – or whether it should be adapted by "reapplying" some of its elements – such as the Guascor or ACCIONA Microenergia cases.

All the experiences analyzed have, or have had, the support of other organizations, especially the public sector, in promoting inclusive access to energy. From the exploration of these different experiences it can be concluded that while appropriate technology or a business model are important, they are not enough in themselves to guarantee success. Aspects relating to the environment in which the initiative is to be implemented, including the possibilities of access to funding and the existence of adequate public policy, are equally relevant.

Building on the lessons learned in one country by transferring them to another and adapting them to a particular and unique context

INCLUSIVE DISTRIBUTION

The first finding related to inclusive distribution networks is that **the distribution models adopted by these initiatives are diverse**. This choice has implications that are relevant for the development of the initiative. Ilumexico, for instance, emphasizes the importance of having their own staff in their communities, in this case "Community Engineers", in order to serve them adequately. Energetica, meanwhile, works through a micro-franchise scheme in partnership with municipalities, while EnDev's strategy is focused on partnerships with existing wholesaler and retailer sales channels.

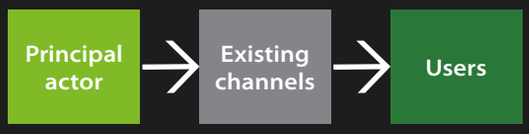
The following box **briefly summarizes the different distribution strategies that exist in the access to energy area** with examples from each of these initiatives. According to the literature[14], **each one of these models has a series of advantages and difficulties and it is generally not possible to establish that one model is better than another**. For example, a model that incorporates their own staff, such as Ilumexico, allows better control over distribution and after sales services but it has less capacity to expand than a model that employs independent retailers as distributors such as EnDev.

14 Lighting Africa (2014): "Solar Lightning for the Base of the Pyramid - Overview of an Emerging Market".

DISTRIBUTION STRATEGIES FOR ENERGY ACCESS

Internal network (the company carries out the distribution, example Ilumexico): in this model the company that provides the service also creates their own distribution channels through the establishment of a network of outlets with paid staff. It offers the possibility of undertaking marketing directly to the consumers. This has proven to be one of most effective ways of letting potential clients know about their products and services. The network requires an extensive sales force in each of the areas the company wants to influence, something that is particularly expensive in remote rural areas.

Existing sales channels (example EnDev): the company supplying the service is supported by existing and established sales and distribution outlets (general or specialized). This implies a two-level distribution hierarchy: at distributor level and retailer level. This model is widespread in initiatives around the world but the companies that use it face the challenge of having to turn a retailer's network, which is often very heterogeneous, into an adequate distribution network for their products. Additionally, there are difficulties in ensuring that vendors offer an adequate after sales service.



Micro-franchises (example Energetica/PHOCOS): the creation of (micro)-franchises constitutes an intermediate solution between the two examples above. Here the promoter of the initiative offers franchisee packs (including such aspects as initial training, marketing support, funding…) to small local entrepreneurs. In this model, the supplier must identify and build their own network of franchisees by training them and safeguarding the reputation of the brand. This ensures a lower cost than having to create their own sales force.

Institutional partnerships (example Guascor): this strategy consists of forming a partnership with a relevant actor with access or connection to a great number of potential consumers (for example NGOs, suppliers of other products or even the government itself) to provide the product service directly to them. Depending on third parties to distribute products implies having to trust their capacity to undertake the job and offer an adequate service. However, it may also generate more confidence among users if the third party is a well known and socially valued actor.

With regard to the specific findings detected in these initiatives, the following aspects should be highlighted:

- The inclusive distribution energy initiatives explored have developed business models which have **contributed to creating entrepreneurship and opportunities** for the "last mile" population in addition to providing affordable, safe and clean access to energy. The connection of these populations with the inclusive distribution network can take place in any of its links, including dissemination, marketing and installation or after sales service.

- All the distribution networks analyzed **show weaknesses in their structure**, from the difficulties of having to find a business model capable of serving dispersed communities with high operational costs to challenges relating to the managing capacity of the network itself. The initiatives do not usually have information on market or business management systems to ensure the adequate and professional management of their operations. In those cases where the initiative does not have their own selling points there is hardly any control or influence over their distributors and outlet[15]. Additionally, their own staff may have training deficiencies which condition the effectiveness of their work.

- A key element of all these initiatives is a **capacity to dialogue with users in order to understand their needs** and work with them collaboratively. Influential local leaders or institutions are often employed to facilitate this dialogue. In the case of Energetica, the municipalities exercise an important outreach and promotion role for their products. The NGO Vaga Lume, which is well-established in Amazonia, helped to promote dialogue between the Amazonian communities and the company Guascor. Ilumexico has "ambassadors" in the communities who facilitate access to them and act as mediators for the company in areas that it would find difficult to reach through its own staff.

- The networks examined are lineal and **do not provide a waste recovery and treatment system**. With the growth of "off-grid" systems, the management of lighting equipment related waste, particularly batteries, is a growing environmental issue[16]. This problem may be an entrepreneurship opportunity for incorporating users through reverse logistic networks by creating, for instance, micro-businesses providing adequate treatment for the waste generated.

FINANCE

Difficulty in obtaining **financial support is one of the main constraints of the initiatives**, both with regard to the initial funding and the working capital required to launch them and promote users to purchase their energy products and services. To date, the role of the micro-financing entities has been limited in the cases studied. In this regard, some of the findings applicable to all the initiatives include:

- For micro-financing entities, cheaper equipment such as solar lamps represents a minor opportunity, while those with higher value such as Residential Photovoltaic Systems fit within an interesting price range for micro-financers. This second type of technology offers more clearly defined financing opportunities. In order to benefit fully from this, a number of barriers within the micro-financing entities need to be overcome, including: (i) the willingness of micro-financing entities **to finance production equipment** (lighting equipment or cookstoves are often classified as consumer equipment) and (ii) l**ack of adequate knowledge** of inclusive energy products and services. Against this background, organizations such as Tecnosol or Ilumexico have opted to offer loans to their clients with the possibility of paying for equipment in instalments. In both cases this decision has been crucial to the increase in scale of the initiatives. The success of the latter is illustrated well by the large difference in dissemination of devices with similar features through ACCIONA Microenergia (sold in cash) and Ilumexico (sold in instalments plus interest) in the Oaxaca region. When equipment is sold in instalments sales are slightly higher. Although infrequent, collaborations with micro-financing entities exist, for example with Tecnosol and EnDev. These collaborations could be larger and play a more fundamental role in scaling up the initiatives if the capacity necessary for this was generated within micro-financing entities through specific products with a reasonable operational cost.

- Several initiatives have sought **alternative sources of funding** in order to be able to obtain additional resources. Both Tecnosol and Ilumexico have partnered with Kiva, a crowd funding platform[17] to attract donations and offer capital in the form of small loans for the purchase of equipment. This diversification is especially important for reaching scale and taking on higher risk customers

- Tecnosol has also been working with SNV, a Dutch NGO, in **carbon credit** projects. Decisions adopted at the recent 2015 Climate Change Conference in Paris suggest that this type of mechanism will become increasingly more important for financing the transition to renewable energies. Of great relevance here is

15 Lighting Africa (2014). "Solar Lightning for the Base of the Pyramid - Overview of an Emerging Market".

16 GOGLA (2013). "Delivering Universal Energy Access: The industry position on building off-grid lightning and household electrification markets".

17 http://www.kiva.org

the pioneering experience in the region of the cosmetics company Natura and the Brazilian NGO Instituto Perene. Through Natura's Neutral Carbon Program[18] which is implemented by the Instituto Perene, 5,000 traditional cookstoves will be replaced with less polluting improved cookstoves by 2018, with a reduction of 17,500 tonnes of CO_2. This will generate entrepreneurial and employment opportunities within the community through installation of the cookstoves. It is worth noting, however, that the current low price of carbon credits is seen as a barrier for this type of funding[19].

TECHNOLOGY

Apart from the case of the EnDev's improved cookstoves program, the technological solutions found in these initiatives are based almost exclusively on photovoltaic solar energy. Some initiatives like Tecnosol also offer other types of related equipment such as biodigestors, solar water heaters or pumps.

Additionally, none of these initiatives can be framed within a logical extension or connection to the conventional electrical grid. On the contrary, they are providing off-grid access to energy. The utilization of photovoltaic technology and its off-grid nature have spawned different solutions on offer to the client that vary greatly. As already mentioned, two initiatives (EnDev and Energetica) offer solar lamps to users; three initiatives (ACCIONA Microenergia Mexico, Ilumexico and Tecnosol) offer larger Residential Photovoltaic Systems; and Guascor has employed mini-networks to generate electricity for an entire community. The following box provides a brief description of these technologies.

TECHNOLOGICAL ALTERNATIVES IDENTIFIED

Solar lamps: portable equipment containing a small photovoltaic panel (up to 10W) and usually a spotlight. They usually include a USB port for cell phone charging. The price range is from USD20 to 100 and can act as a catalyst for the demand for more powerful systems[20].

Residential Photovoltaic Systems: fixed systems (the panels are usually installed on the roof) providing the customer with a variable service according to the power (between 10 and 100W) for several light sources, cell phone charging and radio to household appliances such as TVs, etc. The price of these systems may vary between USD200 - 600.

Mini-networks: involves use of a small-scale power generator (between 10kW and 10MW) to provide services to a limited number of clients through a distribution network that normally operates outside the national grid. Although the source of energy may vary (hydropower, biomass, and wind power) the most common are those based on photovoltaic systems and batteries or diesel back-up generators.

With regard to technology, the following findings can be identified from these initiatives:

- There is particular emphasis on **offering quality solutions** that ensure safe and sustainable access to energy. As a result, the products offered, as in the case of Energetica, are more expensive than other less reliable products distributed in the same region. The proliferation of low quality products in local markets

18 http://www.ambientalpv.com/noticia3.swf

19 International Institute for Environment and Development (2014). "Sharing the load: Public and private sector roles in financing pro-poor energy access".

20 Kearney, A. T. & GOGLA. "Investment and Finance Study for Off-Grid Lightning".

is considered a threat to these initiatives as it creates mistrust and rejection among users[21]. This situation is aggravated by the lack of adequate technical standards to guarantee quality.

- The initiatives show **very different technological capacities**. Some have specialized staff able to attend international fairs and are well-informed about new technological developments. Other organizations, however, do not have the resources or personnel necessary to undertake technological follow up. Their adjustments are thus based on trial and error methodologies with their users. There are no information and knowledge platforms in the region to facilitate self-training or training for the promoters of these initiatives.

- Although incorporating **Information and Communications Technologies (ICTs)** could contribute significantly to lowering operational costs[22], very few initiatives have been able to integrate these innovations into their solutions. The Guascor case shows that operational costs have been reduced dramatically by remote management of the photovoltaic mini-networks from the capital of the Amazonia region (Manaos) along with a prepayment scheme for the purchase of electricity. EnDev have also started to experiment with this type of technology.

- In order to improve the use of energy in the preparation of food, improved cookstoves have been used, as in the case of EnDev, which represent significant savings in terms of energy efficiency, time spent collecting firewood – particularly among women and children – and above all, a reduction in the emission of toxic gases

PUBLIC POLICY

Issues related to public policy constitute a key dimension for the success of these initiatives[23]. This is particularly important given the **difficulty experienced by these initiatives in achieving economic sustainability and increasing their scale**. In this regard, the importance of public policy lies in the availability of resources to fund the first steps of an initiative in a given territory, as well as in their role as regulators and opinion leaders for the products and services offered to the local population[24]. During the course of this study various ways of collaborating between public administrations and the initiatives were found, including **the existence of quality assurance, dissemination assistance, awareness raising and policies for economic support through subsidies or social tariffs**. Key findings identified are as follows:

- The initiatives have demonstrated that **they are capable of building partnerships with existing pubic programs that can catalyze their impact**. A good example of this is the work of EnDev Peru with different Peruvian public institutions. This has allowed the development of technical standards, the strengthening of local suppliers and user awareness. Another clear example is the case of Guascor. Thanks to the technological innovation of an SME such as Guascor, in partnership with a multinational in the development of technological systems like Kyocera, it was possible to provide effective and sustainable energy access to riparian communities in the Amazon River with resources from a public program ("Luz para Todos") and a public distribution company (Eletrobras Amazonas Energia). The program covers communities that would otherwise have been unreachable and has generated valuable learning. The technologies and methodologies developed by members of the project are being used to replicate the experience in other areas of the Amazon region.

- **Local public entities such as regional governments and municipalities play a crucial role** in facilitating the implementation and strengthening of all the initiatives. The regional government of Oaxaca has, for example, contributed in a significant way to the development and expansion of the activities of Ilumexico and ACCIONA Microenergia. In the case of Energetica in Bolivia, important differences in the purchasing of

21 United Nations Development Programme (2015). "EnergyPlus Guidelines".

22 World Bank (2014). "From the bottom up: how small power producers and mini-grids can deliver electrification and renewable energy in Africa".

23 Lawrence Berkeley National Laboratory (2013). "Sustainable Development of Renewable Energy Mini-grids for Energy Access: A Framework for Policy Design".

24 International Finance Corporation (2013). "Access to Energy in Low-income Communities in the Latin America and Caribbean Region: Lessons Learned and Recommendations".

solar lamps levels are apparent when these are promoted by the municipality. In these cases, sales increase significantly in comparison to those situations where public support at local level does not exist or is weak.

- In spite of their relevance and their key role in developing these initiatives, in some of the countries visited a **certain lack of coordination between different institutions and public policies** responsible for expanding access to energy was noted, as well as a collaboration gap with the private sector in the planning of activities. This lack of coordination leads to inefficient program design and implementation for expanding the use of energy.

- The **negative consequences of these programs may endure over time**. Badly oriented programs may not just mean inefficient use of resources but also the generation of false expectations among users. The cases of Mexico and Peru serve as an example. Since the end of the 1990s large programs for the electrification of rural areas based on off-grid technologies have been promoted in these countries. Some of these programs employed inadequate systems or failed to provide additional services such as systems repair and maintenance[25]. As a result, potential users are often unwilling to try technologies whose reliability and performance they mistrust. However, the upgrading and maintenance of these systems is a business opportunity for these initiatives. For instance, one of Ilumexico's lines of work is the reparation, maintenance and substitution of Residential Photovoltaic Systems that were put in place during previous public programs for expanding rural electrification.

25 An example of this can be found at: Ministerio de Energía y Minas, Peru (2008). Evaluación Final: Electrificación Rural a base de Energía Fotovoltaica en el Perú – proyecto PER/98/G31. Available at: http://www.climate-eval.org/sites/default/files/evaluations/513%20Photovoltaic%20Based%20Rural%20Electrification.pdf

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RECOMMENDATIONS

A number of recommendations are set out below which suggest lines of action for improving the impact of existing initiatives and informing those that may be developed in future. These recommendations have emerged from an analysis of the findings across the six initiatives, including the challenges they face, as well as from relevant literature.

INCLUSIVE DISTRIBUTION

- **Build on existing distribution networks**. In their design phase, inclusive initiatives for energy distribution may build on existing inclusive distribution networks to deliver their products and services. A possible way of starting this would be to take advantage of the networks already identified in projects with SCALA.

- **Share the inclusive distribution energy network**. In many cases, for example with Energetica and Ilumexico, the inclusive energy distribution network is the first formal distribution network available to users. This network may be used to supply other products and services such as medicines, building materials, food products, agricultural inputs or telecommunications equipment. If access to a wider range of products and services for the "last mile" population was possible, operational costs would be reduced and a greater profit margin could be generated for the products offered. Ilumexico, for instance, is delivering medicines and concrete through a partnership with Cemex and the NGO Cantaros Azules.

- **Diversify products**. The initiatives studied offer both long-lasting and low-turnover products such as home solar systems in the case of ACCIONA, Ilumexico and Tecnosol, and/or of a reduced price such as the solar lamps in the case of Energetica. Diversification is a way of generating extra income and contributing to the economic sustainability of the initiatives. Micro-financing entities are reluctant to fund low price products such as solar lamps or improved cookstoves due to the high operational costs that providing such small loans involves. However, they may be interested in financing higher cost products for which specific financial systems already exist. This could include new products whose use depends on having access to energy such as telephones, computers, fridges or agricultural equipment. This would contribute to new development opportunities and to the economic sustainability of these initiatives.

- **Incorporating new actors from the service sector into the partnerships**. The expansion of the distribution channel and possibilities of accessing electricity could open the door not only to new products but also to services such as telecommunications or healthcare. In this way, public and private actors from these sectors may find incentives for contributing to the maintenance of the distribution network and access to energy. For instance, in the areas covered by Energetica, despite not having access to energy, some of the users have smart phones. Financing access to solar lamps (PicoPV) could probably generate higher income for the initiative from telecommunication and micro-franchisees services and contribute to covering distribution costs for the energy products.

- **Implement advanced management and information systems**. The majority of the initiatives do not have advanced/adapted management and information systems or tools. This deficiency limits business decision-making and the management of their value chain in terms of costs, inventory or logistical organization. The

implementation of comprehensive management software tools adapted to business procedures in this type of initiative may help to tackle this.

Meeting between the community and Ilumexico Community Engineers at Cordoba, Veracruz

- **Build capacities among all the actors in the distribution chain**. Capacity building should not just be restricted to the organizations promoting these initiatives but also to their outlets and external collaborators. These partners are crucial in providing services to users and in the early identification of issues and improvement opportunities[26]. In the case of Energetica, for example, growth and profitability depend to a great extent on the capacity of micro-franchisees and their interest in developing commercial activity.

- **Developing reverse logistics for products**. There is an opportunity for the initiatives to develop reverse logistic networks – recycling and reutilization of waste – incorporating people without access in a similar way to what has been done for distribution, installation and maintenance. These networks could also alleviate the potential environmental impact of technologies such as the solar home systems once their useful life is over.

- **Share learned lessons among the different initiatives and actors**. Knowledge generated by these initiatives is difficult to transfer because it is highly context dependent, hard to document and closely linked to the people who produce it. With a view to facilitating learning between initiatives, the promotion of interactive exchanges and learning through training activities in the field is recommended.

FINANCE

- **Build partnerships with financial institutions and capacities within the initiatives themselves**. Some of these initiatives have successfully managed to fund their own users, for example Tecnosol through micro-financing entities or Ilumexico through a payment in instalments scheme have managed to grow significantly thanks to this type of funding. Access to funding has been a key factor for achieving a scale that could be catalyzed by greater involvement on the part of financing entities. Building partnerships with financial institutions and capacities within the initiatives themselves in order to promote greater understanding of the existing opportunities inside the initiatives would be interesting for their scaling up.

- **Broaden funding sources**. New forms of funding such as crowd funding, social impact bonds and green funding have been reinforced by the Paris Climate Change Conference and may be worth further exploration for initiatives promoting the inclusive distribution of energy. Initiatives such as Ilumexico and Tecnosol have already explored these possibilities successfully. In this regard, partnerships with micro-financing entities that have experience with some of these new sources of funding may be of great interest.

- **Incorporate innovations in payment methods**. Payment through mobile technologies such as the "Pay-As-You-Go" systems used by some African initiatives may facilitate the management of payments and reduce operational costs[27]. It is also fundamental that legislation is aligned in each country to make these methods viable.

26 Sustainable Energy for All (2014). "Franchising in the Energy Access Market: An Assessment".

27 International Energy Agency (2015). "Innovative Business Models and Financing Mechanisms for PV Deployment in Emerging Regions".

TECHNOLOGY

- **Develop and/or harmonize technological standards**. The development and/or harmonization of technological standards is necessary in order to guarantee the quality of the products used and to facilitate technological selection[28]. An initial step would be harmonize and simplify existing standards in collaboration with manufacturers and the public sector.

- **Develop manuals and training materials**. There is a lack of knowledge and training materials on third generation equipment such as LEDs, lithium-based batteries, etc. available to the initiatives, governments and final users. The encouragement of effective dissemination of this information to cover this gap is needed in the region.

- **Promote technological collaboration**. Based on their size and resources some of the initiatives are able to participate in international fairs, hire specialized staff and keep themselves up to date with the latest technology, but smaller initiatives cannot do this. The creation of spaces for exchange among initiatives so that they can share information on innovations may contribute to improving technological dissemination in the region.

- **Test the incorporation of Information and Communication Technologies (ICT)**. The introduction of ICT systems for monitoring and payment management may reduce operational costs and create efficiencies in the distribution network. To meet this objective it is important to undertake small pilot projects that implement ICT solutions, both in the laboratory and in the field.

PUBLIC POLICY

- **Creation of coordination spaces between actors**. Facilitation of spaces for exchange between energy distribution initiatives is needed among the public sector and key actors from the private sector such as energy distributor companies or equipment manufacturers. These spaces are indispensable to improving coordination among the different actors and avoiding duplication. Such links can also accelerate the dissemination of relevant technologies and avoid wasting resources. The experience of ACCIONA Microenergia, both in Mexico and in Peru, shows the potential of good coordination between public and private actors.

La Tallera community, San Pedro y San Pablo Ayutla Municipality, Sierra Mixe, Oaxaca

- **Link Latin American initiatives to existing international initiatives**. According to the United Nations, there are several global initiatives working to achieve the energy targets of the Sustainable Development Goals. They include "Sustainable Energy for All", the "Alliance for Rural Electrification" or "Lighting Africa", all of which involve actors such as the United Nations, World Bank and important companies from the energy sector. In order to share the lessons learned and coordinate efforts with other donors, the participation of Latin American initiatives in these international forums should be strengthened.

- **Reinforce the role of regional and municipal governments**. These initiatives demonstrate great impact when they receive clear support from governments. Public sector participation thus needs to be encouraged and promoted in future initiatives. As the case of Energetica shows, when micro-franchises are supported by the municipal authorities the distribution of their products increases significantly.

- **Search for other types of collaborative instruments with the private sector**. A model like Tecnosol, where an important part of their expansion was influenced not by subsidies but by tax exemptions, demonstrates that beyond

28 Alliance for Rural Electrification (2011). "Rural electrification with renewable technologies: quality standards and business models".

direct and non-reimbursable funding there are other ways of supporting the application of public policy. In terms of looking for greater involvement of the private sector, it is important to innovate in collaborative instruments with the public sector.

Tecnosol branch in Matagalpa city, Matagalpa District

It should be stressed that the transition towards greater access to energy initiatives requires collaboration between multiple actors and the coordinated management of aspects such as distribution networks, technology, funding and public policy[29]. The creation of space for exchange and more information-sharing on the impact of these initiatives is indispensable for improving their capacity to scale up and replicate.

In this respect, MIF's SCALA initiative for creating an Inclusive Distribution Lab has the potential to become an ideal vehicle for undertaking a large part of these initiatives. These Labs are secure spaces that allow exchange, dialogue and experimentation between different actors by testing, measuring and adjusting different initiatives in order to achieve greater impact. Experiences such as the "eLab" from the Rocky Mountain Institute in the United States[30], where all the actors involved in the energy products and services market are able to test different solutions to try and solve complex problems related to energy that a sole actor cold not solve, already exist. This type of open space for experimenting and collaborating is particularly useful for the promoters of these initiatives. Here they can work with other actors in the expansion of their programs and share information about models that are already generating important successes in the region

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29 International Finance Corporation (2012). "From Gap to Opportunity: Business Models for Scaling Up Energy Access".

30 http://www.rmi.org/elab_what_is

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World Bank (2014). "From the bottom up: how small power producers and mini-grids can deliver electrification and renewable energy in Africa"

ANNEX.
CASE SELECTION PROCEDURE

FIRST PHASE

Selection was made from a **group of 21 experiences** which were identified by revising the literature; developing a focus group with experts in Madrid in June 2015; and taking into account the recommendations of the MIF team. The pre-selection **"pillar" criteria** were applied to this group of studies which permitted the selection of a group of ten particularly promising cases ("extended group") along with two more cases from outside the Latin American context.

The following figure represents the result of this first phase:

Study Group
21 cases

- ACCIONA Microenergia Mexico (Mexico)
- CRERAL (Brasil)
- DISCOS (Guatemala)
- EnDev (Peru)
- Energetica (Bolivia)
- Enertec (Bolivia)
- Envirofit (Guatemala)
- EJSEDSA (Argentina)
- Fundacion EcoAndina (Argentina)
- GreenGT (Peru)
- Guascor (Brazil)
- Hybritech (Colombia)
- Ilumexico (Mexico)
- Instituto Perene (Brazil)
- Kingo Energy (Guatemala)
- PHOCOS Latin America (Bolivia)
- Senstech (Colombia)
- Solaris (Honduras)
- SOLUZ (Honduras)
- Tecnosol (Nicaragua)
- Trama Medioambiental (Ecuador)

Extended group
10 preselected cases in Latin America
+ 2 from outside Latin America

- ACCIONA Microenergia Mexico (Mexico)
- EnDev (Peru)
- Energética (Bolivia)
- EJSEDSA (Argentina)
- Fundacion EcoAndina (Argentina)
- Guascor (Brazil)
- Ilumexico (Mexico)
- Instituto Perene (Brazil)
- PHOCOS Latin America (Bolivia)
- Tecnosol (Nicaragua)
- SunnyMoney (Tanzania)
- IDCOL (Bangladesh)

Each one of the cases in the extended group was analyzed individually and assessed on the basis of the methodology outlined in the section above.

In the second phase of the selection process, the 10 Latin American cases from the "extended group" were rated according to the quantitative and qualitative "relevance criteria" agreed with MIF. The results are shown in the following table:

Cases	Relevance					Total
	Quantitative					
	Innovation	Impact	Sustainability of business model	Risks	Replication/scaling up	
Ilumexico	2	2	2	2	2	16
Energetica	2	1	2	2	2	16
EnDev	2	2	2	1	2	15
ACCIONA Microenergia Mexico	2	2	2	1	2	14
Guascor	2	1	1	2	2	14
Tecnosol	1	1	2	2	2	13
Instituto Perene	2	2	1	1	2	13
Fundacion EcoAndina	2	1	2	2	1	13
PHOCOS Latin America	2	1	2	2	1	13
EJSEDSA	1	1	1	1	1	10
	Qualitative					
	Participation or actors and roles		Opportunities		Accessibility of information	

The six experiences with the highest score were selected according to these rates. They formed the initial proposal for a **"preferential group"** with the addition of the two cases from outside Latin America for comparison (see below):

Extended group

10 preselected cases in Latin America + 2 from outside Latin America

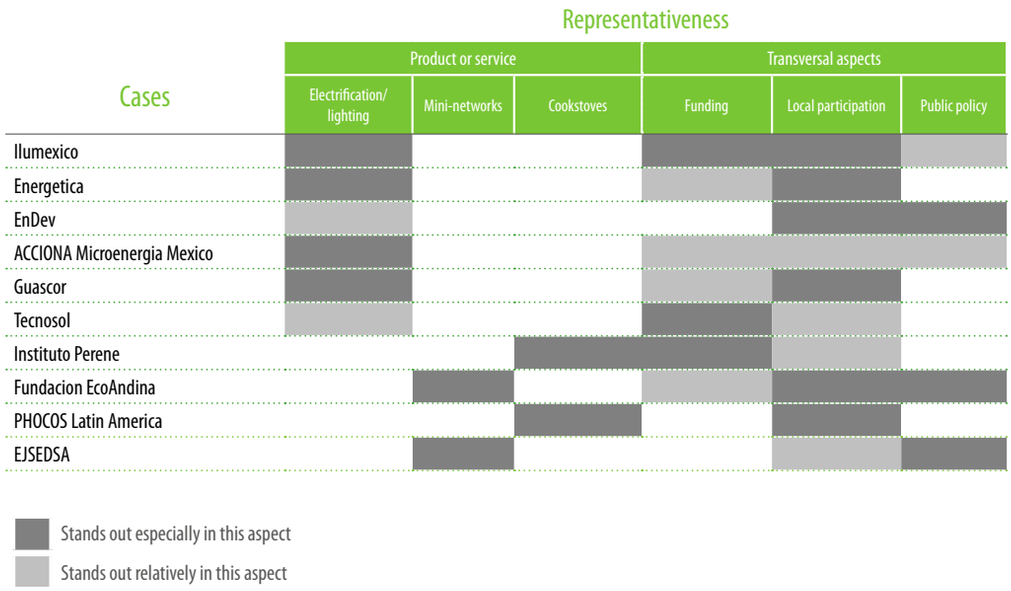
- ACCIONA Microenergia Mexico (Mexico)
- EnDev (Peru)
- Energetica (Bolivia)
- EJSEDSA (Argentina)
- Fundación EcoAndina (Argentina)
- Guascor (Brazil)
- Ilumexico (México)
- Instituto Perene (Brazil)
- PHOCOS Latin America (Bolivia)
- Tecnosol (Nicaragua)
- SunnyMoney (Tanzania)
- IDCOL (Bangladesh)

Preferential group

6 cases to study in depth + comparison with 2 cases from outside Latin America

- ACCIONA Microenergia Mexico (Mexico)
- EnDev (Peru)
- Energetica/PHOCOS (Bolivia)
- Ilumexico (Mexico)
- Guascor/Eletrobras Amazonas Energia (Brazil)
- Tecnosol (Nicaragua)
- SunnyMoney (Tanzania)
- IDCOL (Bangladesh)

The result of applying the **representativeness criteria** is shown in the following table. This was based on a qualitative assessment from the information gathered from internal analysis by the team.



Although there was evidence that the six preselected cases formed a group with an acceptable level of representativeness, it was decided to enrich the extended group in the following manner:

- The Tecnosol case was included at the express request of MIF based on its specific financial and geographical features.
- A joint case study will be carried out on the experiences of the Bolivian institutions Latin America and Energetica.

The **final group of cases to be studied** was the following:

Six cases for in-depth study

» ACCIONA Microenergia Mexico (Mexico)
» EnDev (Peru)
» Energetica/PHOCOS (Bolivia)
» Ilumexico (Mexico)
» Guascor/Eletrobras Amazonas Energia (Brazil)
» Tecnosol (Nicaragua)

CASES FOR IN-DEPTH STUDY

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