Rexel foundation

FOR A BETTER ENERGY FUTURE

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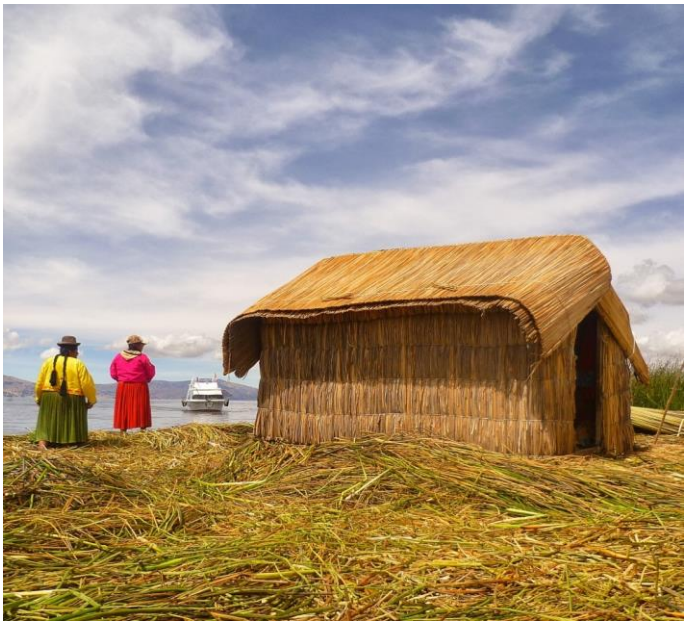


Developing energy-efficient social projects in the Andean region

Are carbon mechanisms a relevant long-term solution?

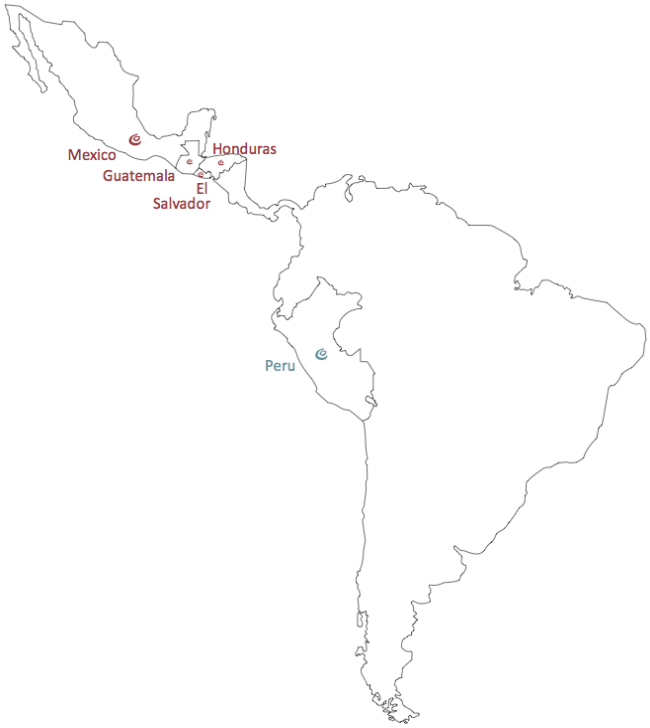
Content

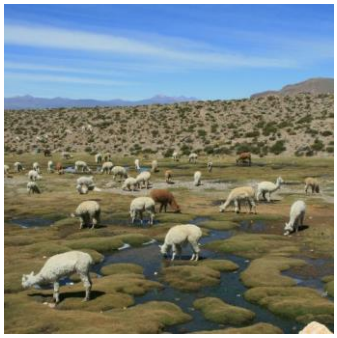
The present document is a summary of the report : « Study of the potential to spread energy efficiency's carbon programs in Latin America ».

Microsol conducted this study with the founding of the Rexel Foundation.

The complete version of the report is available in English:

http://www.rexelfoundation.com/en/our-programs/knowledge/study-energy-efficiency-programmes-latin-america





An innovative and original

thematic study

Microsol and the Rexel Foundation are teaming up to contribute to the production of knowledge on a key issue: the fight against poverty in Latin America. Their study, conducted from June 2013 to May 2014, sought to answer the following question: **How can we use the voluntary carbon offset market to accelerate and sustain projects that provide access to electricity or lighting to dispersed rural populations in the Andean region?**

This study aimed to identify and explore:

- the dynamics of rolling out energy-efficient programs among the poorest populations;
- the opportunity to use carbon mechanisms to support the widest possible dissemination of these programs.

This project was supported by the Rexel Foundation because of its **innovative, original approach**: until now, the use of carbon mechanisms had never been considered for projects providing access to renewable electricity in the Andean region. It also satisfies the Foundation's four core principles:

- it is socially innovative;
- it is environmentally friendly and provides energy savings;
- it is collaborative and partnership driven; and
- it is repeatable and scalable.

The study covers the Andean region (Bolivia, Chile, Colombia, Ecuador and Peru), an area at the crossroads of the activities of Microsol and Rexel. The focus was on dispersed rural populations in these countries for whom the extension of existing grids is not a feasible solution for electrification in the short term.

Access to energy is a prerequisite for escaping poverty

High electrification potential in the Andean region

6.1 million people do not have good access to electricity

In the five countries studied, **6.1 million people living in rural areas do not currently have good access to electricity**. Bolivia, where 42% of homes have no electricity, has the lowest electrification rate, but Peru has the highest number of people affected: 2.4 million people in rural areas. The study ranks the countries by number of rural residents without effective access to electricity, in descending order: Peru, Bolivia, Colombia, Ecuador, Chile.

This figure masks very different realities in a large area with highly varied geography – highlands, rainforests, coastlines – but we can still pinpoint the main cause of low electrification rates: **the very low density of rural populations**. Their remoteness and dispersion make it very difficult from both operational and financial perspectives to extend the electricity grids that supply urban areas.

Access to electricity is a prerequisite for social and economic development; it is a source of light and makes possible the dissemination of information, communications and the use of modern equipment. A major asset for those trying to escape poverty, it improves health, education, safety, the environment and economic competitiveness[1]. Today, the populations concerned use electricity mainly to light their homes and farms, listen to the radio (news, music), use the radio to communicate (a common practice in remote areas where there is no telephone network) and recharge mobile phones. Electricity is needed to replace other technologies currently in use: candles, oil or kerosene lamps and non-rechargeable batteries.

It should be noted that connection to the grid would electrify homes but does not entirely cover the particular needs of these populations, including autonomous mobile lighting on farms.

Untapped renewable energy sources despite available solutions

While renewable electricity and lighting solutions do exist in the area studied, they are not commonly used. Electricity can be produced by photovoltaic solar panels, micro- and mini-wind turbines, micro-hydroelectric plants or biodigesters. For lighting, the three key technologies considered as pre-electrification solutions are solar lamps, gravity lamps and lamps with pedal generators.

The study assesses the relevance of these processes according to four criteria:

- the **availability** of resources (sun, wind, water, organic waste);
- the **cost** of acquisition and maintenance;
- whether the technology can be used for a **group** of dwellings as well as **isolated** homes; and
- **ease** of use.

Two solutions emerge from this analysis: **photovoltaic panels** for electricity and **solar lamps** for lighting.

Since sunshine is abundant in the Andean region throughout the year, the potential for electrification is good, especially through the use of photovoltaic panels and solar lamps, but because of a lack of resources, these solutions – which offer a real opportunity for social and economic development – have not been exploited.

An assessment of profitability *vis-à-vis* the carbon market is needed to confirm the relevance of such projects.

[1] The direct and indirect impact of access to electricity in the fight against poverty is detailed on pages 39-44 of the complete report.

Carbon mechanisms are a tool for improving the quality and sustainability of electrification projects

What is the carbon market?

The regulated carbon market was established in 2005 to help the 192 States that have ratified the Kyoto Protocol to meet their targets for limiting Greenhouse Gas (GHG) emissions.

This is how it works: to achieve its objectives, each state allocates emissions allowances to its most polluting[2] companies. If one of these companies exceeds its annual quota, it must compensate by buying allowances from other companies that have a surplus. These allowance trades are made between companies operating in the signatory countries. To extend the scope of the Kyoto Protocol, the company offsetting its emissions may also acquire **carbon credits**, or emissions avoided through projects in developing countries. This flexible device, called the "Clean Development Mechanism," helps promote economic development in emerging countries while taking climate issues into account.

So we see that carbon markets allow for the exchange either of **emission allowances** or **carbon credits**. The exchange unit is a tonne of CO_2 avoided or its equivalent in other greenhouse gas emissions (expressed in tonnes of CO_2 equivalent). Carbon asset transactions can be used to comply with State regulations or can be voluntary.

Since no allowances are allocated at the outset on the voluntary carbon market, there is no ceiling. **Companies that want to offset some of their carbon footprint voluntarily purchase carbon credits**. The sale of carbon credits provides funding – often only partial – for GHG-emission-reduction programs in other countries, which might be, for example, an electrification project using photovoltaic panels for isolated dwellings, replacing other, less-effective and more polluting solutions. Microsol specializes in supporting voluntary carbon-market projects, forging partnerships between projects that generate credits and businesses that buy them.

The cost of joining the carbon market

To ensure that these markets are functioning properly, it must be verified that the assets exchanged are in conformity, that GHG emissions are indeed avoided and that reliable, recognized and standardized calculation methods are used.

To join a carbon market and have the right to sell carbon credits, a project developer must demonstrate that it will result in avoided emissions. The project must satisfy the following requirements:

- use **methodology** recognized by certification bodies and based on international standards;
- create **monitoring procedures** to estimate emission reductions;
- conduct **annual field surveys** to verify the actual impact of the project; and
- have an **annual external audit** done to certify the project's impact.

Verification of the methodology and of the amount of reported emissions is mandatory and must be performed by an independent third party in order to obtain the certification of credits from an accredited organization. This costs money, since it requires the use of human and financial resources, especially for the remuneration of the independent third party and certifying body.

A project is considered profitable from the perspective of the carbon market if the revenues from the sale of carbon credits generated during the certification period[3] are higher than the costs mentioned above. The income depends on the number of credits sold and their selling price.

Today, for various reasons, especially because of high uncertainty about the future of the Kyoto Protocol, a carbon credit is valued at around 5 euros per tonne of CO_2 equivalent on the European regulated market, whereas when it was launched in 2005, the price was around 15 euros.

[2] The sectors concerned are the most polluting: production of energy (electricity and heat production, refining, etc.), mineral industries (cement, lime, glass, ceramics), metallurgy (steel, iron) and paper.

3 The accreditation period is the period during which the project is authorized to issue carbon credits. This period lasts eight years on average and may be renewed once, depending on the solution used and the methodology.

Joining the carbon market is a virtuous, innovative, approach.

On the voluntary market, companies commonly choose to purchase carbon credits generated by development projects that have a strong social or environmental dimension and conform to their social responsibility approach. Credits are no longer purchased just to compensate for a carbon footprint but also to support a project with social and environmental benefits. Some certification bodies like The Gold Standard take this dimension into account in the accreditation process[4]. Voluntary carbon markets allow for differentiated prices depending on project content and a higher valuation of projects that have, in addition to an environmental impact, a strong social component. This makes it possible to raise the price of a tonne of carbon.

The price can vary depending on:

- **the type of project**: a project with a social component can earn from 3 to 6 euros more per tonne of CO_2 equivalent than the same project without a social component;
- **the certification channel**: The Gold Standard, for example, does not just look at a project's carbon component, but also conducts a qualitative evaluation of it, while the official market pays less attention to it. Once again, this allows the price of a tonne of carbon to rise by 3 to 6 euros.

In this way, Microsol was able to increase the price of carbon credits generated by improved stoves to 9 euros per tonne for the Qori Q'oncha program, the first program of activities (PoA) to obtain The Gold Standard's quality label. These stoves make it possible not only to avoid GHG emissions and save on energy (wood, in this case), but also to greatly reduce household air pollution, considered by World Health Organization (WHO) to be responsible for over 4 million deaths each year worldwide. To a lesser extent, these stoves also improve the quality of women's lives, since they are more efficient than traditional cooking fires and allow women to spend less time collecting wood and cooking.

The social dimension of a project can increase the price of a tonne of carbon.

Joining the carbon market helps improve a project's impact, quality and sustainability

Very often in access-to-energy projects, sponsors (governments, Non-governmental Organizations (NGO), development banks) give priority to financing installations, not their maintenance. Once the two- or three-year period of equipment implementation and project financing is over, there is often no monitoring of performance, and many installations no longer work.

Joining a carbon-market project creates a virtuous circle in two complementary ways:

- if they are primarily devoted to the maintenance of facilities, **the revenues from the sale of carbon credits can provide annual funding to cover routine maintenance, repair, replacement of components, and training** of end users and maintenance staff, all of which are essential to a project's sustainability;
- if they want **to issue and sell credits every year, project stakeholders must ensure proper functioning and quality.** Accreditation methodologies require an annual estimate, based on on-site measurement, of GHG emissions actually avoided as well as an external audit of the social and environmental quality of the project if these factors were included in the original price of the carbon credits.

[4] The Gold Standard certification body verifies, for example, the consultation methods of stakeholders prior to the project and ensures that there are no negative secondary consequences.

Two eligible, profitable projects in the Andean zone

The report describes the maturity of each country[5] in terms of electrification and lighting projects using renewable energy. For this analysis, three criteria were used:

- evaluation of the NGO network present in the area and active in the field of renewable energy;
- identification of existing projects and those under study; and
- the experience of the government with carbon markets. This led to the identification of 50 projects in the Andean region.

Eligibility criteria for the carbon market were applied to all the projects identified: from the beginning, **carbon revenues were taken into account in balancing the project's projected budget** (through the "previous consideration" provision) and estimating its **profitability**, mainly conditioned by the critical size of the project.

Once these criteria had been analyzed, two projects in the Andean region stood out:

One electrification project with solar panels in Peru

In September 2013, **the Peruvian Ministry of Energy launched a tender for solar-panel electrification of 410,000 homes, 7,530 medical centers and 2,100 schools**[7]. The consultation file for businesses included the criterion of "previous consideration," which was not to be a restriction to joining the carbon market.

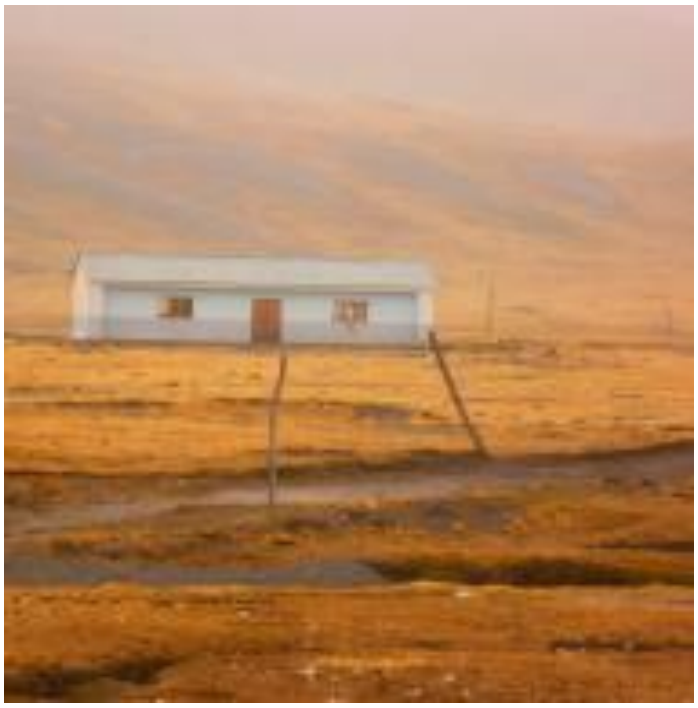
The profitability analysis showed that this type of scheme is viable and generates significant revenues for project promoters, but if it is **to ensure a good return on investment on all the certification work carried out**, it is still necessary **to raise the value of a tonne of carbon avoided to a slightly higher level than the current price (7 euros/tonne)**.

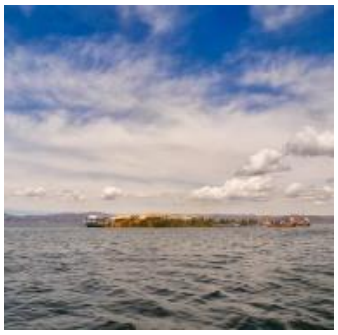
One pre-electrification project with solar lamps in Bolivia

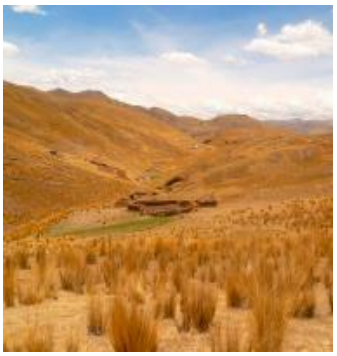
The Inter-American Development Bank provides **funding for 15,000 solar lamps in Bolivia**, a project supported by the NGO Energética. Since the latter, which had already registered a project on the voluntary market, is familiar with carbon mechanisms, the "previous consideration" provision should not be an obstacle. The profitability analysis shows that the projected volumes will cover the cost of entering the carbon market but will not produce significant profits. However, it is possible that the development of this market in Bolivia and Peru could be profitable in the medium term, given the acceptance of the technology, its low cost and the presence of competent players. This first project could be used as a model for others.

To ensure the profitability of the projects identified, an innovative approach is needed to increase the value of the carbon credits generated.

[5] Pages 85-97 and, in Appendices pages 112 à 155.
[6] Pages 89-92.
[7] http://www2.osinerg.gob.pe/EnergiasRenovables/contenido/Documentos/1SubastaOffGrid/Bases/NuevasBasesSubasta10042014.pdf







Taking inspiration from the carbon markets to invent a new approach that increases the projects' value

If joining the voluntary carbon market is to be profitable for an energy-efficient project, the value of the carbon tonne must be increased. To accomplish this, various conventional means can be used:

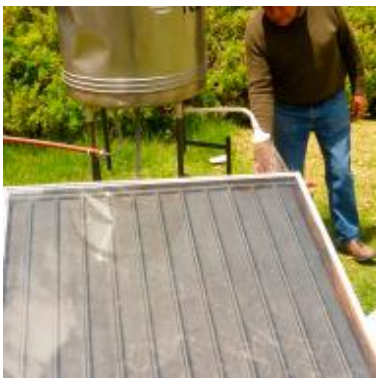
1. Propose a "product" with higher added value – in this case, projects that have not only a high environmental impact but also a social impact;
2. Hire a qualified sales force;
3. Invest in communications and marketing.

This report raises questions for reflection on the value of a project, i.e., how to change compensation markets so that the "currency" is not limited to a tonne of carbon but also includes the social, societal and environmental dimensions of projects. This development would also involve modifying certification standards and proposing indicators to measure the improvement of social and societal impact.

We therefore propose changing the markets so that the "currency" is no longer just a tonne of carbon avoided, but also a unit that measures the contribution to social and economic development. The challenge is to determine the unit of contribution, in particular by defining indicators, applicable methodologies and, most importantly, associated value.

Change the market to use units measuring contribution to social and economic development rather than just tonnes of carbon avoided

Knowledge
The study's other notable contributions



Consultations with experts and stakeholders

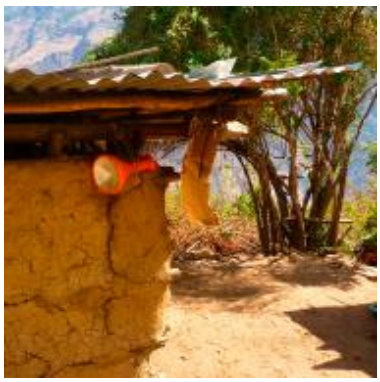
Numerous interviews were conducted for this study with key stakeholders in five countries, with 175 respondents in 97 organizations (see pages 286-292). In addition, 10 electrification projects using renewable energy were visited. A report was prepared for each project, with information on its location, accessibility, the number of people consulted, the duration of the project, the beneficiaries (sometimes including their personal stories), the situation before the electrification project was implemented, technical aspects of the project, management methods and various benefits. This information compiled by Microsol is of value to all project developers (see pages 194-259).

The challenge: going beyond simple access to electricity

Pages 39-43 of the report detail how access to electricity improves standards of living in the Andean region. Access to electricity produced the following benefits:

- **health**: decrease in lung diseases, decrease in loss of visual acuity, improved nutrition, improved conditions of reception in health clinics;
- **education** and information: more time for study, better access to effective educational tools (computers, Internet, videos);
- **safety**: fewer fires caused by candles and oil lamps;
- **economic development**: better preservation of the food produced and increased productivity;
- **equality between men and women**: some manual tasks traditionally performed by women can be replaced by electrical equipment.

Also noted are other necessary conditions so that access to electricity can help reduce poverty: access to markets, for example, and financial and technical means to maintain equipment.



All about renewable-energy electrification technologies

The report provides an overview for each technology – photovoltaic panels, micro- and mini-wind turbines, micro-hydroelectric plants, biodigesters and lighting solutions – with valuable technical, operational and financial information for project managers in response to the following questions:

- How does the technology **work**?
- How widespread is it **globally**?
- How is this technology used in the **Andean region**, and what are its advantages and disadvantages?
- What is the area's energy potential (sun, wind, water power, biomass)? And what studies are needed for a better understanding of local potential?

- What amount of **energy** can be expected from this technology? How can it be calculated?
- What are current estimates of the **cost** of the equipment and its **overall cost,** depending on need and opportunities for connection to a local mini-grid?
- How is the **technology installed?** What are the maintenance needs?
- Who are the **main players** – NGOs and private companies – involved in developing this technology in each country?
- What **human and organizational aspects** must be taken into account to successfully implement this technology?

All this information can be found on pages 50-60 and in the comprehensive datasheets on pages 156-193.

The human dimension: key to the success of any project

Successfully creating a "sense of ownership" that gives people a feeling of responsibility toward the new facilities is key to the success of an electrification project. The report provides a comprehensive list of success factors and pitfalls (pages 61-72). For each stage of the process, it covers the following points:

- **Project design**: Working with the beneficiary communities to identify their real needs. Ensuring that stakeholders at the community, national and local levels are consulted and involved.
- **Implementation**: Determining users' financial or other type of contribution. Deciding how roles should be distributed among the different stakeholders.
- **Operations**: Training users and local technicians.
- **Long term**: Defining the goals of follow-up visits. Assigning roles for maintenance. Ensuring recycling of the equipment.

Varying levels of maturity in relation to carbon markets

Methodologies that are already approved by the authorities in charge of regulating carbon markets and that are applicable to the projects identified are detailed on pages 80-81.

A summary of the analysis of the carbon market's relevance to each country studied can be found on pages 85-94.

On pages 266-285, the report presents all the information needed to analyze the projects' eligibility for and potential profitability on the carbon market.

	Colombia	Ecuador	Peru	Bolivia	Chile
Households without electricity	**360 000**	**120 000**	**580 000**	**410 000**	**30 000**
Government's position on carbon markets	Favorable	Somewhat favorable	Favorable	Somewhat favorable	Favorable
Existing projects eligible in the short term	No	No	Yes (solar panels)	Yes (lanterns)	No
Existing projects eligible in the long term	Yes (solar panels)	Yes (solar panels)	Yes (solar panels and lanterns)	Yes (solar panels and lanterns)	No
Conclusion on the relevance of carbon markets	• Major need • Promotion of carbon markets	• Desire to promote renewable energy	• Major need • Desire to promote renewable energy • Short- and long-term projects planned • Promotion of carbon markets	• Major need • Desire to promote renewable energy • Short- and long-term projects planned • Position on carbon markets not yet defined	• Promotion of carbon markets
	• Possible long-term renewable-energy projects	• Possible long-term renewable-energy projects			• Low level of need • Few short- or long-term renewable-energy projects
	• Few short- or long-term renewable-energy projects	• Low level of need • Few short- or long-term renewable-energy projects			

Partners:

Rexel Foundation and Microsol

Rexel Foundation for a Better Energy Future

Energy is the underpinning of our entire society. It makes possible heating, transportation, communication, industry, etc. Yet today 1.3 billion people worldwide still have no access to electricity. The **Rexel Foundation for a Better Energy Future,** under the aegis of the Fondation de France, is dedicated to promoting access to energy efficiency for all with a three-pronged approach. The aim of the first, "Knowledge," is to improve understanding and awareness of energy efficiency. The Rexel Foundation helps to interpret and inform by conducting studies and holding conferences.

Microsol, serving community projects

Microsol is a social enterprise that has been working since 2007 in Latin America to provide access to basic energy services. It allows companies to offset their carbon footprint through projects that benefit rural communities, in partnership with NGOs and development bodies. The projects are selected by Microsol for their environmental qualities – reducing greenhouse gas emissions and control of local environmental impact – but also for their strong social dimensions; Microsol favors projects that ensure progress toward poverty reduction and improvement of health and living conditions.

Microsol has developed expertise in increasing the value of these projects in the voluntary carbon offset market. Located in Mexico and Peru, it supports projects throughout the South American continent.

Its core business, building partnerships between development bodies and companies, covers all stages of a project: bringing local players together within the same program, certification of impact, the sale of impact certificates, the promotion of the actions of partner companies and support for NGOs in the field.

Study Methodology:

1. What are the needs and challenges in terms of electrification and lighting in the five countries studied?
2. What electrification and lighting solutions exist for isolated rural populations in the Andean region?
   - What are the technical solutions?
   - What theoretical, practical, financial and cultural constraints are involved in the development of these solutions?
3. In theory, can carbon mechanisms accelerate the rollout of energy-efficient solutions?
4. Is the use of carbon markets in the Andean region possible and appropriate for electrification and lighting projects using renewable energy?
5. How should these carbon mechanisms be designed to ensure better efficiency and greater financial sustainability over the long term?

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under the aegis
of the Fondation de France

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