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OFF-GRID INNOVATION IMPROVES THOUSANDS OF LIVES IN RURAL PERU

The positive impact of electricity and the development opportunities that come with it can be life changing. The introduction of electricity into homes and communities makes them safer and healthier, and it expands opportunities for education and productivity. A decade of World Bank support has helped rural communities in Peru to realize the profound benefit of energy access. Innovative efforts, such as scalable models for solar home systems and the promotion of productive uses of electricity, funded by the Energy Sector Management Assistance Program (ESMAP), were instrumental in reaching the poorest and most remote communities while contributing to Peru's efforts to diversify the energy mix with renewables.

Peru boasts one of the strongest economies in Latin America. With prudent macroeconomic policies, Peru has been able to sustain a continuous recovery and increase per capita income by 50 percent over the course of a decade. Between 2004 and 2010, historic growth helped lift more than 4 million people out of poverty and decreased the rate of extreme poverty to less than 10 percent of the population.

However, disparities between rural and urban areas remained high. By 2010, the national poverty rate had fallen from almost 50 percent to 31 percent, but it was still close to 61 percent among Peru's rural and indigenous communities. One explanation for the gap: access to electricity. While the national rate of access was 74 percent, only 29 percent of rural households had access to electricity. This meant 6 million people were still without power, representing one of the lowest rates of electrification in Latin America.

The government had to act.

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KEY ACHIEVEMENTS

FIRST RURAL ELECTRIFICATION PROJECT (RE1)

- 105,000 new connections
- 450,000 beneficiaries
- 3,000 schools, clinics, and community centers
- 7,000 solar home systems (SHS), benefiting 31,500 people

SECOND RURAL ELECTRIFICATION PROJECT (RE2)

- 143,000 people provided with new or improved electricity services
- 36,500 new connections
- 12,000 solar home systems
- 73 percent of all connections located in remote rural areas
- 33 percent of all connections were made using SHS in areas that were too isolated to be served cost effectively by grid extension

PARTNERING WITH THE WORLD BANK

The government launched an ambitious development agenda to overcome social gaps and improve equity. With the goal of providing equal access to basic services and reducing extreme poverty while keeping high rates of economic growth, the government looked to the World Bank for support. With the World Bank's assistance, a new general framework for rural electrification was prepared in 2005, and a dedicated fund was created to mobilize, manage, and disburse funding solely for rural electrification.

BRINGING ELECTRICITY TO RURAL COMMUNITIES

In 2006, with a US$50 million World Bank loan and a US$10 million Global Environment Facility (GEF) grant, the Rural Electrification Project (RE1) set out to increase rural access to efficient and sustainable electricity services. The project had a unique design—introduce incentives to encourage the existing network of electricity distribution companies, already serving urban areas, to expand coverage to rural communities. The companies prepared, executed, and operated rural electrification subprojects as part of their regular commercial operations. Nine distribution companies in 16 regions participated in co-financing the project, mobilizing an average of 25 percent of co-investment, for a total of US$29 million, surpassing the original target of US$23 million.

The project was highly successful—installing 105,000 connections in rural and poor households, benefitting 450,000 people. The project also brought electricity connections to almost 3,000 schools, clinics, and community centers. This increased rural electricity coverage by almost 6 percent.

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TAPPING INTO RENEWABLE RESOURCES

The GEF grant sought to fully incorporate renewable energy options into the project by supporting pre-investment studies on off-grid renewable energy sources and the promotion of productive uses of electricity.

The World Bank's Energy Sector Management Assistance Program (ESMAP) complemented the GEF component by supporting the development of an innovative model for bringing power to remote populations that could not be economically reached by the grid.

Solar Home Systems (SHS)

A stand-alone photovoltaic (PV) system can supply power for lighting and appliances. In remote off-grid households that are not connected to the grid, SHS can be used to meet a household's energy demand, fulfilling basic electric needs. SHS typically includes one or more PV modules consisting of solar cells, a charge controller that distributes power and protects the batteries and appliances from damage, and at least one battery to store energy for use when the sun is not shining.

An ESMAP-funded pilot program provided regulated services through two distribution companies using solar home systems. While the pilot successfully delivered power to 2,000 customers and the distribution companies strongly supported the model, an ESMAP analysis found that incomplete regulatory frameworks limited growth in the off-grid renewable energy market. Based on this analysis, the government passed a law and established regulations that created standards, tariffs, and subsidies for rural electricity systems and the promotion of renewable energy.

The government then implemented the model, establishing a nationally regulated tariff that allowed for electricity distribution companies to provide service using solar home systems to off-grid customers. Cross-subsidies were introduced to ensure affordability for customers. This resulted in the installation of more than 7,000 solar home systems, delivering power to more than 31,000 people in remote rural areas.

EXPANDING IMPACT WITH INNOVATIVE SOLUTIONS

Based on the success of RE1, the government requested an additional loan to continue the application of the rural electrification model. The Second Rural Electrification Project (RE2) aimed to provide electricity service in localities that were even more distant from the grid and with more dispersed populations.

Expanding on the off-grid model introduced in RE1, ESMAP helped Peru to establish regulated service from the electricity distribution companies to the solar home systems. With ESMAP support, training was provided for staff of the distribution companies, and online tools were developed to help utilities manage the solar home systems, optimizing service and reducing costs. In addition, effective commercial arrangements were established for billing and collection among the dispersed households. This was a pioneering effort for Latin America and provided an important model for future projects.

RE2 successfully connected almost 143,000 households to the grid and installed an additional 12,000 solar home systems, exceeding targets by 10 percent. Approximately 34 percent of the beneficiaries were women, and 15 percent—21,000 people—were part of Peru's indigenous population.

PROMOTING PRODUCTIVE USES OF ELECTRICITY

When communities understand how energy can boost productivity, the impact of electricity access can significantly enhance quality of life. Women and children especially benefit from the introduction of electricity through increased opportunities for income, lower indoor air pollution, enhanced lighting for education, and reduced labor burdens from the adoption of appliances.

Despite these benefits, international experience has shown that promotional efforts are often needed to encourage the adoption of electrical equipment for production.

ESMAP supported the design and implementation of a pilot program to increase productive uses of electricity as part of RE1. In villages near Cusco, a city in southeastern Peru, the pilot program partnered with local nongovernmental organizations (NGOs) to assess the market for the presence of small enterprises with the potential to increase electricity consumption. The NGOs then carried out promotional activities to encourage people to adopt tools and equipment that would further their productivity.

The results of the pilot were promising—almost 1,500 families adopted electric equipment to process cereals, coffee, cocoa, baked goods, meat products, milk, wood, and metal products, as well as to pump water for expanded agricultural production and processing.

The World Bank then aimed to replicate and scale up the Cusco pilot in other rural communities and to incorporate the effort into the design of RE2. The World Bank funding allowed for local NGOs to be competitively selected, capitalizing on their links to the community and specific field experience. The NGOs then deployed marketing and outreach, not only to family producers, but also to micro-, small-, and medium-size enterprises and cooperatives to adopt electricity and explain how it can be used for multiple purposes. They often used innovative methods—such as live theater performances—to communicate and connect with the local communities. Finally, the NGOs worked with the individual producers and cooperatives to build capacity

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and implement business plans using the newly adopted electrified equipment.

The effort ultimately assisted 10 NGOs in 18 Peruvian provinces across 3 major geographical and disparate regions, benefiting more than 25,000 rural family producers and enterprises, including women-led micro and small businesses, to adopt electrical equipment that increased their productivity and incomes. At project closure, participating producers had increased their incomes by an estimated 6 percent annually, and their average electricity consumption increased from 56 to 240 kWh/month—an increase of more than 300 percent.

Overall, about a third of the promotion's beneficiaries were women. This came about naturally, as women entrepreneurs are active in bakeries, dairy production, ceramics, and textiles. In Cusco, that rate was much higher—almost two-thirds of participants were women. The program identified an association of women bakers who specialized in artisanal cookies made from the amaranth plant, a high-nutrition traditional crop native to Peru. The women adopted machinery to increase production of bakery products and to more effectively brand, label, and market the goods.

STRENGTHENING THE GOVERNMENT'S INVESTMENT

Peru's rural electrification efforts have had a tremendous effect on the people living in those communities. These projects have also been instrumental in promoting new models for project delivery and design. The success of RE1 and RE2 has institutionalized a new system for rural electrification whereby distribution companies can be effectively tapped for the delivery and operation of grid extensions and solar home systems. The promotion of the productive uses of electricity helped to confirm that economic sustainability is more likely to be achieved in rural electrification efforts if there are direct impacts on livelihoods and revenue generation. Based on the government's investment, along with the coordinated and innovative support of the World Bank, GEF, and ESMAP, it is estimated that the electricity coverage in rural areas of Peru more than doubled, from 30 percent in 2007 to 78 percent by 2015.

ESMAP MISSION

The Energy Sector Management Assistance Program (ESMAP) is a global knowledge and technical assistance program administered by The World Bank. It provides analytical and advisory services to low- and middle-income countries to increase their know-how and institutional capacity to achieve environmentally sustainable energy solutions for poverty reduction and economic growth. ESMAP is funded by Australia, Austria, Canada, ClimateWorks Foundation, Denmark, the European Commission, Finland, France, Germany, Iceland, Italy, Japan, Lithuania, Luxembourg, the Netherlands, Norway, the Rockefeller Foundation, Sweden, Switzerland, the United Kingdom, and the World Bank.

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