Photos: iEnergía Group

The Solidarity and Social Investment Fund of the Chilean Ministry of Social Development brought renewable electricity to 75 families in southern Chile.

Access to energy was a big problem for villages in the "lake region" in southern Chile. Today, the 75 families of the project enjoy clean and reliable solar electricity.

Electricity for amazing landscapes

Off-grid PV: Chilean energy efficiency company iEnergía, founded in 2008, brought solar electricity to 75 families in three different territories in the "lake region" in southern Chile.

Chile, which stretches along 4,300 kilometers of South America's western coast, features some of the world's most extreme climates: in the north the Atacama Desert, the driest place on earth, and in the south the glacial mountains of Patagonia, all of which border the immense Andes Mountains. This kind of geography leads to the existence of isolated communities living in hard to reach places and tough climatic conditions.

Access to energy is a major problem in these remote villages and this results in a lack of energy for basic necessities such as refrigeration, lighting and communication. It is not a surprise that the conventional electric grid does not reach these far-flung places. The communities are left with few options for electricity, and those who can afford it usually opt for small diesel gensets. While solving the immediate problem of the lack of electricity, these are not a stable source of energy and far from the ideal solution.

To tackle the problem of energy access, several departments of the Chilean government have set aside funding for rural electrification projects. The departments range from regional governments wishing to improve energy access in their areas, to departments such as the ministry for social development, who look to improve the quality of life for those who live on the margins of society. Once the money is allocated they issue public tenders for the projects. The public tenders can be accessed online via a "public market" website. Private companies then compete to win the projects. The projects are awarded to a particular company via a points-based system. Points are awarded in several differently weighted categories. Categories include, among others, the technical specifications of the products, the price, and quality of services offered. For example in the case of PV systems, the tender will specify the maximum standby consumption of the inverter, the capacity of the battery bank, the nominal power of the PV array etc. The offer that meets the most or exceeds these requirements will be awarded the most points. Other categories could include the experience of the company implementing similar projects and the experience of the people involved in the project.

In 2013, the company iEnergía was awarded a rural electrification project in the south of Chile. FOSIS, the Solidarity and Social Investment Fund, allocated funding to bring electricity to 75 families in three different territories in the "lake region" in southern Chile. The systems were required to produce the electricity using renewable sources. There were three separate tenders for the territories of Chiloé, Palena and Rio Negro. iEnergía won the competitive process and was awarded all three tenders. Each of the families would receive an off-grid PV system to provide them with electricity to improve their quality of life and increase their work productivity.

Founded in 2008, iEnergía is a Chilean energy efficiency company. Its main markets include solar pumping, solar electricity generation and ultra-efficient lighting systems. Since the beginning the company has seen steady growth and today it stands as a leader in the Chilean renewable energy sector. Through the

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tender process, it was ensured that the funding was allocated to a reliable company who was fully capable of carrying out the project to the highest standard.

Although isolated, the communities are surrounded by an amazing landscape. Due to the people's lifestyle, they have a very low impact on their stunning environment. These places are not easily accessible by conventional means of transport. This, combined with the distance between the villages and even between individual houses, the inherent fragility of PV equipment, and the fact that the install had to be carried out in winter, lead to a significant logistical challenge. Some of the villages are only accessible by small boat and some houses only accessible by foot. Large quantities of cable and conduit for the interior electrical installations of the homes, PV modules, mounting systems, lead acid batteries, inverters, charge controllers and metal cabinets for the PV systems, all had to be transported to these sites. A high level of planning, care and preparation for unforeseen events is crucial for the success of a project like this. Where the latest 4 x 4 technology is overcome by the terrain, the local oxen take charge and provide the transport service. Zip-lines, small wooden and often leaking boats, help to cross the many streams and rivers.

Since different working activities require a different amount of electrical energy, several differently sized PV "kits" were designed. A survey of each household was performed identifying the working activity, the lighting requirements and the quantification of the electrical materials required for the electrical installation of the house. Based on the energy consumption of the tools or appliances to be used in that household, an appropriately sized kit was assigned to the user. This ensured the most efficient distribution of the resources available and ensured that the end user had a system that was suited to their needs. Working activities included, among others, sheep shearing, accommodation for tourists, sewing and fishing.

The average size of the systems was 1.2 kWp of PV and a 7.5 kWh battery bank. All of the systems were designed to deliver the power needed in a worst case scenario, which corresponds to the month with the least solar irradiation. The battery banks of the systems were designed to have three days of back-up with no solar input. This ensured that even in periods of particularly bad weather the users would still have sufficient power.

The weak link in off-grid systems is energy storage. Mostly lead acid batteries are used. These batteries represent the highest O&M cost of the system as they need to be replaced several times throughout the system's lifetime. They are also the most sensitive part of the system and if not treated correctly they will fail very quickly. There are three ways to ensure a long and healthy life for the batteries. The first is to ensure that the batteries' charging parameters are set properly in the charge controller. This ensures that the solar panels charge the batteries in the most appropriate way and ensure they reach a fully charged state without overcharging. The second is to implement a device which prevents the batteries from being discharged too deeply. This device is called a low voltage disconnect (LVD) and can be programmed directly in the inverter or using a switch and external relay. The third and perhaps most important means is to train the end-user on how to properly use the system to ensure it has a long life. Using the integrated battery meter display, the user can see the state of charge (SOC) of the batteries and therefore know when to reduce consumption and ensure that the system fully recharges on a regular basis.

Today, the 75 families of the FOSIS project are enjoying clean and reliable solar electricity. The systems have completely fulfilled their goal of improving the quality of life and increasing productivity. Children can now do homework in proper lighting conditions, women can sew in the evenings and fishermen can refrigerate their catch. The success of this project marks the way for future rural electrification projects in Chile and is living proof that solar energy can work wonderfully not only in the north, but also in the south of Chile. A quote from one of the users illustrates just how important these projects are: "The photovoltaic system has been the best thing that has happened lately on our farm and we will be eternally grateful for it. It has been working excellently well and with the great blessing of father sun who gives us this energy we are even better." Project manager iEnergía continues to implement these projects to the highest standard and is now in the process of completing a similar project for 120 families in the Aysen region in southern Chile. ◆Michael Norton