

Case study summary

Cooperativa de Energia e Desenvolvimento Rural do Médio Uruguai Ltda. (CRELUZ), Brazil

CRELUZ's 2010 Ashden Award recognises their use of mini hydro plants to improve the quality and reliability of electricity supply to rural communities in Southern Brazil.

Unreliable supply of electricity from the national grid used to restrict employment and development in Southern Brazil, causing people to leave the region. The cooperative CRELUZ, was set up in the state of Rio Grande do Sul, to improve the electricity supply. CRELUZ has installed mini hydro power plants to provide communities with reliable electricity and all the benefits that come with it.

- CRELUZ built and operates six run-of-the-river mini hydro plants, two using Francis turbines and four using Kaplan turbines.
- Plant capacity ranges from 0.27 to 1.2 MW, with a total of 3.96 MW.
- Turbines and dams are made in Brazil using a German design. Four have hydraulically driven moveable dam sections that allow the water level to be controlled to avoid flooding.
- CRELUZ has 4,500 km of power lines, supplying power to 36 municipal areas and to rural communities across an area of 13,000 km².
- In 2009, hydro plants supplied 17 GWh of electricity (27% of CRELUZ's total requirement) at a cost of about US\$0.04 per kWh. Remainder bought from the national grid at US\$0.06 per kWh.
- 20,000 families are cooperative members, so about 80,000 people benefit from this electricity.
- Greenhouse gas emissions cut by approximately 7,000 tonnes/year CO₂, by displacing fossil-fuel generation.
- CRELUZ members pay an average of US\$0.20 per kWh for electricity, with a sliding scale of tariffs, where larger wealthier users pay more and poorer families are subsidised. 600 poorest families are provided with free electricity under the CRELUZ social programme.
- To prevent deforestation and protect the water courses, river banks and hydro sites are replanted with local Brazilian varieties of trees, using seeds from local forests.
- Reliable electricity enables members to engage in more income generating activities, and allows a wider range of home appliances, improving quality of life.
- CRELUZ generates a profit each year. Members decide how this is used, including investment in extra hydro capacity and social and environmental projects.

CRELUZ was established in 1966 as a cooperative to improve electricity supply in its region. It has now grown to 87 full time staff and 20,000 members. In 2009, its annual turnover was US\$12.8 million.

2010 Ashden Social Enterprise Award

Supported by Zennström Philanthropies



Brazil statistics 2006/7

(UNDP/WRI)

GDP: US\$8,311/year per person

CO₂ emission: 1.9 tonnes/year per person

13% of people live on less than US\$2/day

3% of people lack grid electricity

Location



"The co-operative has helped the municipality to develop and has given us a good quality of life. We are concerned about the environment and the co-operative does a lot of reforestation work."

Mariana Pedo, Administrative Council.



Dam and bridge at Usina Granja Velha.

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Case study

Cooperativa de Energia e Desenvolvimento Rural do Médio Uruguai Ltda. (CRELUZ), Brazil

Background

Cooperativa de Energia e Desenvolvimento Rural do Médio Uruguai Ltda. (CRELUZ) is located in the state of Rio Grande do Sul, in Southern Brazil. The region was once largely covered in forest, but for over a century the trees have been cleared for farms. The regional economy is primarily reliant on agriculture, although there are other activities such as amethyst crystal mining.

The region is at the very end of the national electricity grid, and the supply of electricity used to be very unreliable, with many rural families not even connected to the grid. This limited employment opportunities, forcing some people to leave the region. CRELUZ was set up to manage and improve the electricity supply and the local distribution, initially in rural areas but gradually taking over the supply to urban areas as well.

The cooperative used to buy all its electricity from the national supplier, but supply was inadequate and the power quality variable, which restricted development in the region. So in 1999 CRELUZ decided to begin generating some of its own power using mini hydro plants, and now owns and operate six plants which generate about 27% of its electricity needs. All except the first plant were funded through the profits generated by the cooperative.

The organisation

The cooperative was founded in 1966 by a group of local people who wanted to improve the supply of electricity to rural areas. CRELUZ has now grown to 20,000 members, and 87 full time staff. It has a yearly assembly that elects the members of the administrative and fiscal Councils, as well as the President, Secretary and Treasurer. The Councils appoint a Board to manage CRELUZ's day to day operations. There is a strong sense of ownership by members of the cooperative, and CRELUZ has won prizes for the highest percentage of voting members.

CRELUZ had an annual turnover of US\$12.8 million in 2008, and all profits are reinvested in its own capacity or for projects benefiting the communities.

The technology

How does it work?

Hydro schemes use turbines to generate mechanical power from falling water. This can be used directly to drive machinery or coupled to a generator to produce electrical power.

CRELUZ has built and operates six mini hydro plants, with generation capacity from 0.27 MW to 1.2 MW, giving a total of 3.96 MW. All are 'run of the river' plants, which use a low dam or weir to divert water from the river to the turbine.

CRELUZ has taken care to minimise environmental impact in the design and construction of the hydro schemes. Run-of-river schemes do not require large areas of land to be flooded to create a reservoir, which is one of the main environmental concerns of hydro schemes. Two of the CRELUZ schemes have fish ladders, to help migrating fish cross the dams. Four have hydraulically driven movable dam sections that allow the water level to be controlled, which helps in flood protection.

The cooperative currently owns 4,500 km of power lines and is licensed to supply electricity to 36 municipal areas as well as rural customers, within an area of 13,000 km². As well as managing the existing distribution grid, it installed power lines to areas where other suppliers have refused connection because of their remoteness.

The technology in more detail

The schemes built by CRELUZ are classed as 'mini-hydro', because their generation capacity is between about 0.1 and 2 MW. In each plant, the low dam or weir diverts part of the river flow into a canal, from where it is directed through the penstock pipe onto the turbine blades. The two largest schemes (0.88 and 1.2 MW) use Francis turbines, and the other four use Kaplan turbines.

The improved power lines and local electricity generation have greatly reduced the distribution losses in the CRELUZ network, which now stand at about 10%.



Drilling a geode in the crystal mine

"We look at the decisions made about all the generation plants to ensure that they provide good energy at low cost, help poor people and do no damage to the environment."

Mariana Pedo, member of the Administrative Council

How much does it cost and how do users pay?

US\$1 = R\$ 1.85 (Brazilian Real) [May 2010]

Customers pay for their electricity usage based on the meter reading and the tariff that is agreed with CRELUZ. The cooperative has offices in many urban centres, and various shops and pay points have been authorised as collecting agencies where customers can go to pay.

CRELUZ sells electricity to its members at similar prices to other electricity distribution companies. The average price including tax is US\$0.20 per kWh (R\$0.37 per kWh). There is a sliding scale of tariffs, whereby larger, wealthier users pay more per kWh. Poorer families get a subsidised price of up to 64% discount, and about 600 families receive free electricity through the cooperative's social programmes.

The cost of electricity generated from the cooperative's hydro plants is about US\$0.04/kWh (R\$0.08/kWh), and CRELUZ pays on average US\$0.06/kWh (R\$0.12/kWh) to buy the rest of the electricity which it needs in bulk from the national supplier. Generating cheaper electricity through its hydro plants has helped CRELUZ to make an operating profit each year. This has been used to expand the distribution network, build more hydro plants, keep the tariff low and reduce it for poorer customers, and also for social activities within the local communities.

How is it manufactured, promoted and maintained?

The turbines in the hydro plants were all manufactured in Brazil, based on German designs, and have a design life of 20 years. Almost all the plant operators were also involved in the construction of the plants. The CRELUZ engineers train operators on the technical aspects of the hydro plant. Employees are also given training on the environmental component of their work, with strict rules to follow in this respect.

Each member is given a free phone number to call that is available 24 hours a day in order to report problems with the power supply. CRELUZ has a team of engineers who come out to repair line faults. A computerised map identifies each customer's location on the distribution network and allows CRELUZ to locate and repair faults quickly.

Once they become members and receive their electricity from the cooperative, people are required to participate in its activities, including voting in assemblies and being part of the social and environmental activities that are part of CRELUZ's work.

CRELUZ promotes its hydro power achievement to the rest of the country through television adverts, lectures, seminars and magazines.

Benefits

In 2009 CRELUZ hydro plants generated 16,591 MWh of electricity, which was 27% of its 61,551 MWh total. The remaining 73% was bought from the national grid.

CRELUZ has 20,000 members, or associates. This translates to 20,000 families (one member per family) and therefore about 80,000 beneficiaries (assuming four people per family).

Environmental benefits

The CRELUZ hydro plants replace electricity from the national grid. In Brazil, about 80% of this is from large-scale hydro, with natural gas, oil, biomass and nuclear power covering the remaining 20%. Assuming that the CRELUZ plants mainly offset the use of natural gas, then in 2009 they cut greenhouse gas emissions by about 7,000 tonnes/year CO₂ (at 0.42 tonnes CO₂ per MWh).

The hydro plants were designed to minimise local environmental impact, with small dams, fish passes and flood control systems. In addition, each canal that diverts water from the river has a trash rack to collect floating debris before the water enters the penstock pipes. Plastic bottles are then collected and recycled, whilst organic debris is used to make compost.

Each hydro plant site is extensively planted with trees, especially along the riverbank to prevent soil erosion. All trees that are planted through CRELUZ's reforestation projects are local Brazilian varieties, using seeds from local forests.



Elemar Battisti with Francis turbines Usina Granja Velha.

“The price of electricity has stayed the same for the last six years. I now run eight compressors at once and there is no problem with the light fading. I could not work at all, if I did not have support from CRELUZ.”

Nercei Da Silva Dudra owner of a crystal mine.



Francis turbines Usina Fortaleza.

CRELUZ runs a variety of environmental projects, all chosen by its members. Examples of projects include a water cistern that collects and stores rain water for a school and keeps it clean for drinking during the dry season; and tree nurseries planted out by volunteers in degraded areas and around the generating sites. CRELUZ runs environmental education projects in local schools, and school children are often involved in these reforestation projects.

Social benefits

The electricity supply in the communities now served by CRELUZ was very variable in the past, and many families were not connected to the grid. The people living in these communities were often forced to migrate to the cities due to limited income generating opportunities. The communities now have access to better quality and more reliable electricity, which allows them to have lights, TV, fridges and better lifestyles.

CRELUZ is involved in charitable work in all areas where it operates, providing support for poorer families. A part of the profits is allocated to social projects put forward by the members of the cooperative, and on which the whole assembly votes. These programmes include connecting off-grid homes, providing free electricity for poor families, and installing clean water in over 100 rural communities where families do not have access to clean drinking water in their homes.

All the generation sites are designed to be educational, and facilities are provided for schools and university student groups to learn about power generation. The plants also attract tourists to the area, which creates income generation opportunities for the communities nearby.

Economic and employment benefits

CRELUZ has 87 full time staff, who all receive training to improve their technical skills.

Members of the cooperative can now engage in a greater range of income generating activities because the hydro plants have improved the availability and quality of the electricity supply. Many businesses can now operate more efficiently because they can rely on using machinery such as milking machines, milk coolers and electric fencing on farms, and compressors for drills in the amethyst mines. Tourism has also increased, due to the infrastructure available because of the electricity supply, which has benefited communities in the area.

Potential for growth and replication

CRELUZ would like to supply all its electricity from locally-generated hydropower. The immediate plans for expansion are through a cooperative of cooperatives, COOGERVA, which has been jointly formed with four other cooperatives in the area. There are two potential sites of 24 MW and 17 MW where COOGERVA plans to build hydro plants. Detailed designs have already been made for the 17 MW plant.

CRELUZ has also identified at least 10 more potential sites for hydro schemes of a similar size to the ones it already operates, and there are others that would be suitable for smaller hydro systems.

The rate at which CRELUZ can develop these schemes is limited by the availability of profits to reinvest. CRELUZ is therefore interested in other sources of financing, such as carbon finance, to allow them to expand their hydro capacity more quickly.

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“CRELUZ is very well managed and I like working here. They offer a health plan, food, transport and recreation sites. They help students at the University. They care about the development of the workers and offer lectures and other training.”

Sonia Garbin, CRELUZ employee for 17 years.



A reliable, affordable electricity supply means that electric milking machines can be used.

This report is based on information provided to the Ashden Awards judges by CRELUZ, and findings from visits by members of the judging team to see its work in Brazil.

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