



## Micro-hydro scheme, Chambamontera, Peru

Report to The Matthiesen Foundation

March 2008



## Background



Chambamontera is one of many isolated communities in the highlands of Peru, largely forgotten by government agencies. The development of this rural area is seriously restricted by the lack of access to basic services, including energy.

As such, the families of Chambamontera are dependant upon towns and cities in their district for services which could be available locally by introducing electricity.

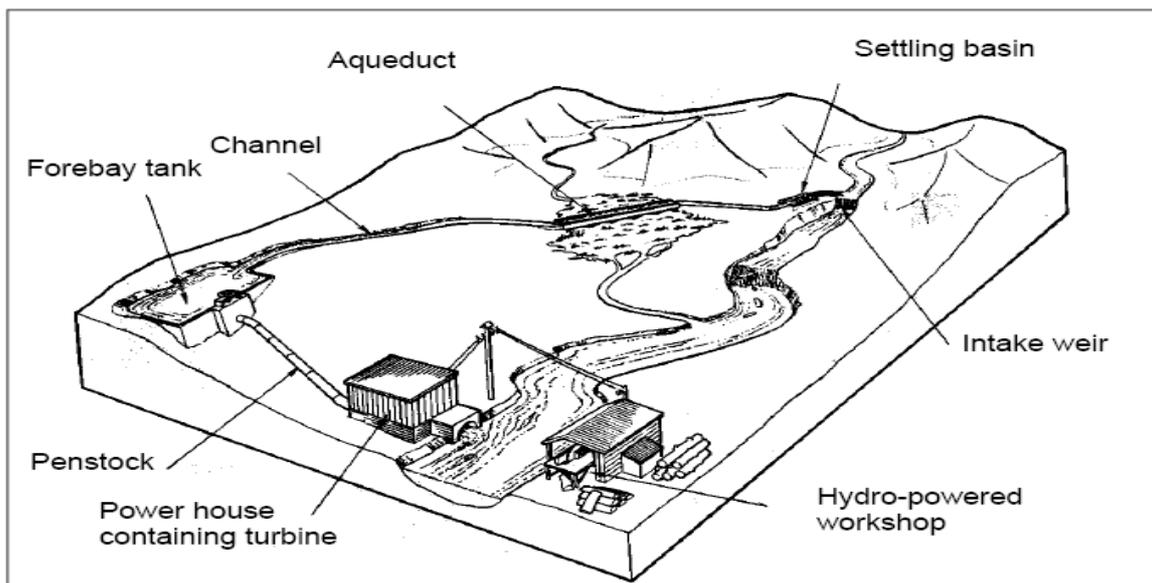
*(Photo: View of Chambamontera)*

Since October 2007, Practical Action has been working with the families of Chambamontera to install a micro-hydro scheme in their community. Once operational, this will provide families with electricity for the very first time, enabling them to improve their lives and livelihoods. The work has been made possible as a result of the generous support of the Matthiesen/Orbis Pictus Foundations (totalling £21,055) received in October 2007, supplemented by local people's contributions of funds (through a soft loan), materials and labour. This report covers the progress made during the period October 2007 to February 2008.

## Project overview

In recent years, the Ministry of Energy and Mining in Peru has begun a process of rural electrification, extending the coverage of the national grid. However, communities such as Chambamontera are unlikely to be included in such schemes. As rural population densities are generally low and the cost of energy supply is high (compared with densely populated areas), electricity companies have little incentive to provide services to these families.

Given the local need, and our significant experience in renewable energies, Practical Action is introducing electricity to Chambamontera, through micro-hydro power.



*(Diagram: Layout of a typical micro-hydro scheme)*

Poor people require only relatively small amounts of energy to meet their basic needs. Micro-hydro schemes therefore represent a practical alternative; once established, they can provide enough power for domestic, industrial and agricultural uses, and can have a life-changing impact on poor, isolated communities. Over the past two decades, Practical Action has implemented tens of micro-hydro schemes across rural areas of Peru, significantly and successfully testing the appropriateness of this technology.

## Chambamontera

Chambamontera is a rural settlement in the region of Cajamarca, Northern Peru. It is geographically isolated, at 1,700 metres above sea level, and is around 2.5 hours away (by road) from the closest significant town, Jaén.

Local families earn a living by farming, particularly coffee, and rearing small livestock. Livelihood development and diversity is limited because the community has access to so few services. Chambamontera has a primary and secondary school, chapel, health centre and satellite telephone, all of which could be much more effective if connected to an electricity supply. The community is generally well organised and has a number of local *Rondas Campesinas* (peasant organisations), associations of coffee producers and mothers clubs, which bring local families together.

As a result of this project, some 60 rural families will directly benefit from access to energy. An additional 100 families, living in neighbouring villages, will benefit indirectly through the introduction of electricity in Chambamontera. The lives of local families will be changed through this project: houses and streets will be well-lit, coffee de-husking and processing can be mechanised, small businesses, such as carpentry workshops, can be developed and new businesses, such as battery charging, will be established.



*(Photo: Local labourers from the community of Chambamontera)*

The water which flows through Chambamontera is sufficient in volume and strength to power a micro-hydro scheme. The kilowatts (kW) of power produced will go a long way towards meeting both the needs of households and small businesses.

Household demand	12 kW (peak) <sup>1</sup>
Institutions	3 kW (peak)
Street lighting	0.96 kW (peak)
Small industry	6 kW (peak)
<b>Power produced through Micro-hydro scheme</b>	<b>15 kW</b>

## Micro-hydro scheme details

Specification	Micro-hydro scheme - Chambamontera
Volume of flow	0.035 (m <sup>3</sup> /second)
Gross head	89.50 (ml)
Type of turbine	Pelton
Generator	Three-phase, synchronous
Regulator	Three-phase, includes secondary charge
Water inlet	Mixed (different types of bars)
Conduction channel	PVC SAL tubing of 8" diameter, length = 230 metres
Sand removal system and charge chamber	Reinforced concrete, 6 metres long x 1.00 metres wide x 1.00 metres deep.
Pressure pipes	PVC SAP pipes, 6" diameter, includes curves in direction shifts, length= 281 metres
Machine house	6.50 metres long x 4.00 metres wide
Medium tension	Approximate length= 1.3 km., includes transformers and distribution board.
Low tension and household connections	A self-carrying system, with 25 mm <sup>2</sup> and 16 mm <sup>2</sup> aluminium cable, will be used. The household connections include a meter for each house.

## Project Activities

***"We are so happy to have light, we feel very thankful and proud: our neighbouring communities envy us. At first, they thought our work was in vain but now they are asking us what they can do to obtain light".***

Quote from Alfredo Sarango, who benefits from a previous Practical Action project which installed a micro-hydro scheme in Pampa Verde, Peru

<sup>1</sup> The estimated need is based on peak demand. The 15kw produced by the micro hydro scheme is a reflection of the realistic need of the community, rather than peak need.

The region of Cajamarca, in which Chambamontera is located, has experienced heavy and constant rain from December through to February, which has significantly limited the amount of physical progress made at the site. Civil works are due to begin in April.



(Photos: Heavy rain has dislodged rocks, caused landslides and turned pathways into mud)

Given this constraint, and the fact that the project is still in its inception phase, the activities carried out in this period focused mainly on supporting local families to form an association and facilitating access to credit for the community's part-payment of the micro-hydro scheme. In addition, the project design and budget were adjusted and finalised.

The main activities during the reporting period included:

**Engaging the local community** - Meetings were held with local families to share information about the project. Subsequently, an agreement was made, outlining their commitment to contribute labour, local materials and the funds resulting from their soft loan.

**Organising beneficiary families** – Local community members are now organised in a legally recognised association, which has enabled collective decisions to be made more easily and allowed the community to access credit for the micro-hydro scheme.

**Detailed site study** – A series of reports have been produced outlining the technical specifications and budget estimates for the electro-mechanic equipment and the electricity grids. These include site adjustments, particularly in terms of the civil engineering works and electric grids, and the new location of the water inlet, the conduction channel, and charge chamber. These adjustments have also required the restructuring of the initial budget (detailed information is provided in the Finance section below).

**Socio-economic study of the community** - This recently completed study, prepared by a social science consultant, will be particularly useful when planning the project's community management model (which enables local people to maintain their local electricity service).

During the course of the next reporting period, a high level of activity is anticipated (with completion of the scheme currently expected around September/October 2008). The following activities are scheduled:

- Constructing civil engineering works (water inlet, conduction channel, sand removal system, charge chamber, pressure tubing and machine house)

- Purchasing and installing electro-mechanic equipment
- Installing electric grids (medium and low tension, as well as household connections)
- Testing the operation of the equipment and electric grids
- Initiating the process for the management of service delivery
- Training selected service operators and managers, as well as the service users.

## Finance

Due to the adjustments made to the site design and the higher price of the electro-mechanical equipment and electrical accessories, the total cost of the scheme has increased from £29,713 to £34,228 and the financing structure has had to be redefined. The revised budget and financing structure are shown in the table below (a more detailed breakdown is shown on the following page):

Source	Budget (£)			Total
	Credit (Association)	Donation	Users contribution	
Matthiesen /Orbis Pictus Foundations		18,950 <sup>2</sup>		18,950
Other donors		7,651		7,651
Practical Action	5641			5,641
Users			1,986	1,986
<b>Total</b>	<b>5,641</b>	<b>26,601</b>	<b>1,986</b>	<b>34,228</b>

## Thank you



On behalf of the 60 families whose lives will be dramatically improved please accept our thanks. Your support will make a significant difference to the prospects for poor rural people in Peru.

For more information please contact Warwick Franklin on 01926 634446 or [warwick.franklin@practicalaction.org.uk](mailto:warwick.franklin@practicalaction.org.uk)

*(Photo: Local family who will benefit from access to electricity)*

**Practical Action**, the working name of Intermediate Technology Development Group Ltd, is a British charity (Registered Charity No 247257) that aims to build the technical skills of poor people in developing countries, enabling them to improve the quality of their lives and that of future generations. We have offices in Bangladesh, Kenya, Nepal, Peru, Sri Lanka, Sudan and Zimbabwe, together with a head office in the UK. The charity was founded in 1966 by E F Schumacher, author of the book "Small is Beautiful".

*At the heart of our work is people and assisting them to find practical answers to poverty. Appropriate technology and the knowledge, skills and policies that surround technology are tools used to achieve this goal.*

*(Photos: Practical Action/Peru)*

*(Any stories provided are true, but names may have been changed to protect people's identities).*

<sup>2</sup> The total donation equalled £21,055, with 10% allocated to management and support as per the original proposal

- Detailed budget for Chambamontera Micro-hydro Scheme

Item	Budget (£)			
	Credit	Donation	Users' contribution	Total
<b>Civil works</b>		<b>4,769</b>	<b>1,473</b>	<b>6,242</b>
Water inlet		436	231	667
Conduction channel		1,113	539	1,652
Charge chamber		513	184	697
Pressure tubing and pipes		1,836	211	2047
Machine house		871	308	1179
<b>Electro-mechanic equipment</b>	<b>5,538</b>	<b>3,745</b>		<b>9,283</b>
Turbine	2,820			2,820
Generator	2,718			2,718
Regulator		2,667		2,667
Assembly and start operations		1,078		1,078
<b>Electric grids</b>		<b>9,231</b>	<b>513</b>	<b>9,744</b>
Primary electric grid		4,359		4,359
Secondary grid		4,872	513	5,385
<b>Transport charges</b>		<b>641</b>		<b>641</b>
Lima – Jaén		256		256
Jaén – MCH		385		385
<b>Skilled labour</b>	<b>103</b>	<b>820</b>		<b>923</b>
Master builder	103	820		923
<b>Implementation expenditure</b>		<b>7,395</b>		<b>7,395</b>
Operational expenses		3,436		3,436
Technical assistance		2,626		2,626
Management model		615		615
Credit monitoring		718		718
<b>Total</b>	<b>5,641</b>	<b>26,601</b>	<b>1,986</b>	<b>34,228</b>