

Trip to Peru by the UML Village Empowerment Crew

January 21, 2009

We made our twenty-fourth trip to Peru from U Mass Lowell for two weeks, January 5-20, 2009 to serve the people in remote villages in the mountains and in the process to learn and develop professionally and personally. What follows is an informal report on what we did and discovered as part of the Village Empowerment project.

Our Group

Sixteen of us worked together:

- Carolina Barreto, a graduate student in the solar engineering program, originally from Nicaragua and an agricultural engineer formerly with a solar group in Nicaragua: Grupo Fénix;
- Rebecca Edwards, community psychology major, UML;
- Nicholas Brecken, philosophy major and videographer, UML;
- Chad Montrie, Professor of History, UML;
- Cheryl Kim, English major, UML;
- Amy Musgrave, civil engineering major, UML;
- Zachary Spera, civil engineering major, UML;
- Matthew Sirum, photovoltaic system installer, volunteer;
- Suk Hwan Yun, chemical engineering major, IIT, Chicago;
- Katrina Ongchangco, architectural student, IIT, Chicago;
- Antero Castro, mechanical engineering student, UNI, Lima, brother of Rafael, a graduate student in solar engineering at UML;
- Janice and Steve Kurkoski, experienced solar system installers, volunteers, and veterans of many trips;
- Manuel Heredia, in the solar engineering graduate program (graduate of UNI, the National Engineering University of Peru), veteran of many trips;
- Gerber Ramos Martinez, graduate of UNI, former engineer with CONCYTEC in Lima (with our old friend Alfredo Oliveros), also a veteran of several trips;
- John Duffy, coordinator, twenty-first excursion.



The crew in Huarmey: Top row, left to right: Nick, Chad, Gerber, Steve, Carolina, Zach, Suk Kwan, Rebecca, Matt; bottom row, left to right: John, Manuel, Antero, Janice, Cheryl, Katrina, Amy.

What We Did

We split into three groups and went into the three valleys: Huarmey, Culebras, and Casma. We were able to complete a number of tasks, even though El Nino rains prevented us from traveling to some of the high villages. Accomplishments are highlighted below.

- The Huarmey valley group installed a photovoltaic (PV) battery charging station in Utcu, a small village which will probably never get electricity from the grid, as many of the other villages have received in the last couple of years. Some of the community folks have car batteries which they charge up to use for lights and radio.
- The group also installed a battery charging station in Carmocho, another small village off the grid. As there is no road to drive on, the group walked for over three hours to this village. Because the installed battery charge controller did not work properly, another trip was made from Huarmey by bus and foot with a new controller. Interestingly, the village grows organic crops, and it grows almost all the food it consumes. It exports habas – a bean that is a food staple in Peru.
- We got a step closer to establishing a WiFi link with parabolic antennas between the Huarmey hospital and the school in Malvas with the help of Antonio Patricio. This trip the internet connection seemed to have disappeared in Huarmey at the

time when we had a crew in Malvas at the same time Antonio was in Huarney. Next time it appears that just a little more tweaking will have it working.

- The Culebras group expanded the drip irrigation system in Turripampa with a new tank. We recently obtained a grant from NCIIA (National Collegiate Inventors and Innovators Alliance) to develop microenterprises of solar drip irrigation systems and in the short term to design and build two more prototypes. Carolina is going to do this work as part of her doctoral thesis.

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Folks working on the drip irrigation system in Turripampa

- This group also made quite a few repairs of systems in Quian. The radio in the posta had some connections backwards or missing; the UV water purification system was fixed and restarted and the water tested for bacteria (none). The steel cable corroded which supported the plastic tubes supplying the village with water; the tubes are still intact on the valley floor but are subject to damage from the water from the El Nino rains. We left some funds for the community to purchase some new steel cable in Lima. The biogas digester needs some more attention as one of the villagers tried for three months to get it to work, but we think the manure was too old. Also the biodigester in Laguna was not working because of

a leak in the plastic tube; we provided the family tending to it with a new plastic tube. The unusual rains caused some flooding of the biodigester trench, so the family will replace the tube when the unusual rains cease.

- The group made modifications to the Muchipampa solar water pumping system and for a second time spent considerable time on training the local folks in operation and repair of the system. The people in the village had deepened the well feeding the water system. A floating platform was created so the pump sits just over the water to minimize possible air leaks in the intake, which has been a source of problems in several of the water systems, thanks to the suggestion by Carolina to duplicate the setup that we have had in Quillapampa for some years in a well. The group also set up this type of pump intake in Huayash and repaired several leaks in the outlet pipe leading to the storage tank. The solar water pumping system and sand filter system were found to be working well in Quillapampa.
- We visited Raypa, where a new posta was built. The medical staff, Marivel, an obstetrician, and Asucena, a technician, connected the radio in the new clinic; however, they requested that we keep the solar system in the old clinic as a backup because they have been losing newly obtained grid power fairly often because of the rains. They have lights and a vaccine fridge, plus the living quarters of Marivel. We will wait to see how much the solar system is actually used, and then we can probably remove some of the PV panels to other sites. We have been relocating solar panels to other villages that have no electricity. Even in villages with recent electricity, some posta medicas cannot afford to pay the electric bill. The staff has to decide between electricity and medicine.
- The Casma group installed a radio in the Cachipampa posta medica. We put in a coax switch so the staff could use the same existing antenna for either our radio (ICOM 8000, 75 W) or their short wave radio. A new posta is under construction, and we can install a separate antenna on another trip. It turns out that the postas and the Casma hospital use our radios almost exclusively over the short wave radios provided in a few postas by the Ministry of Health.
- The Casma hospital director agreed with our request to change the frequency of our radios in the network to 145.8 MHz to make communication among some postas clearer and to avoid crosstalk with the Huarmey valley network. We tried this before with no success, but perhaps this time folks will carry through.
- The group traveled to the high villages of Pumapucllanan to repair the posta medica radio and of Chipre to install a vaccine fridge and more PV panels. Travel was tricky on the windy, slippery roads in the fog and drizzle. The fridge and quite a few clothes that we carried with us are donations of the Andover (MA) School of Montessori fifth and sixth grades.



Prof. Duffy and Luis, medical technician in Chipre, with the vaccine refrigerator donated by Andover School of Montessori fifth and sixth grades. They are holding a photo of the class.

- The group met with the Andres Aransaenz , head of Sermugen Solar company (sermugen@hotmail.com) in Casma to make an arrangement for Andres and his colleagues to repair any of our 80 systems in between our visits. Andres then traveled to Molino down in the Culebras valley on a Saturday so some of us could show him one of our solar radio systems. We then took him to the solar drip irrigation system up the valley at Turripampa. We gave him a prepayment and will communicate with him via email and/or telephone when a problem arises that we know about.



Carolina, Andres and Nick inspecting the solar irrigation system in Turripampa.

- The Casma group made more surveying measurements for the planned bridge at Yanacaca. Amy and Zach are scheduled to continue the design of the stone bridge next semester. We hope to construct it next summer.
- All three groups dropped off at the hospitals and various villages donations of clothes, medical supplies (courtesy of Lyvier Conss), medicine samples (courtesy of Anne DiSarcina of Winchester), rosaries (courtesy of the rosary making group at St. Mary's parish in Winchester, MA), and soccer jerseys (courtesy of Rebecca Gore of UML).
- The IIT students, Katrina and Suk Kwan, made water prefilters made out of plastic buckets, sand, charcoal, and old cloth (and cost less than \$5) and tried them out in Yanacaca and Muchipampa. They also constructed a vented stove out of metal containers that their colleagues at IIT had developed. We hope to deploy it in a house on the next trip.
- Chad and Nick collected many hours of video of training sessions for use and maintenance of the equipment in our systems, of local folks in the remote villages, of interviews with users of our systems, and of the installation and use of the solar drip irrigation system in Turripampa. Nick will be taking a course under the direction of Chad the coming semester to make documentaries and a biopic from the footage.

- Rebecca made many interviews of our community partners and student/volunteers participants in the project, some of which were taped by Chad and Nick. As part of a course in the fall semester, she worked on the interview protocols as well as rearranging by community much of the archived information from past trips. She will analyze the results this coming semester.
- Cheryl had developed a participant handbook with a fellow student as part of a writing course taught this last semester by Prof. Diana Archibald, a participant in the January 2008 trip. She will create and write fund raising materials and a web page this coming semester, again under the direction of Diana.
- We started building a solar hot water collector in Huarmey for either the Quian posta or the parish in Culebras. Amy and Zach built a frame from designs by ME capstone students from last spring. Since we could not obtain copper pipe in Huarmey, we decided to experiment with CPVC pipe painted black with no glass covering. Manuel bonded some copper flashing (which we happened to have in the storeroom) to two sections of CPVC ½ inch pipe, painted them black on the one side, put a blanket underneath, capped each end, filled one with water, and put them both on the roof.
- On the last day in Huarmey as we were about to leave the parish, where we store our equipment and tools, Father Ruly came up to tell us that a young man was waiting downstairs in the office asking for a prosthetic limb. He had recently moved into town. We will correspond with him via email and try to recruit a student or two to design and make a prosthetic left leg (with knee) for him.
- Another main focus of the trip was to make sure that all the previously installed systems were working, and we made many preventative maintenance stops at our installations and some minor repairs. We left a number of items for other postas that we could not reach because of time and/or weather constraints, such as, headlamps for Fortaleza, a CFL and base for Colcabamba, a battery and headlamps for Huachuy-Huaraz, a radio for Huallmi.
- On the last day we managed to stay at the little hostel right on the beach in Huarmey.

Acknowledgements

Of course, many others were involved with the project besides those of us who actually traveled down. Father Paul Soper started the project in 1997 at the request of several undergraduates who wanted to get involved with international service. Fr. Paul was the university chaplain for six years until June of 2002. He continues to inspire us.

Our benefactors include: St. Mary's Parish in Winchester; The Merrimack Valley Venture Forum; RWE Shott (ASE Americas) and Evergreen Solar for photovoltaic module donations; and many individual donors, including friends of Lyvier Conss and several past student participants, especially Kirsten Holmen-Cabanas. Without our benefactors, we could not have installed over 85 systems in 47 towns. Thanks to pastor Fr. Ruly, for letting us use the parish house in Huarmey to organize and store equipment and supplies. Also thanks are due to NSF for funding some of the service-learning projects and for the summer of work by our trio and travel.

Future Work

We have many requests for work and donations, and here are just a very few tasks in response for future trips:

- We encountered Pisceno from Malvas and talked to him about the trout farm we designed and funded a few years ago. He has some wild trout now in the tank (which he fed to the Huarmey group when they were in Malvas) but he mentioned that food is a challenge because the wild trout will not eat the manufactured feed and that farm-raised trout fingerlings would be needed to raise enough fish to be economically worthwhile. We had already loaned him funds to purchase fingerlings. But air sparging would be needed to allow more trout to be in the tank on his farm (which we also knew from the design work). So designing and installing a solar air pump system will be a target for future trips.
- Obtain donations of the following, requested by Milagros in the San Miguel posta: antibiotics for bronchitis, antiinflammatory drugs, multivitamins, sterile gauze, headlamps, calcium for bones, antihistamines, disposable gloves, syringes (5 cc, 10 cc, 1 cc).
- Design and build a PV charging station and biodigester for Turripampa.
- Design and build a leg prosthesis for the young man in Huarmey (Miguel Lopez Morgado, miguel1907@hotmail.com).
- Continue work with folks with disabilities needing physical therapy and prosthetics.
- Start microenterprises making and selling bottles with photocatalyst coating for solar water purification along with indicator dye.
- Make more video and sound recordings, training films, interviews.
- Continue education initiatives with the medical clinics on community health education as well as collaboration with K-12 schools in the villages.
- Study chemical pesticides use and possible worker protection.
- Study the biodigester system in Quian; seek the help of the folks Bonnie and Robert took a short course from near Lima last summer.
- Install more solar panels and a fridge in La Gramita.

- Obtain a small centrifuge for Raypa and other clinics with microscopes. This trip we gave microscopes (courtesy of the nursing department at UML) to Quian and to Raypa; immediately Marivel requested a centrifuge to use with the microscope.
- Design and install a water purification system for the Raypa school, which has 300 students, as requested by Marivel. Antonio Patricio also asked for help with the water at the school in Huarmey right near the parish (Colegio de Fatima), which has a high manganese content, which Manuel researched and discovered interferes with tests for bacteria.
- Develop solar crop driers. Gerber says that Cochapeti has a potential for Muñon herb growth for sales to Lima for tea. Herbs need to be dried to a moisture percentage of 8%, which can't be attained at ambient temperatures and humidity—a good potential for solar dryers.
- Finish the Yanacaca vehicle bridge across the river. Bad curves and lack of a bridge prevent human access and truck travel for crop transport from the village.
- Move Malvas' hydro turbine to Pilco.
- Make and install portable solar vaccine refrigerators for Pampachanca, Colcabamba, Chacchan, Huanchuy, Gramita in the Casma system and other towns.

Health Promotion and Wellness Tasks:

- Develop public health information (e.g., sanitation, nutrition, pregnancy) posters and handouts.
- Develop videos with public health information in Quechua. Some of the health clinics have waiting rooms with TVs, on which the videos can be played.
- Augmentative Communication Devices for kids (per assessment and teacher identified needs).

Thanks to all of you for your support, on behalf of our friends in Cochapeti, Malvas, San Miguel, Huamba, Huayan, Molino, Quian, Raypa, Quillapampa, Muchipampa, Erajirca, Huayash, Laguna, Puerto Huarmey, Culebras, Pilco, Victoria, Huanchay-Huaraz, Utcu, Turripampa, Carmocha, Huarmey, Fortaleza, Chacchan, Colcabamba, Cochabamba, Chipre, Pumapucllanan, Pariacoto, Casa Blanca, Pampacancha, Quillo, Huallmi, Huanchuy, Gramita, Huacuy, San Rafael, Yanacaca, Huacho, Punap, Comandante Noel, Buena Vista, El Olivar, Yautan, Huambo, Cachipampa, and Casma. (47 villages; 41 radios)

Any help with contacts to raise funds and obtain donated equipment would be greatly appreciated.

John Duffy and Crew

P.S. Some student comments on the trip, a chart of the systems installed.

Comments by participants about the trip and project:

| UMass Lowell Village Empowerment Peru Project Installations as of January, 2009 | | | | | | |
|--|--|------------------------------|----------------------------------|---|--|---|
| Location | PV | Controller | Lights | Equipment | Battery | Lanterns, PC, other |
| Clinics: | | | | | | |
| Malvas | 50 W ASE | 12 A Prostar | 20W fl 10W exam | radio | 3-126 Ah new 1/07 | 2 lanterns, PC, printer, parabolic cooker, headlamp |
| | 200 W ASE | 30 A Prostar | | vap. comp fridge, H2O pasteurizer | share with lights, radio | |
| Cochapeti | 100 W ASE | 12 A Prostar | 2-20W fl, 5 W exam | radio | 126 Ah new 1/08 | 2 lanterns, 2 PCs, parabolic cooker, headlamp |
| | 250 W ASE | 30 A Prostar | | vap. comp fridge | share with lights, radio | |
| Huayan | 40 W | C12 Trace | 15W cfl | radio | 160 Ah new 1/06 | PC |
| San Miguel | 60 W-Sol disconnected | 12 A Prostar disconnected | 20W, 18W, 5 W exam | radio | 2 -141Ah 1 new 6/07 1 new 1/09 | 2 lanterns, PC, headlamp |
| | 200 W Evergreen | 30 A Prostar | | vap. comp fridge | share with lights, radio | |
| Huamba | 150W ASE | 30 A Prostar | 3-20W fl, 18W, 2- 10W exam | radio | 2-140 Ah new 6/07 | 1 lantern, PC, parabolic cooker, headlamp |
| | 150 W ASE | 15 A Prostar | | vap. comp fridge | share with lights, radio | |
| Molino | 170W ASE, 50W Solarx 150W Evergreen | 30 A Prostar (old style) | 20 W fl, 5 W exam, | radio | 115 Ah | 1 lantern, PC, parabolic cooker, headlamp |
| Quian | 100 W ASE | 30 A Prostar | 3-20 W fl, 10W exam | radio | 1-160 Ah new 6/06 1-140 Ah new 1/09 | 2 lanterns, PC, headlamp |

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|--|---------------------|----------------------|-----------------------|-------------------------------|------------------------------------|---|
| | | | | | | |
| | 200 W ASE | 30 A Prostar | | vap. comp fridge – not used | share with lights, radio | |
| Raypa | 100 W ASE | 30 A | 2-20 W fl 10W exam | Radio moved to new bldg | 3-140 Ah 1 new 1/04, 2 newer | 1 lantern, PC, printer, headlamp |
| | 200 W ASE | 30 A | | vap. comp fridge | share with lights | |
| Colcabamba | 100 W ASE | 15 A | 15 W cfl, LED | radio | 141 Ah new 1/08 | 2 lanterns, PC, headlamp, charger - pilas |
| Cochabamba | 100 W AstroPower | 20 A | | radio | 140 Ah | 1 lantern, PC |
| Chipre | 180 W mix | 30 A | LED, 11 W Lumina | radio, vap. comp fridge | 140 Ah new 1/08 | 2 lanterns |
| Fortaleza | 100 W Evergreen | 15 A | 18 W Lumina | radio | 140 Ah | |
| Pumapucllanan | 100 W AstroPower | 12 A | 15 W | radio, vap. comp fridge | 140 Ah | 1 lantern, |
| Gramita | 100 W Evergreen | 15 A | 2-15 W cfl | radio | 140 Ah new 6/08 | |
| Huacuy | 80 W Arco 53 | 30 A | 2-15 W cfl | radio | 125 Ah new 6/07 | headlamp |
| Huallmi | 150 W | 30 A | 15 W cfl | radio, vap. comp fridge | 260 Ah | |
| Punap | 80 W Arco | 30 A | 15 W cfl | radio | 140 Ah | headlamp |
| Huambo | 2-50 W ASE | 30 A | | (not our radio) | 140 Ah | charger- pilas |
| Schools: | PV | Controller | Lights | Equipment | Battery | Other |
| Carmocho School Station (removed from Malvas school 1/09) | 90 W-ASE | C12 Trace/Xantrex | 15 W cfl | for charging batteries | using own batteries | multimeter |
| Malvas School | 110 W-Sol | 12 A | 20 W | | 140 Ah | laptop PC, printer |
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|-------------------------------------|-----------------------------|-------------------|---------------|--------------------------------|--------------------|------------------------|
| Raypa School Station (removed 6/07) | 200 W-Siemens | C30 Trace | | for charging batteries | | |
| Raypa School (removed 6/07) | (shared array) | 30 A | | | 140 Ah | laptop PC, printer |
| Cochapeti School Sta. | 150 W-ASE 40 W Siemens | C30 Trace | | for charging batteries | | |
| Cochapeti School | (shared array) | 30. A | | | | laptop PC |
| San Miguel | 50 W ASE, 50 W Evergreen | 12 A | | | | 2 laptops, printer |
| Pilco | 60 W Sol | 10 A Sunsaver | 11 W fl | | 140 Ah | laptop PC |
| Huamba Baja | 50 W AstroP | 6 A Sunsaver | | | 140 Ah | laptop PC |
| Erajirca | 50 W AstroP | 10 A Sunsaver | | | 140 Ah | laptop PC |
| Quian (removed 6/07) | 80 W Siemens | 10 A Sunsaver | | | 140 Ah | laptop PC |
| Town Government: | PV/hydro | Controller | Lights | Tools | Batteries | Equipment |
| Quillapampa | 150 W Evergreen | C12 Trace | | pliers, screwdriver | 140 Ah new 6/04 | water pump sand filter |
| Utcu (removed 6/08) | 150 W | 30A Prostar | | pliers, screwdriver | 140 Ah | water pump |
| Utcu | 100W ASE 47W AstroP. | C12 Trace/Xantrex | 15W cfl | | 140 Ah (from 2005) | battery charging |
| Muchipampa | 120 W | 30A Prostar | | | 160 Ah new 1/06 | water pump |
| San Miguel hydro (removed) | 1400 W gen. | 20 A Two C40, 48V | 20 W | 220 V ac inverter | 4-140 Ah | town lighting |
| Quian UV H2O | 200 W PV-ASE | 20 A | UV 20 W | | 3-126Ah new 1/07 | water purification |
| Yanacaca | 90 W Astropower | 30 A Prostar | | multimeter multitool, headlamp | 126 Ah new 1/07 | water pumping |
| Cochapeti town hall | 100 W | 12 A Sunsaver | 2 - 20 W fl | | 140 Ah | lighting |
| Huayash | 200 W ASE | Prostar 30 A | | screwdriver | 140 Ah new 1/09 | waterpump, sand filter |

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|----------------------------|--------------------|------------------------------------|-----------------------------|-------------|--------------------|----------------------|
| Laguna | 100 W | Prostar 30 A | | misc. tools | 140 Ah new 6/07 | Water pumping |
| Quian | biodigester | | | | | Community cooking |
| Churches | PV | Controller | Lights | | Battery | |
| Malvas church | 50 W | 12 A | 2 - 20 W fl | | 140 Ah | |
| Malvas parish house | 50W ASE | 12 A Prostar | 4 - 20 W fl 1 auto lite | | 140 Ah | |
| Quian church | 50 W | 6 A Sun saver | 2 - 20 W fl | | 140 Ah 6/04 | |
| San Miguel parish house | 50 W | 12 A Prostar | 2 - 20 W fl, 1- 5W cfl | | 3 old 140 Ah | |
| Cochapeti church | 50 W | 12 A | 3 - 20 W fl | | 140 Ah | |
| Radio Systems: | | | | | | |
| Clinic | Radio | Antenna | Emergency Hand Radio | | | |
| Huarmey Hospital | 75 W | 13-element Yagi and vertical | | | | 10 PCs |
| Huarmey amb. | 5 W | Magnetic | | | | |
| Malvas Clinic | 5+35 W 75 W | 4-element Yagi and vertical | | | | |
| Cochapeti | 5+35 W | Vertical | RadioShack | | | |
| Huayan | 5 + 35 W | 13-element Yagi and vertical | | | | |
| San Miguel | I-com 2100 50 W | Vertical | I-com | | | |
| Huamba | 75 W | 13-element Yagi | Kenwood, RadioShack | | | |
| Quian | 5 + 35 W | 4-element Yagi and vertical | Kenwood | | | |
| Raypa | 5 W + 30 W | 4-element Yagi | Radio Shack | | | |
| Molino | 5 + 35 W | 13-element Yagi | | | | |
| Culebras | 50 W | Vertical and 4 element Yagi | | | | |
| Colcabamba | 5 + 35 W | 4 element Yagi | | | | |

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|----------------------|-----------|--------------------------------|---------------|--|--|------|
| Cochabamba | 5 + 35 W | Vertical | | | | |
| Cochabamba ambulance | 5 W | Magnetic antenna | | | | |
| Chipre | 5 + 35 W | 4 element Yagi | | | | |
| Pariacoto | 75 W | Vertical, 4 Yagi | | | | 1 PC |
| Pariacoto amb. | 5 W | Magnetic | | | | |
| Pumapucllanan | 5 + 35 W | 4 element Yagi | | | | |
| Fortaleza | 5 + 35 W | 4 element Yagi | | | | |
| Puerto Huarmey | 50 W Icom | Vertical | | | | |
| Chacchan | 75 W Icom | Vertical | | | | |
| Casa Blanca | 50 W Icom | Vertical | | | | |
| Huanchay | 5 + 35 W | Short wave | | | | |
| Victoria | 50 W Icom | Vertical | | | | |
| Quillo ambul. | 5W TH-K2 | vehicle antenna | | | | |
| Pampacancha | 5 + 35W | Antenna Ministry Health | | | | |
| Quillo | 50 W | 4-element Yagi | | | | |
| Casma | 75 W | 13-element Yagi | | | | |
| Casma ambul. | THK2AT | Magnet antenna | | | | |
| Huanchuy | 50 W | 4 element Yagi | | | | |
| Huallmi | 5W + 35W | 4 element Yagi | | | | |
| Gramita | 5W + 35W | 4-element Yagi | | | | |
| Quillapampa | 5 W only | | Town use | | | |
| San Rafael | 50 W | Vertical | | | | |
| Huacuy | 5W + 35W | Vertical | | | | |
| Buena Vista | 75 W | Vertical | | | | |
| Huacho | 75 W | Antenna, Ministry Health | | | | |
| Yuatan | 50 W | Vertical | | | | |
| Punap | 5W + 35W | Vertical | | | | |
| Huambo | 35 W amp | Antenna, radio Ministry Health | PV, bat. ours | | | |
| Cachipampa | 75 W | SW Antenna shared | | | | |

| Micro-enterprise: | Type | Equipment | Service | Other | | |
|--------------------------|---------------------------|-------------------------------|----------------------|----------------------|-------------|--|
| Malvas | Aquaculture | 1 cement pool | trout | | | |
| Utcu | Aquaculture | 1 rock pool | trout | | | |
| Quian | Charging station | 50 W PV, C12? Trace | headlamps | | | |
| Fortaleza | Charging station | 50 W PV | lanterns/ headlamps | | | |
| Laguna | Biodigester, rocket stove | bladder, gas stove | community cooking | tin snips | | |
| Turripampa | Drip irrigation | 5-35W PV Arco 30 A Prostar | Irrigation farming | 141 Ah battery, 1/08 | | |
| Paty, San Miguel | Charging station | 3 – 45 W ASE PV, C12 Trace | charge big batteries | | | |
| | | Microscopes | | | | |
| Huarmey school | Pariacoto school | Chacchan posta | Huarmey hospital | Raypa posta | Quian posta | |