

Rental of PV systems provides quality lighting in remote Laos villages

Summary

The electricity grid in Laos is concentrated mainly in the towns and cities, many poor people in remote rural areas rely on firewood for cooking and kerosene for lighting. Kerosene lamps can be dangerous, causing burns, starting fires and polluting the air indoors, so using solar PV lighting can offer a range of benefits in addition to better quality light.

Sunlabob has introduced high quality solar photovoltaic (PV) systems to Laos in a way that people can afford. Solar-home-systems (SHS) and portable solar lamps are rented at prices starting lower than the spending on kerosene for lighting, so that families can save money by switching to solar PV. Sunlabob uses a carefully selected and trained network of franchises to install and maintain the solar PV equipment, and each franchise trains technicians in the villages to perform day-to-day maintenance. Sunlabob rents equipment to the Village Energy Committee (VEC), who are selected by the whole community, and the VEC leases it on to individual households. This puts the community in control of setting prices, collecting rents and performing basic maintenance. Larger village systems provide power for community services such as health systems and water pumping.

Households that use solar PV equipment from Sunlabob have safe light in the evening for household chores, income generation activities and school homework. These extended evening hours and the time saved from fetching kerosene and firebrands give more time to spend as a family and with their neighbours. Portable solar lanterns are popular for use when working away for two or three days at a time in distant family lands. At present 1,870 SHS (including 20 larger ones for community use) and 500 solar lanterns are rented to families in 73 different villages.

The business model of Sunlabob ensures high-quality solar PV lighting and good customer service at a price people can afford. The model could work in many other countries, and is already being replicated outside Laos.

The organisation

Sunlabob is a commercial company, which was set up in Laos by Andy Schroeter, the current Managing Director, in 2001 to providing renewable energy services to people living in remote off-grid areas. It employs 34 people at present, but is growing quickly to meet the demand for energy in rural areas. As well as the rental of solar PV equipment, Sunlabob is involved with micro-hydro, biogas plants, and diesel generators running on jatropha oil.

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Context

Statistical information	
Population (2004)	5.8 million
Urban population (2004)	20.3%
GDP per capita US\$ (2004)	\$ 493
- at purchasing power parity	\$ 1,954
Population living on less than \$1 a day (2004)	27%
Population living on less than \$2 a day (2004)	74.1%
Population with access to grid electricity (2005) (<i>Lao PDR National Statistics Centre</i>)	50%
Annual electricity consumption per person (2003)	135 kWh
Annual CO ₂ emissions per person (2003)	0.2 tonnes
Population undernourished (2001-03)	21%
Population with access to an improved water supply (2004)	51%

Sources: UNDP, World Resources Institute, National Statistics Centre of the Lao PDR

Laos is a poor country and its remaining natural resources are under pressure from mining and logging operations. Although 48% of the population has access to grid electricity, this is concentrated in cities and towns, as are healthcare and communications, leaving large areas of the country without services. In the remote rural areas, where Sunlabob works, the main source of income during the wet season is farming. Rice, maize, vegetables and some specialist cash crops are grown, and a small number of cattle, pigs and poultry are raised. In the dry season, people turn to craftwork such as basket-making, weaving skirts and making incense sticks to earn a living. Most people use kerosene lamps and firebrands for lighting in their homes, with the associated risks from burns, fire and air pollution. Family land is fragmented, so people often spend several days away from home to tend their fields, and kerosene lamps and firebrands are taken on these trips as well.

The target of the Lao government is for 90% of the population to have electricity by 2020, and it has recognised that this will not be achieved using centralised systems alone, because the people without electricity are largely in sparsely populated rural areas. Sunlabob has approached rural electrification in Laos through a commercial rental method.

Technology and use

Photovoltaic (PV) modules generate electricity from sunlight. With re-chargeable batteries to store electricity, they can provide an independent dc electricity supply system that can be used both day and night. A PV system incorporates a charge controller, which prevents the battery from being over-charged or deep-discharged, and may also include an inverter to convert dc power to ac thus allowing the use of ac appliances. Sunlabob supplies a range of solar PV systems, suited for different applications and customer budgets.

Sunlabob solar-home-systems (SHS) use 20 to 120 Wp of PV modules. Although car batteries were initially used, Sunlabob has switched to using deep-cycle lead-acid gel batteries, because

they have longer lifetimes and avoid the risk of acid spills. The most popular system, used in 60% of homes, has a 20 Wp PV module and a 33 Ah battery. New charge controllers incorporate data logging facilities, which will be used to monitor electricity use. The SHS are used to power two or more 3 – 7 W compact fluorescent lights, including one for the kitchen and one for the main living room, typically for three to four hours per evening. Homes with larger systems may also use a television, radio and other small electronic items. Sunlabob does not supply inverters, in order to keep the systems simple, but some households purchase their own inverter if they have sufficient power to operate it.

The PV module is installed on the top of a wooden pole rather than on the roof of a house, which allows it to be placed at the ideal orientation to the sun in order to generate maximum power. The battery and charge controller are placed in a locked box to which the village technician has the key – this eliminates the risk of the owner bypassing the charge controller when the battery charge level falls, as this could damage it.

Larger systems, rated at 150 – 800 Wp are provided for community use, and can power lighting, small cool-box style refrigerators for health centres, ice-making machines, water pumps or other useful devices.

Sunlabob also supplies solar lamps. These use a 2 – 4 W compact fluorescent bulb and a 7.5 Ah lead-acid gel battery, enclosed in tough plastic and a steel cage to make them very robust and also resistant to heavy rain. A reflector is set behind the bulb to concentrate the illumination in one direction, and a timer within the lamp limits its use to 15 hours, so protecting the battery from being deep-discharged. The lamps are recharged by a 24 V charging station based in the village, which uses two solar panels to give an output of 160 – 240 W. The charging stations are imported from Germany, as well as the lamps. Batteries are imported from China. The innovative timer is developed and produced by Sunlabob. Every timer has also an interface to allow the tracking of every lamp; this makes the system accountable in terms of financial issues as well as in all CDM related issues.

Most of the technology used by Sunlabob is imported from Germany or China, with an emphasis on high-quality components to ensure reliable service and avoid unplanned maintenance of the systems. LED lamps are being investigated, but Lao people are currently resistant to them, saying they prefer 'proper' lights.

At present Sunlabob has 1,870 rented solar systems (20 of which are large community systems) installed in 73 villages and managed by 68 VECs. The installation rate has recently been 500 systems per year, although it is expected to increase to 5,000 per year with new investment that is arriving in 2007. At last count there were also 500 portable solar lamps being leased to people, and this number is increasing rapidly.

Nevertheless Sunlabob sold 5,600 SHS so far in Lao PDR.

How users pay

£1 = 20,000 kip approximately [April 2007]

The financial system in Laos makes it very difficult for individuals in remote areas to take out loans. Sunlabob has set up a successful rental programme for users of PV SHS and lanterns. The rental approach means that Sunlabob retains control of quality, maintenance and training – factors that have not always been managed well in other programmes to supply PV in Laos. The rental programme runs on a commercial basis, so the rent covers all capital and maintenance costs.

Sunlabob does not rent equipment directly to the end users; instead it requires each participating community to set up a Village Energy Committee (VEC), to whom it rents the PV equipment. The community selects the members of the VEC, and the VEC rents the equipment to individual households. The VEC is responsible for collecting payment from households, which frees Sunlabob from this task. Payments are usually made by women, who generally manage household finances. Local management of payments allows the VEC to be flexible if someone cannot pay due to temporary problems with their finances. However, late payment and defaults are rare, as customers know that by not paying the company they are letting the whole community down.

The cheapest SHS, rated at 20 Wp, costs 35,000 kip (£1.75) per month to rent, while a 100 Wp system costs 160,000 kip (£8) per month. Households typically spend between 36,000 and 60,000 kip (£1.80 to £3) per month on kerosene for lighting, so that if they choose a small solar PV system just to provide lighting, then they will save money compared to using kerosene lamps.

Solar lanterns are financed by a recharging fee. For the first fully charged lamp the household makes a deposit. From then on the household brings depleted lamps and takes home fully charged ones, paying only the charging fee. One charge that provides light for 15 hours costs at present 5000 Kip (£0.25). Users are very keen on the solar lamp rental, as they pay a fixed price and get 15 hours of light, allowing them to plan their usage and spending accordingly.

About 5,600 more affluent users have bought systems outright.

Training, support and quality control

Although Sunlabob signs contracts directly with the VECs, it uses a network of 34 franchisees to carry out installations, training and repairs. Each franchisee is vetted for competence, and receives both initial and follow-up training from Sunlabob. The franchisee then trains technicians in each community, who are selected by the VEC, and are responsible for the day-to-day running of the charging station for the solar lamps, as well as the rented out SHS. The service network also manages spent batteries, which are returned to Sunlabob for recycling. There are regular regional and national meetings of franchisees to share problems and solutions, and upgrade their training; selected village technicians also take part in these. Sunlabob's master trainers carry out regular checks to make sure everyone is properly trained.

If a problem arises with a system or a lamp, the village technician will attempt to fix it; if they cannot, then the franchisee will repair or replace the component. The number of days without power is deducted from the customer's next bill. If the customer caused the fault through misuse, such as overloading the system, then the technician will explain the problem to them. As a last resort franchisees have occasionally taken equipment away from customers who misused it, but this is extremely rare.

Quality control and customer support have been key to the success of Sunlabob. Every piece of equipment that they rent out has a unique serial number, and the company can track any individual item to an end-user. No PV modules have failed during the time the programme has been running, and less than 3% of the charge controllers.

Benefits

The different solar technologies are used in different ways. The community systems are most commonly used to provide lighting, electric fans and refrigeration in health centres, but they are also used for ice-making in fishing communities, allowing them to transport fish to markets in towns. A new application for the community systems, currently at pilot stage, is pumping water and purifying it, providing a village with two water taps – one for drinking, and one for other uses.

The replacement of kerosene lamps with solar PV lighting in homes brings a range of benefits, including a reduced risk of burns and fires, improved air quality and better quality light. Households with more powerful systems also appreciate the ability to use TV, radio and other small electronic items.

The improved light is useful for children doing their homework – a Lao government study into rural electrification indicated that children with electric light at home performed better in exams than those without.

The solar lamps are sometimes rented to supplement a solar-home-system, as and when extra light is needed, but their main use is outdoors. Some people have fields at a distance from their homes, so they take the solar lamps to provide light while they work in the fields and stay over there in a hut for a few nights. Often families come together in the evenings, each bringing their lamp along, and together work on crafts such as weaving or basket-making, so the income generating effect is combined with the social benefits. The durability and portability of the lamps is very important for this type of use. The solar lamps are much safer to use than kerosene lamps or

the firebrands people used to take when they went to the fields and forests. Also, firebrands often go out just when they are needed most, while the solar lamp stays on for its guaranteed 15 hours, allowing people to plan their use and to get home safely at night.

Sunlabob's customers especially appreciate the time savings from not having to go out to get kerosene or firebrands, and this allows people to spend more time with their children and their neighbours. Also, good quality light allows household chores to be postponed until the evening, leaving the day free for outdoors work.

Renting a small PV lighting system from Sunlabob is cheaper than paying for kerosene. In addition, customers use the availability of light in the evening to spend extra time on their craftwork, typically earning an extra 5,000 to 10,000 kip (£0.25 - £0.50) per month – equivalent to a third of the monthly cost of a 20 W SHS. However, users who extend their work hours for high value crafts such as weaving can earn much more. There is anecdotal evidence that people are less likely to migrate from villages to towns, and more likely to come back, when solar power is available, because of the increased services and business opportunities.

The programme has created seven full time jobs within Sunlabob, and full-time or part-time work for 34 franchisees and over 80 village technicians.

Potential for growth and replication

The potential for growth in the use of solar PV in Laos is huge; Sunlabob is already installing systems at a rate of 500 a year, and new investment this year will allow it to scale up to 2,500 systems, and 5,000 a year after that. The potential market for Sunlabob SHS is estimated at 10-15% of the country's households – almost 1 million people.

The technology used is applicable all across Laos and also in other countries. The Sunlabob rental model has proved successful, and could be replicated in other countries with similar community structures, where people do not have access to an electricity grid. Sunlabob is already starting work in Cambodia and Indonesia, and is exploring possibilities with interested potential partners in Bhutan, East Timor, Eastern Africa and Latin America. The main barriers that must be overcome in replication of Sunlabob's work are the development of a local skill base and the establishment of small enterprises to run the franchises. This requires initial and follow-up training and inevitably takes time. Capital investment is also needed to provide an initial stock of rental equipment, and access to capital is one of the main limits to growth.

Management, finance and partnerships

The way in which Sunlabob gets in contact with a village, sets up the VEC, and interacts with the VEC and the franchisees has been developed very carefully, to provide a quality service at low cost.

Before starting work in a village, Sunlabob must gain support from both village and district authorities, and spend time in the village explaining how PV systems work, what the rental charge will be, and what the VEC does. A demonstration system is installed in the village to show what services it can provide, since most villagers have never heard about PV.

Sunlabob owns the PV equipment and sets up the rental contracts with the VEC. The franchisees are responsible for the physical installation and maintenance of the equipment. Each franchise is an independent business, usually based around a family who may also have other work. The franchisee trains local technicians in the villages, but the technicians are paid and managed by the VEC. The VEC deals with day-to-day management of the systems within its charge – for instance enabling families to increase their system size, cease renting if they no longer want a system (in which case there is always demand from others in the village), and managing the local technicians. Users are not allowed to be charged for evenings when their rented system is not providing light, so there is a real incentive for the VEC to manage systems well.

Sunlabob maintains a well-run office in Vientiane, where there is also a workshop for the assembly and testing of equipment. Sunlabob currently employs 34 people but is growing fast; it recruits technical staff from the Lao National University, with whom it has good connections. There is an

emphasis on building management capacity within its staff, and on training in management, technical skills and English language.

Sunlabob helped to set up the Lao Institute of Renewable Energy (LIRE) to carry out research and policy work that would not be appropriate or possible for a single company to pursue, and to be an independent voice for renewable energy in the country. It also works closely with the government, in order to target the rental programme at areas least likely to get a connection to the electricity grid.

This report is based on information provided to the Ashden Awards judges by Sunlabob Rural Energy, and findings from a visit by one of the judges to see their work.

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