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Electricity where the sun shines

Solar battery charging stations for household lighting

A solution for the low income households in Lao villages

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1. Situation

Rented Solar Home Systems

Sunlabob has had a remarkable success so far with the renting out of solar home systems. These are small independent photovoltaic systems that allow a household to operate lights or small appliances operating on 12 Volt. With the possibility of renting such systems the hurdle for large initial investments was overcome and electric lighting became affordable to many more households in a village. This is usually more than half the households, depending on the economic situation in the village. The rental service for solar home systems is presently the benchmark of Sunlabob for technology and operations in rural electrification.

Village Grids

For income generating purposes 220 Volt is usually required, ie. for mills, pumps, freezers, autoclaves, etc. and of course most household appliances on the market work with 220 Volt. This can be achieved by installing independent village grids which are fed by various sources of energy, ie. small hydro turbines, photovoltaic generators, generators powered by combustion motors, etc. Sunlabob is now engaged in installing and operating such grids for villages that are remote from the national grid. A financial approach that leverages public and private investments comes to play to ensure sustainable operations. Through this Sunlabob manages to service those villages that are better endowed with a range of energy sources. However, village grids are only commercially viable with large compact villages. Small hamlets dispersed in difficult terrain prefer to rent the solar home systems.

Rented battery charging stations

The households with the least income cannot afford to rent even a solar home system. And yet they would very much prefer electric light over the petrol lamps and candles that they presently use. We have been persistently asked by lower income households for a cheaper solution just for simple lights. After some research our solution is battery charging stations for rechargeable lamps, which are rented by the operators. This allows to expand the accessibility of solar lighting to the large number of lower income households, while at the same time retaining all the proven advantages of a rental service for the villagers. This paper explains the technology, operations and financing of battery charging stations in villages.

2. Technology

Solar-rechargeable lamps

Such lamps are compact units that can be hung up inside a room. They include:

- An LED light bulb with acceptable spectra (colour of the light)
- A lampshade that directs all available brightness down into the room
- A rechargeable battery (an accumulator).
- A counter that indicates the hours the light was switched on.
- A mechanism for warning when the light will go off due to low battery charge.

Charging station:

This is a large state-of-the art photovoltaic system with suitable sockets and charge-control equipment for charging the batteries of the lamps. It is installed somewhere at a central location that is safe.

Modular expansion

This system can easily be expanded in a modular way to follow the changing demand and developments in the village:

- a) the charging station can be enlarged to service more lamps in the village
- b) other batteries than those of solar lamps can also be charged, such as for operating radios, TVs, mobile phones, laptops, audiovisual players, etc.

3. Operations

Procurements:

Sunlabob buys and installs the solar charging stations and rents them out to Village Technicians. The charging stations remain in the ownership of Sunlabob in order to ensure correct maintenance and longevity. Sunlabob also buys the lamps on behalf of the village authorities and hands them over into their ownership.

Trainings:

Sunlabob trains Village Technicians who will be capable of operating the solar charging stations as a small enterprise by renting them from Sunlabob. They are also trained to service the lamps.

Sunlabob trains Village Energy Committees. VECs are public institutions operating under the supervision of the village authorities. They are trained by Sunlabob to fulfill their public functions of organizing the energy requirements for the village. This is the procedure that has been successfully implemented with the rental service for solar home systems.

The Village Technicians train the households who will operate these lamps.

Operating the charging station in a village:

The battery charging station is commercially operated by the Village Technician who is trained by Sunlabob to correctly service and maintain both the charging station as well as the rechargeable lamps. He or she rents the charging station from Sunlabob at cost covering prices. This village enterprise is based on:

- expenses for renting the station
- income from charging the lamps

Technical backup to the Village Technician is provided by the Service Provider in the district who is franchised with Sunlabob. He ensures fast response in the event of technical problems with the charging station.

Operating the lamps in the village:

All lamps are in the ownership of the Village Energy Committee. The VEC hands them into safekeeping by the Village Technician who is accountable to the VEC for tracking the location and status of each lamp. The Village Technician also checks and services the lamps each time they return from the households for recharging and can thereby keep them in good operating order.

Household operations:

The households operate one or more lamps. Each time the battery of a lamp is empty, they go to the charging station and exchange it for a lamp with a fully charged battery. They pay the Village Technician for the hours that each lamp gave light.

After initial training by the Village Technician on the correct use of the lamps, the households pay an affordable but tangible deposit to the Village Technician before taking their first fully charged lamp home. The deposit is returned when they return the lamp. Exchanging empty lamps for recharged lamps of course means the deposit remains with the Village Technician. The Village Technician is accountable to the Village Energy Committee for the deposits. A household that loses a lamp must repay the costs to the Village Energy Committee, whereby the deposit will help to partly cover those costs.

4. Financing a charging system in a village

Charging station

Credits allow Sunlabob to buy the equipment for the solar charging station, install it and rent it out to the Sunlabob-trained Village Technician. The charging station remains property of Sunlabob. The rent of the charging station covers all costs to continuously operate the station, ie.

- initial equipment
- servicing, repairs, replacements
- amortizations
- capital costs (interests, payback)
- any operational costs at the level of Sunlabob
- profit of Sunlabob

Lamps

Credits on behalf of the Village Energy Committees VEC also allow Sunlabob to buy the rechargeable lamps. These become property of the VEC. The lamps are put by the VEC into the hands of the Village Technician for operations and servicing.

The fee for the lamps is collected by the Village Technician each time a spent lamp is exchanged for a recharged lamp, calculated from the timer on each lamp: The price is calculated on a per hour basis, ie. on how many hours the lamp provided light. The price per hour of light covers all costs of the total system, ie.

- rent of the charging station (paid by Village Technician to Sunlabob)
- amortization of the lamps (paid by Village Technician to Sunlabob), from which replacements will be paid.
- consumables, servicing, operations of the charging station at the level of Village Technician
- repairs, maintenance and servicing of the lamps
- capital costs of the lamps in the recharging loop.
- profit of Village Technician

The Village Technician pays to Sunlabob each month the rent for the charging station plus the amortization for the lamps. All the rest is his/her business. Replacements of lamps or their parts will be paid for by Sunlabob from the amortization payments.

At least once each year Sunlabob has a meeting with the Village Energy Committee and the Village Technician to assess the financial situation, decide on the price per hour of lamplight for the next year, and discuss with the VEC what they want to do with the accumulated amortizations that are left after deducting replacement costs: Buy more lamps (which means Sunlabob would have to agree to upgrade the charging station)? Invest in a unit at the school or at the health post? Etc. VECs may also decide to put a margin on the price per hour of light of the lamps in order to pay for the rent of a unit that is to the benefit of all villagers, ie. at the school, temple, health post, etc.

5. Investments and money flow

An internationally acknowledged independent financial institution operates an account in Europe that is dedicated to this effort (eg. GEXSI, ResponsAbility, etc).

1. Investors provide funds into the designated account with the financial institution, based on their agreements with Sunlabob for operating this effort.
2. The institution transfers these funds to Sunlabob as and when required.
3. Sunlabob buys the equipment, installs the solar charging stations, hands over the solar lamps to the VECs.
4. Village technicians pay rents on the charging stations to Sunlabob.
5. Village technicians also forward the amortizations of the lamps to Sunlabob. Sunlabob has an account for each village, from which replacements are paid. Surplus in the amortizations are then up to the VECs to decide how they want to invest them for increasing the number of lamps (revolving fund at the village level).
6. Sunlabob pays interest and payback to the financial institution on the investments in 1, (for the charging stations, and for the lamps on behalf of the VECs).
7. Depending on the intentions of the investors, the financial institution pays back to investors or reinvests in new credits to Sunlabob and VECs to increase the number of solar charging stations and lamps (revolving fund at Sunlabob level).

6. Expected Developmental Effects

- A. The most directly intended effect is electric lighting that is a) affordable to the poorer households of a village, and b) provided through commercially viable mechanisms and therefore sustainable. (The proven developmental effects of lighting need not be mentioned here). Affordable means this: The recharging fee per hour of comparable brightness is the same or cheaper than what the poorer households pay for petrol and candles.
- B. Health benefits due to reduced fumes from wicks of petrol lamps.
- C. Creation of a modern and sustained village enterprise, ie. the Village Technician selling hours of brightness in the dark.
- D. Environmental effect of reduced CO₂ usage and reduced use of unrecycled torchlight batteries (the accumulators of solar lamps that can no longer be recharged are recovered by the village technician and sent back to Sunlabob for correct recycling). Due to the rental mechanisms of Sunlabob a network is in place to recover and recycle all spent materials.
- E. “Good governance” effects at the village level through trainings of VECs to be transparently accountable to the whole village public on their actions and finances for operating the whole system. These skills often then transfer to other public services that have to be taken care of at the village level.