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*Electricity where the sun shines*

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## Public - Private cooperation for building and operating village level hybrid energy grids (hydro-solar).

### **Concept**

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Background and summary

A large number of villages in Lao PDR will not be connected to the main grid for many years to come. Small village grids fed by decentralized local energy sources are the option to be explored and developed. In some places it is feasible to consider small hydro-electric solutions. However, in most areas in the dry season flows are considerably reduced. A feasible small grid will therefore in most cases have to be boosted with solar generators. This means hybrid hydro-solar village grids. The government policies support decentralized solutions in order to reach the goal of 90% electrification by 2020.

Insular grids have an intrinsically low load-factor (sold energy compared to produced energy), because they cannot draw on the larger grid to cover peak consumption or feed into the larger grid during low consumption. This makes it unattractive for private investors to consider installing and operating such hybrid grids.

With this in mind, an innovative financial and operational structure is proposed (also see graph):

- a) All movable assets of a hybrid energy supply system shall be owned and operated by a Private Energy Provider (PEP), ie. turbines, generators, solar panels and controllers, batteries, etc.
- b) All fixed-unmovable assets shall be owned and operated by the village: Dams, intakes, channels, housings, supporting structures, the grid.
- c) The PEP sells energy to the village-owned grid. The village sells energy to the individual users.

The village will invest in its fixed assets. If the village does not have the financial means, the investments must be made by higher levels of the public, including donor agencies. This is in line with policies for public support for rural infrastructure.

The PEP will invest in the movable assets. If the PEP does not have the financial means, of course credits, loans and other private financing mechanisms will facilitate these investments. This is in line with policies to promote private investments.

Thus a close cooperation between Public and Private evolves, that allows to operate village energy supply on an economically viable basis. Public infrastructure investments leverage private investments into the movable assets, and vice-versa the willingness of private investors for operating the movable assets allows the public to save on scarce public funds for ensuring that village grids actually become operational. Initial pilot efforts along this line will provide the data for designing further joint Public-Private investments for rural electrification on a large scale.

The Lao government's efforts for electrification take decentral energy production and distribution very much into consideration. This concept paper sketches some details for exploring and developing Public-Private cooperation for ensuring sustainable electrification for remote villages in Laos and SE-Asia in general.

#### Installation and building

- For each location initial surveys by PEP assess the technical and economical viability. Negotiations among stakeholders build the institutional framework, resulting in the required contracts among the actors.
- Then PEP plans, engineers and builds/installs: Dams, intake channel, penstock, turbine, generator, meters to village grid, village grid, solar generators and inverters, battery-stacks, household meters, household systems, etc. PEP sells a package of engineering, construction and training/coaching to the village for the elements of the whole system that will be in the ownership of the village.

#### Training and coaching

During installation, the PEP trains a Village Energy Committee (VEC) mandated by the elected Village Authorities, or directly elected by the villagers. The trainings include

- correct management of the village grid and the village owned infrastructures
- transparent public accounting for the benefit of the village
- organizing trainings and events for discussing and learning about efficient use of electricity in the village
- exploring and initiating productive use of the available energy.

PEP continues to coach the VEC after operations begin.

During construction and installations, at least two Village Technicians (VT) are trained on the job. These Village Technicians will be independent small entrepreneurs. These entrepreneurs will be hired and contracted

- by the Village Energy Committee for operating the public village grid and infrastructures
- by the PEP for operating the movable assets
- by individual users for installing/servicing their own installations.

PEP will provide further coaching and training to the VT through its franchised service agent,

both on technical-operational matters, as well as on business skills for operating the enterprise of

VT. This includes the skills to explore how the available electricity can be increased and benefit as many households as possible (issues of equity in the village).

#### Ownerships

When the system becomes operational, ownership is as follows:

The households own and operate their house-systems

Village enterprises own and operate their small-enterprise systems

The village owns and operates all the fixed assets of the system, ie:

- Dams, intakes, channels
- Housing for the hydro-electric power plant
- Fixed structures for solar generators, etc.
- Village grid

The PEP owns and operates all the rest that could be theoretically dismantled and moved, ie:

- Penstock
- Turbines and generators
- Meters to the village grid
- Solar panels
- Inverters
- Batteries and chargers

#### Reasoning for this split in ownership:

- The unmovable constructions and the grid become a public infrastructure asset of the village. This allows the village to negotiate good deals with the energy providers who want to produce and sell the energy to them. In case an energy provider defaults, the village can easily switch to a new one and does not have to wait for complicated negotiations on ownership transfer of the infrastructures (in case the infrastructure is owned by a defaulting energy provider, it would lie idle until the ownership is renegotiated).
- The movable items become a feasible investment for private investors, as they no longer have to worry about investing in infrastructures over which they will have little control. The movable assets are easier for banks to accept as collateral. Private investments are not tied up in unmovable assets.
- This allows a market to emerge. Villagers can decide to switch to another PEP if they are not satisfied. A PEP can also decide to stop servicing a village if problems with payment discipline arise. The old PEP can move its assets elsewhere, or negotiate their sale to the new PEP. The village can also negotiate a new deal with a new PEP.

This split in ownership allows for win-win options for all concerned in any conceivable situation. Furthermore public investments into the fixed infrastructures leverages private investments, and vice versa.

#### Who pays for what when the grid operates?

Households fund their house installations. They may get credits or grants from public sources if they are too poor to afford them, and if they are eligible for public support.

Village enterprises fund their installations for operating their equipment (rice mills, dryers, pumps, coolers, food-processing, communications, etc..).

The village pays for the installations in its public uses, i.e. schools, health posts, temples, etc..

The village pays for its fixed infrastructures. It also pays for the required trainings for the Village Energy Committee. It may get public financial support for being able to afford the package offered by the PEP (i.e. building/installing the fixed infrastructures, and the trainings).

The Village Technician pays for his training. He may be financially supported by the village in order to make him accountable to the Village Energy Committee.

The PEP pays for its movable assets. The PEP may get loans and equity from private funding agencies.

Public-private cooperation for investing in hybrid village grids:

Public sources can provide:

- Funds for the village to achieve viable village infrastructures for energy production and distribution.
- Funds for the village for the required trainings and coaching to be able to efficiently manage its fixed infrastructural assets and operate its grid.

Private sources can provide:

- Funds for the PEP to finance the power generation.
- Funds for building the competence and capacity of the PEP to operate the power generation at top reliability.

Operations and financial flows

The PEP operates the power generation.

- It hires/contracts the Village Technician for operating the power generating assets.
- It sells electricity to the village at the points where the power generators feed into the village grid.

The Village Energy Committee operates the fixed infrastructures and the village grid

- The VEC buys electricity from the PEP, and...
- ...sells it to the households at the household meters.
- The VEC hires/contracts the Village Technician for servicing the village grid and the infrastructures

The households operate their systems.

- They buy electricity from the VEC
- They pay the Village Technician for servicing their household systems.

Public concern on the environment:

A stream or river is a natural asset that the public must take care of. Whoever uses it, be it public or private, must divert some of the profit of using the water to allow the public to protect and increase this natural resource, for instance watershed management, catchment protection, ensure residual water in the stream for the fish-migrations, etc. Water rights are therefore sold by the respective public entities to take care of this environmental public concern.

Therefore:

The VEC will divert some amount of its margin for measures to protect the water resources in the catchment area of the tapped streams.

Contractual arrangements

1. Village with PEP
2. PEP with private funding sources
3. Village with public funding sources
4. Between public and private funding sources for coordination
5. Village with public owners of the water source ("water rights". In Laos this may be the village itself).

Concrete pilot case:

- Village = Nam Ka
- PEP = Sunlabob. Sunlabob partners with Entec for the engineering and building of the hydro systems, with SMA for establishing the grid connections, and with RWE for the solar components.

- Public funding sources = KfW?, ...
- Private funding sources = Triodos?.

**Next steps:**

2005-06: Sunlabob will initiate and operate the pilot effort with interested partners.

2006: Establish the contractual, institutional, operational, and financial conditions for sustainability and commercial viability

2006-07: Formulate and establish an investment program for hybrid village grids for SE-Asia.