

## PROJECT BACKGROUND

In Cambodia today, less than 10 percent of rural households are connected to electricity grids. Most rural villages utilize various energy sources for lighting and cooking including, oil lamps, candles, charcoal, wood, rice husk and batteries (charged by diesel generator sets). Where available, electricity services in rural areas are supplied by Rural Electricity Enterprises (REEs). These enterprises are operated by local entrepreneurs using diesel generator sets that distribute electricity through stand-alone grids that the REE owner has constructed from available materials. Households not connected to local electricity grids have either no access to electricity services or must use batteries to power fluorescent lights, radios or TVs. Lighting for households without batteries is limited to kerosene lamps and candles. The REEs are severely limited in their ability to expand services to more distant villages due to lack of capital.



System inefficiencies and the high fuel costs of imported diesel oil result in electricity rates in rural villages that are among the highest in South-East Asia, ranging from \$0.40 to \$0.95 per kilowatt hour. The high electricity rates are a major obstacle to developing local businesses, that can compete with those in urban areas. Reducing the cost of fuel and dependency on imported fossil fuels will be critical to improving the economic status of rural residents. Presently chronic poverty, uncompetitive rural enterprises, and slow economic growth continue due to:

- poor quality high cost electricity service;
- economic leakage due to importation of expensive fossil fuels;
- dependency of communities on central authorities for electricity service.

Fortunately, there is an alternative solution to this problem. Renewable energy technologies and off-line community-owned power grids are viable alternatives. Systems using technologies that transform locally

available biomass into cheap electrical energy have been developed and perfected over the last thirty years and are now used widely in India, China Vietnam, Uganda, Mozambique, Brazil and many other countries. These technologies can supply reliable and affordable electricity for household consumption, local industry needs and other public and private services at prices that are competitive with non-subsidized conventional fossil fuel based grids with captive generation systems.

## PROJECT IDEA

In March 2004, SME Cambodia, with financial support from the Canada Fund and US-AID, implemented a pilot-project to test 100% biomass gasification technology managed by a community energy cooperative. The idea of the project is to:

1. introduce and demonstrate the member-owned – electricity-utility model to rural Cambodia;
2. introduce biomass gasification, an alternative renewable energy technology, that can supply electricity to village households at rates that are 50% below the rates currently charged in surrounding rural villages using diesel generation systems;
3. demonstrate the feasibility of creating community energy reserves (tree farms), that:
  - provide a locally grown renewable fuel source that substitutes for the environmentally damaging, economy draining imported fossil fuels, and
  - reduce fuel wood cutting pressure on local natural forests.

## **Village Energy Cooperative Model**

The village of Anlong Tamey, in Bannan District, Battambang Province was selected for pilot project implementation. This village is comprised of over 130 households and did not have an electricity supply system. A community based energy cooperative, registered at the Ministry of Interior, was formed to own, operate,



maintain and manage the electricity generation and distribution system. The initial cost of equipment required for setting up a biomass gasification, electricity generation and distribution system pilot was covered by a grant provided by the Canada Fund. After completing the initial preparation, construction and operational testing period the Community Energy Cooperative will provide electricity services to 70 households on a non-subsidized, sustainable basis.

### Biomass Gasification Technology

Biomass gasification technology, developed and



widely used in India, and other developing countries in Asia has proven to be a reliable and efficient alternative to technologies dependent on increasingly expensive fossil fuels. Biomass gasifiers using wood fuel are easy to operate and maintain, and can power a modified engine to run on 100% producer gas, eliminating the need for expensive, imported fossil fuel. The energy content of 1 liter of diesel (current price US\$ 0.60) is equivalent to 4 kg of wood (current price US\$ 0.08-0.10).



SME Cambodia staff supervised cooperative members during installation of a 9 kWe biomass gasification, electricity generation system and construction of a 1 kilometer long electricity distribution system serving 70 cooperative members.

### Tree Plantation - "Community Energy Reserve"

The biomass gasification system operates on 100% locally farmed trees. No diesel fuel is required. Fast growing, tropical legume trees (*Leucaena*) are planted, harvested and sold by local farmers to provide biomass fuel for the gasifier. Harvesting the branches ("coppicing") of the trees takes place every 4-6 months. Leaves from the harvested branches are used as fertilizer, for livestock feed or sold in local markets as animal feed. The generation system was commissioned and began services during January-February 2005. In April 2005, the Community Energy Cooperative received a 5 year operating license from the Electricity Authority of Cambodia.



Customers are charged on a per kWh rate, based on metered individual customer consumption. Rates charged for the electricity consumed are established such that all system operation and maintenance expenditures plus equipment replacement ("depreciation") costs are included. The tariff of \$0.30 per kWh is 1/2 to 1/3 of the tariffs currently charged in nearby rural communities, and similar to the rate charged by the government owned electricity provider in the provincial capital (\$0.25 per kWh).

### PROJECT OBJECTIVES

- Increased farmer income through growing and selling fuel wood to the community energy cooperative and selling leaf material to the animal feed markets;
- Increased employment and income generation through creation of new commercially productive activities utilizing the low cost electricity;
- Improved quality of life of rural residents through household electrification;
- Establishment of tree plantations or "energy reserves" sufficient to provide the wood biomass fuel required to power the village electricity system;
- Improved village security through outdoor lighting of public pathways, roads and commercial areas.

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