Performance and Sustainability of A Solar Home System Program in Thailand

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ABSTRACT

This paper concerns with planning, procurement, installation, monitoring and evaluation of 98 Solar Home Systems under the PEA's pilot project on renewable energy rural electrification. In the planning stage, emphasizes have been given to technical specifications, organization and management model designs aiming to ensure the sustainability of the program.

Participatory approach has been employed in the management and organization model design. In-cash and in-kind contributions from the villagers, village revolving fund and village committee are mechanisms employed to realize the participatory approach.

The paper also reports technical performance of installed systems and assessments of socio-economic benefit and sustainability of the program after six months of monitoring. Factors influencing program's success and failure are identified and discussed.

1. Introduction

Two villages in Chiang Mai, Northern Thailand, have been selected for installation of Solar Home Systems under the PEA’s program aiming at implementing a sustainable renewable energy system for remote village [1]. In this program, there are 2 types of SHS employed; TYPE 1 consists of one 75 W PV modules and one 100 AH, 12 V battery storage suitable for powering two 10 Watt fluorescent lamps (FL) for 4 hours per day. TYPE 2 consists of two PV modules and one 132 AH, 12 V battery storage for powering two 10 Watt FLs and 14 inch television for 4 hours per day.

There were 36 (from 42 households) participants in the first village, Baan Mae Ki Mook. And 63 (from 97 households) participants in Baan Tung Ton Ngew. The ratios between TYPE 1 and TYPE 2 systems installed were 24:12 and 50:12 respectively.

Each household was invited to participate in the program on voluntary basis. Basically, each participant was required to contribute about 10 % of the investment cost and about 50 Baht and 100 (TYPE 2) Baht monthly fee. The payments have been put into a revolving fund as will be described later.

2. Planning, Procurement and Installation

Under this program the target groups are very poor villagers in remote villages which are also illiterate. However, it is the program ultimate goal to be sustainable. In other words, the SHS has to be fully utilized and eventually the revolving fund shall become self-reliance. Hence the program has been carefully planned to ensure that the community gets involved at the very early stage. Village administrative committee has been set up and trained to manage the revolving fund designed to cater for battery replacement costs, expected to occur every 2 - 3 years, which is an important factor for sustainable program.

On technical issues concerned with the SHS, Chiang Mai university had assisted in specifications, procurement procedures and supervision of the installations which were carried out by a selected contractor. In addition provisions had been made on technical training for local technicians, maintenance training for users, user manuals, spare parts, local electric appliance shop and major component warranties. Above mentioned measures were designed with the ultimate goal of sustainable program in mind.

3. Performance Monitoring and Evaluation

Chiang Mai university is responsible for the system technical performance monitoring as well as the managerial performance of the revolving fund. Regular visits to the villages were carried out when road accesses permitted. Technical performance has been monitored with assistance from the local technician. The battery voltage of each household was measured and reported to CMU every month, together with reports on troubles occurred, if any. The technician has also been very
helpful in fixing many minor problems occurred during the first few weeks after the installation completion.

Key parameters monitored to evaluate technical performance are battery voltage measurements by well-trained local technician, battery maintenance by user, cleaning and shading of PV module by user and system troubles report by the technician. Battery measurements in the evening and in the next morning are taken once a month for each household. The voltage difference is an indicator of energy usage of each household. And the battery voltage measured in the morning, if too low, indicates the battery has been over discharged over the night.

Key parameters monitored to evaluate the managerial performance of the revolving fund are number of users unable to pay monthly fee, practices in accounting, billing and saving bank account handling, committee monthly meeting, committee and user monthly meeting.

In socio-economic evaluation, questionnaires regarding changes, due to the SHS, in household income, medical expense, energy expense and social lifestyle. In addition satisfactions of users with the SHS and the management model are also evaluated.

4. Monitoring Results

Figure 1 shows results of battery voltage monitoring at Baan Tung Ton Ngew. It can be seen that in rainy season (June – October) PV output can be insufficient.

Table 1 summarizes technical problems occurred in the two villages and trouble shootings as reported by the local technicians.

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<tr>
<th>Problem</th>
<th>Description and remedy</th>
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<td>1. Low light for weaving</td>
<td>1. Villagers work on hand weaving at night found that lighting intensity is too low. The technician had lowered the lamp.</td>
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<tr>
<td>2. Low sunlight in rainy season</td>
<td>2. Energy saving encouraged, introducing 1 and 3 W lightings</td>
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<tr>
<td>3. Connection of 6 V battery to system battery</td>
<td>3. Keep users informed of possible damage to the user battery</td>
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From more than six months of monitoring, several managerial problems had occurred at Baan Tung Ton Ngew but not at Baan Mae Ki Muk. The prominent problems are as follows.

- Large number of users unable to pay monthly fee as they have no income in that month
- In rainy months, use of electricity is limited. Users reluctant to pay monthly fee
- No practices of billing, accounting and maintaining bank account

In socio-economic aspects, it has been found that the SHS helps reducing the household energy expense and is more convenient to use. Users with young children confirmed that the children are healthier. As a consequence, the medical expense is reduced. Moreover, users at Baan Mae Ki Mook are able to increase their household incomes by extending working hours on weaving into the night. For the above mentioned reasons, users are highly satisfied with SHS. However, there are some negative impacts of the SHS. For example, a wealthy user at Baan Tung Ton Ngew, who can afford a video and compact disc (CD) player, has set up a mini theater collecting admission fees from viewers. And children have been exposed to obscene movies.

5. Conclusions

Sustainable SHS has been achieved in Baan Mae Ki Muk, for at least 12 months after installation, but less likely so at Baan Tung Ton Ngew. Analysis of influencing factors taking into considerations geography, culture, economy and social conditions has been carried out. It was found that capable community leader play essential role in good managerial. When electricity can provide means to increase household income, it is also more sustainable. And finally it is equally important that meeting the need of users (e.g. use of 6 V battery for portable torch and/or alternative renewable resource during rainy season i.e. micro hydro) can contribute to customer satisfaction and hence sustainable program.

REFERENCES