




EIE-06-256 REEPRO

Intelligent Energy  Europe

# **Promotion of the Efficient Use of Renewable Energies in Developing Countries**

**REEPRO Level 1 Course 2**

**Training on Solar Home System Installation, Operation and Maintenance**

**Kampong Thom, Cambodia, June 21st-22nd**

**Cambodian Education and Waste Management Organisation (COMPED)**

**June 2008**



## List of Content

1	Summary Sheet .....	1
2	Solar Home System Training .....	2
2.1	Background and Objectives .....	2
2.2	Workshop Methodology .....	2
2.3	Participants .....	4
2.4	Activities .....	6
2.4.1	Solar Home System Installation .....	6
2.4.2	Design and Installation .....	9
2.5	Outcome of Workshop .....	10
2.6	Evaluation and Comments .....	11

## List of Table

Table 1:	Schedule and content of the workshop .....	3
Table 2:	List of participants .....	4

## List of Figure

Figure 1:	Explanation of SHS installation .....	7
Figure 2:	Working on board of SHS .....	7
Figure 3:	Solar Home System Board Installation .....	8
Figure 4:	PV module transportation .....	8
Figure 5:	PV module stand installation .....	9
Figure 6:	House survey activities-Roof condition check .....	10



## 1 Summary Sheet

- Event:** Level 1 course Course 2 on SHS Installation and Operation and Maintenance at the Orphanage Kampong Thom
- Task number** 3.04.02
- Date, Location, Time:**
- SHS Installation Training: 21<sup>st</sup>-22<sup>nd</sup> June 2008 for full day
- Theme:**
- Introduction of procedure of the solar home system installation,
  - Explanation of house survey for project design and Installation.
  - Distribution of handout and manual to the participants
  - Practical of the project design and calculation.
  - 4 Solar Home Systems' Installation
  - Background of PV energy produced from sun light
  - Review of PV system connection and installation
  - General guideline for sustainable and safety use of the PV system
- Target group:**
- Level 1
  - Level 2
  - Level 3
- Performance:**
- Installation: Participants were divided into four groups:
    - On the first day, Group I and Group II worked on SHS installation for House 1 and 2 as mentioned in the schedule below and worked on house survey (data collection regarding location, energy consumption, electricity installation, energy price).
    - On the second day, Group III and Group IV worked on SHS installation for house 3 and House 4 and House survey (data collection regarding location, energy consumption, electricity installation, energy price).
  - Operation and Maintenance
    - 2-hour theory trained by Dr. Phol Norith and Mr. Chau Kim Heng and followed by 2 hours of practical work in practise of operation and maintenance at the Orphanage Kampong Thom
- Participants:**
- 26 participants attended for the training

**Success:** Mr. Chau Kim Heng, COMPED opened the speech and opened the floor to Kamworks and ITC to explain about SHS installation and House Survey working tasks. All participants were divided into 4 groups in order to be able to have practical work for the SHS installation for four houses at the Orphanage and also did house survey for PV application. Finally all the four systems were successfully installed under the supervision of Kamworks, ITC and German Speaking Catholic Community.

Moreover, the participants have also learned about SHS operation and maintenance. Director of COMPED **Mr. Chau Kim Heng** explained about solar energy background comparing the system to the tank retaining raining water. **Dr. Phol Norith**, Dean of the Electrical and Energy Department at ITC gave a presentation on PV System Maintenance. It was following by practical exercise that COMPED together with **Mr. Sok Sarin** from Kamworks

Phnom Penh, May 05, 2009



## 2 Solar Home System Training

### 2.1 Background and Objectives

REEPRO Practical Training Workshop was held on 21<sup>st</sup>-22<sup>nd</sup> July, 2008 at Kampong Thom Orphanage, Kampong Thom province, Cambodia.

The workshop was the result of the cooperation between REEPRO and Kampong Thom Orphanage under the support from German Embassy and German Speaking Catholic Community in Singapore to set the Orphanage as a Pilot Community of REEPRO the project. The workshop is to install Solar Home System for four houses, which one house is supplied by 4 PV modules, and survey for project design and calculation.

### 2.2 Workshop Methodology

- Introduction of procedure of the solar home system installation,
- Explanation of house survey for project design and Installation.
- Distribution of handout and manual to the participants
- Practical of the project design and calculation.
- Explanation during the operational installation step by step by Mr. Arjen from KAMWORKS.

- Videos were made for the installation of SHS activities as movie documentation.

The participants was divided in four groups and able to do all the practical works.

**Table 1: Schedule and content of the workshop**  
**Day 1: June 21st , 2008 – REEPRO- Orphanage Kampong Thom- Pilot Community**

Time	Group 1 (7 participants)	Group 2 (7 participants)	Group 3 (7 participants)	Group 4 ( 7 participants)
8:00-9:00	<b>Introduction</b> <ul style="list-style-type: none"> <li>• Instruction for installation of PV system <i>by Mr. Arjen, Kamworks</i></li> <li>• Introduction of site survey of the house (data collection regarding location, energy consumption, electricity installation, energy price) <i>by Dr. Kai, DGS</i></li> <li>• Design of a PV system for the house (dimensioning, cost estimation and cost/benefit analysis) <i>by Mr. Bun Long</i></li> <li>• Formation of 4 groups for the training and manual development of PV system for a house including site survey results, PV system design, installation, operation and maintenance <i>by Dr. Kai, Mr. Heng and Mr. Sean Chea</i></li> </ul>			
9:00-12:00	<b>Solar panel installation, battery installation and connection for House 1</b>  <i>Arjen, Kamworks</i>	<b>Working on the roof for PV module installation House 1</b>  <i>Kamworks, and German speaking catholic community</i>	<b>House survey (data collection regarding location, energy consumption, electricity installation, energy price)</b>  <i>Dr. Kai, DGS</i>	<b>Design of a PV system for the house (dimensioning, cost estimation and cost/benefit analysis)</b>  <i>Mr. Bun Long, ITC</i>
12:00-13:30	<b>Lunch break at the Orphanage</b>			
13:30-17:00	<b>Working on the roof for PV module installation House 2</b>  <i>Kamworks, and German speaking catholic community</i>	<b>Solar panel installation, battery installation and connection for House 2</b>  <i>Arjen, Kamworks</i>	<b>Design of a PV system for the house (dimensioning, cost estimation and cost/benefit analysis)</b>  <i>Mr. Bun Long, ITC</i>	<b>House survey (data collection regarding location, energy consumption, electricity installation, energy price)</b>  <i>Dr. Kai, DGS</i>

**Day 2: June 22nd , 2008 – REEPRO- Orphanage Kampong Thom- Pilot Community**

Time	Group 3 (7 participants)	Group 4 (7 participants)	Group 1 (7 participants)	Group 2 (7 participants)
------	--------------------------	--------------------------	--------------------------	--------------------------

8:00-12:00	<b>Solar panel installation, battery installation and connection for House 3</b>  <i>Arjen, Kamworks</i>	<b>Working on the roof for PV module installation House 3</b>  <i>Kamworks, and German speaking catholic community</i>	<b>House survey (data collection regarding location, energy consumption, electricity installation, energy price)</b>  <i>Dr. Kai, DGS</i>	<b>Design of a PV system for the house (dimensioning, cost estimation and cost/benefit analysis)</b>  <i>Mr. Bun Long, ITC</i>
12:00-13:30	<b>Lunch break at the Orphanage</b>			
1:30-16:00	<b>Working on the roof for PV module installation House 4</b>  <i>Kamworks, and German speaking catholic community</i>	<b>Solar panel installation, battery installation and connection for House 4</b>  <i>Arjen, Kamworks</i>	<b>Design of a PV system for the house (dimensioning, cost estimation and cost/benefit analysis)</b>  <i>Mr. Bun Long, ITC</i>	<b>House survey (data collection regarding location, energy consumption, electricity installation, energy price)</b>  <i>Dr. Kai, DGS</i>

### 2.3 Participants

The participants comprised of 09 TOT participants; 5 participants from COMPED and 3 from ITC; and 10 advanced students from the Orphanage. All participants were working under thorough supervision of KAMWORKS, ITC, DGS, German Speaking Catholic Community and COMPED.

Below is the list of participants.

**Table 2: List of participants**

1. Dr. Jan Kai Dobelmann	DGS
2. Mr. Chau Kim Heng	Facilitator of the TOT Practical Training workshop, Director COMPED
3. Mr. Bun Long	Trainer, ITC
4. Mr. Thomas	German Speaking Catholic Community
5. Mr. Heim Peter	German Speaking Catholic Community
6. Mr. Valter	German Speaking Catholic Community
7. Mr. Sean Chea	Orphanage Kampong Thom
8. Mr. Sok Sarin	Trainer, Kamworks
9. Mr. Arjen	Trainer, Kamworks
10. Mr. Uch Rithy	Organiser and reporter. Project officer COMPED
11. Mr. Than Sokun	Participant, COMPED

12. Mr. Lay Meng Hort	Participant,
13. Mr. Chrun Rithy	Participant,
14. Mr. Bun Pheng	Participant,
15. Mr. Kim Pisey	Participant,
16. Mr. Hun Bunroeun	Participant,
17. Ms. Sean Simalay	Participant,
18. Mr. Phin Ramine	Participant,
19. Mr. Heng Kim	Participant,
20. Mr. Sam Phalla	Fascilitator
21. Ms. Dorn Davy	Participant
22. Mr. Prak Norith	Fascilitator
23. Mr. Chrin Phork	Fascilitator
24. 10 students from the Orphanage	Participant

**Trainees Grouping:**

<b>Group I</b>	<b>Group II</b>	<b>Group III</b>	<b>Group IV</b>
<ul style="list-style-type: none"> <li>• Bun Peng</li> <li>• Heng Kim</li> <li>• Chrun Rithy</li> <li>• Than Sokun</li> <li>• Uch Rithy</li> <li>• Seng Veng Then</li> <li>• Cheung Sophorn</li> <li>• Phin Ratha</li> <li>• Sot Tang Ly</li> </ul>	<ul style="list-style-type: none"> <li>• Sok Sarin</li> <li>• Leng Chorn</li> <li>• Heng Phanith</li> <li>• Soeun Sann</li> <li>• Seng Salen</li> <li>• Yem Chan Tha</li> </ul>	<ul style="list-style-type: none"> <li>• Sean Simalay</li> <li>• Lay Meng Hort</li> <li>• Saroem Serey Roth</li> <li>• Hun Dalen</li> <li>• Sean Tay Long</li> <li>• Hieng Horn</li> <li>• Orn Sam Art</li> </ul>	<ul style="list-style-type: none"> <li>• Dorn Davy</li> <li>• Phin Ramine</li> <li>• Hun Bun-roeun</li> <li>• Chhom Van Chhuon</li> <li>• Poeung Sophan</li> <li>• Chhun Ran</li> </ul>

**2.4 Activities**

**2.4.1 Solar Home System Installation**

- Mr. Arjen, KAMWORKS explained the theory and drawing the connection of cable from PV module to SHS board and other background information before practical work of the installation.
- Mr. Kim Heng translated into Khmer about the process, which had explained by Mr. Arjen.
- On the first day, Group I and Group II worked on SHS installation for House 1 and 2 as mentioned in the schedule.
- On the second day, Group III and Group IV worked on SHS installation for House 3 and House 4.
- After the installation of the SHS board components, overall explanation of the system function was given to participants by Mr. Arjen.



**Figure 1: Explanation of SHS installation**



**Figure 2: Working on board of SHS**

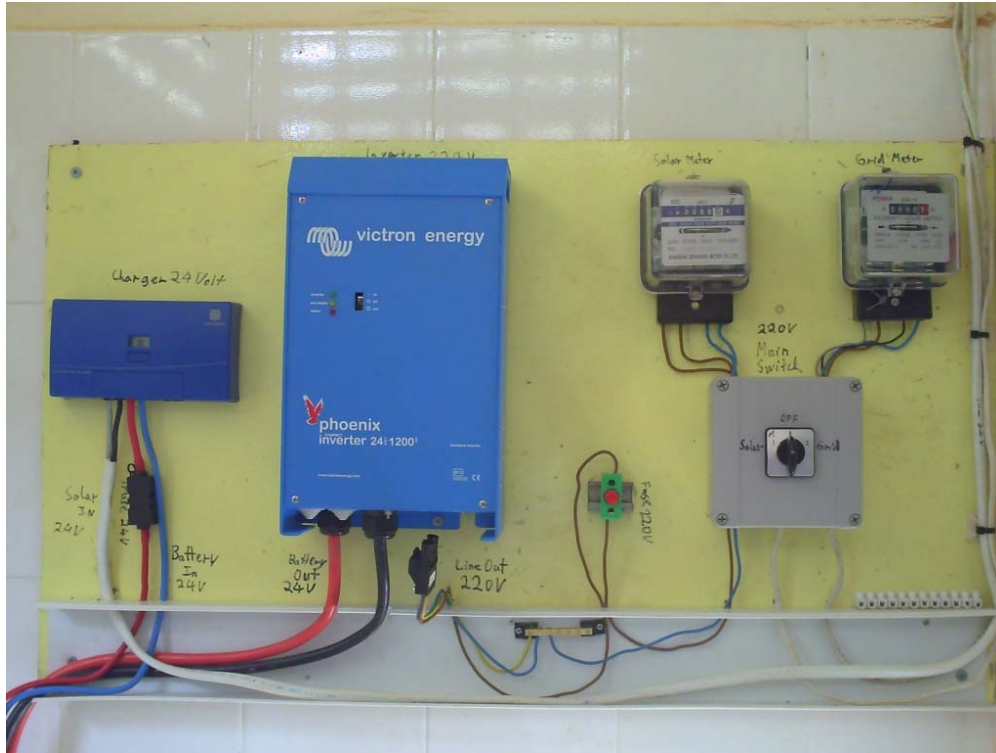


Figure 3: Solar Home System Board Installation



Figure 4: PV module transportation



**Figure 5: PV module stand installation**

#### **2.4.2 Design and Installation**

- Dr. Kai introduced DGS (Germany) and its activities. Project design and survey were also explained by Mr. Bun Long, ITC.
- After providing detail information to the participants, they started working on individual task according to the group
- The checklist for design and installation was provided, explained and translated to the trainees
- Day 1, participants of Group III and IV worked on House Survey for design and installation, which was also the same work for Group I and II on the second day.



**Figure 6: House survey activities-Roof condition check**

## 2.5 Outcome of Workshop

- All participants were explained about the main objectives of activities to be fulfilled:
  - Installation of Solar Home System (by Arjen, KAMWORKS)
  - Design and installation survey (by Bun Long, ITC and Dr. Kai, DGS)
- All participants have learned the theory of site survey for design and installation
  - Site Survey
    - General information collection
      1. Village data
      2. Contact person
      3. Infrastructure and accessibility
      4. Market and supplies, nearest market (domestic supplies)
      5. Employment and sources of income
    - Relevant data for PV plant installation
      1. Household parameters
      2. House structure
      3. Shading analysis
      4. Accessibility of the roof
    - Energy related data

1. Utility and grid connection
  2. Estimate daily energy demand to be served with the PV system
- PV Plant Operation
    1. Ownership and management
    2. Local support and willingness to pay
    3. Type of proposed installations
- All participants have leaned in the joint installation of a solar home system in basic theory and the practical installation.
    - PV module stand installation
    - PV module connection
    - Cable connection of PV module
    - Connection of charge controller
    - Connection of Inverter
    - Connection of public electricity supply
    - Connection of battery
    - Connection of fusible
    - Connection of electric applicants' cable
    - Light stick connection
  - However, only group assignments of House Survey were provided by participants. But the operational manuals was not provided as it seemed to be hard for participants to develop.

## 2.6 Evaluation and Comments

- Due to the time for the installation of SHS for the Orphanage Kampong Thom was not convenient for TOT participants, there were less participants attending the training.
- According to some constraint such as roof condition of one was not convenient for the installation of PV module stand, the installation of one house consumed much more than expected. It had to install on the room of a bathroom of the house and the time was spent on drilling of roof's wooden beam (too thick) and the location of the roof was not easy to the PV module installation work.
- Two PV stands for 2 houses were installed on a balcony of a main building. One stand set on bathroom roof and the other one on the kitchen roof (which was decided shortly after finding out that the planned location for the PV stand was not possible).
- The course is very advantageous to participants to apply theoretical knowledge in practical work.
- Participants obtain knowledge of house survey and design for SHS.
- Participants have chance to practice SHS installation including PV module connection, and SHS component assembling on board.

- No SHS batteries were available for the system instead of using car batteries for a house to show its functioning.
- House survey assignments were completed but not operational manual because it is difficult in drawing of the system. Moreover, most of participants were students of the Orphanage and they are lacking of English knowledge for communication and understand well the concept of the installation.

02. July 2008

Reported by Mr. Uch Rithy

COMPED Project officer