



EIE-06-256 REEPRO



Promotion of the Efficient Use of Renewable Energies in Developing Countries

Training equipment data sheet

Data sheet No.: 7

Authors

Antje Klauß-Vorreiter, DGS
Phok Chrin, ITC

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Type of Equipment: (tick off the type)	PV	Solar Thermal	Biomass to Energy	
	✓			
Name:	4 Solar Home Systemes at Kampong Thom Orphanage			
Location of the equipment:	Kampong Thom Provincial Town, Ackarleak Commune, Stung Sen District, Kampong Thom Province			
Year of purchasing:	2008			
Operator: (Name and address)	Director Sean Cheah, Kampong Thom Orphanage			
Planner: (Name and address)	ITC, Pochentong Blvd, Toul kok district, Phnom Penh COMPED, Dangkor district, Phnom Penh			
Detailed description of the installation: (technology, function, benefit for training, etc. max 150 words)	<p>At the Kampong Thom Orphanage Centre 4 Solar Home Systems (SHS) has been constructed in June 2008. One solar generator got a peak power of 0.7 kWp and can produce up to 2,000 Wh in daily average. Every of those SHS consist of 4 Sharp 24V 175Wp solar panel, 1 Victron Inverter C 24/1200, 12 Battery OPzV 420Ah/2V, 1 Charge controller Phocos CX40 12/24V, cables etc.</p> <p>Solar modules are very important to support trainings level 1 to 3 done at the Orphanage. They're used for practical training on installation, operation and maintenance. Beside this the 4 SHS serve different houses at the Orphanage and provide electricity for light in the evening hours, e.g. for evening class, or to run tv and fan.</p>			
Generated Energy service: (tick off the energy type)	electricity	heat	gas	light
	✓			
Power output of installation: (kWel, m³ biogas, kW th, etc.)	average 53 kWh per system and month 4x53kWhh = 212 kWh			
Financing* (tick off the financing type)	private investment	loan	donation	grant
			✓	
Investment costs in US\$*	42.850			
Maintanance costs in US\$*	N/A			
Savings US\$ per month	140			
Energy sale income in US\$*	0,00			
Comments	The system does not reach the estimated 66 kWh per system and month during first 8 months of operation. The performance will be evaluated and improved.			



Installation on the office roof



Installation of inverter and charge controller



Maintenance-free batteries



Batteries inside box and solar board above



Moved panel from its first position to a shadow-free location



Output of solar system

Possible practical exercises with the Solar Home System

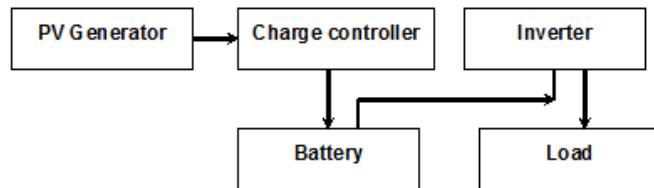
Level 1 – Solar Home System

1. Purpose of this exercise

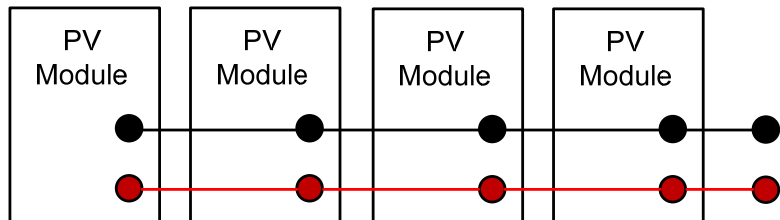
Main objective is to provide knowledge how the system work, design system capacity and provide the skills in practical work of SHS, connection of PV module in parallel/series, Batteries connection, Charge controller, cable connection, Inverter and load (Lamp).

2. Performance

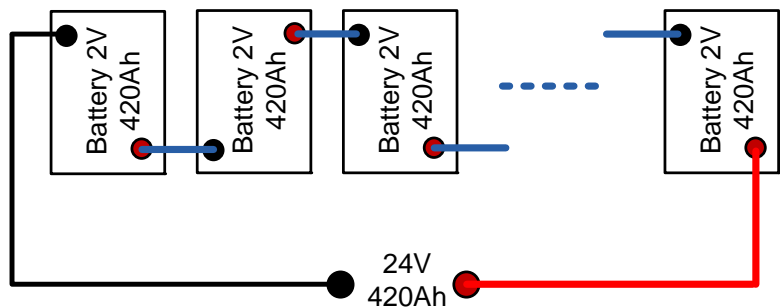
Block diagram of SHS is very important to student and it will be use for training (case study), and then let the student to connect the circuit according to diagram.



Install SHS system according to its block diagram

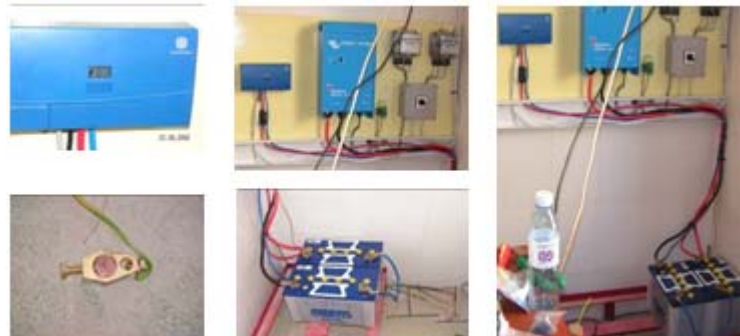





PV module in parallel connection




12 batteries in series connection

3. Results



Level 2 und Level 3– Operation and maintenance	
1. Purpose of this exercise	Provide knowledge on how to maintenance SHS in order to keep the system work properly, Energy output, and trouble-shooting
2. Maintenance	<ul style="list-style-type: none"> • PV panel (connection box) • Wires/Cable • Controllers • Inverters • Electric Appliance • Batteries
3. Troubleshooting and System Maintenance at the centre	<p>PV Module, Battery connection problem, System short circuit,</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p>Lamp</p> </div> <div style="text-align: center;">  <p>Broken fuse batteries do not charge</p> </div> </div> <div style="text-align: center; margin-top: 20px;">  <p>Cleaning PV Module every 6 months</p> </div>

<p>4. Performance</p> <p>Student need to list down the energy consumption from solar PV every month so that they can know how much the energy that they can get from SHS. If there is something change with energy usage; i.e if energy consumption is going down then they will find out what happen to the system.</p>	<p style="text-align: center;">Consumption energy from Solar Home System</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Month</th> <th>SHS 1 [kWh]</th> <th>SHS 2 [kWh]</th> <th>SHS 3 [kWh]</th> <th>SHS 4 [kWh]</th> <th>Total energy [kWh]</th> <th>Cost [USD]</th> </tr> </thead> <tbody> <tr><td>July</td><td>41.6</td><td>35.9</td><td>76.7</td><td>77.5</td><td>231.7</td><td>150.605</td></tr> <tr><td>August</td><td>49.8</td><td>52</td><td>65.4</td><td>63.1</td><td>230.3</td><td>149.695</td></tr> <tr><td>September</td><td>38.4</td><td>49.9</td><td>47.5</td><td>58.1</td><td>193.9</td><td>126.035</td></tr> <tr><td>October</td><td>23.8</td><td>58</td><td>58.2</td><td>66.4</td><td>206.4</td><td>134.16</td></tr> <tr><td>November</td><td>50.6</td><td>50.6</td><td>57</td><td>61.3</td><td>219.5</td><td>142.675</td></tr> <tr><td>December</td><td>38.1</td><td>62.4</td><td>50.4</td><td>61.6</td><td>212.5</td><td>138.125</td></tr> <tr><td>January</td><td>39.3</td><td>63.9</td><td>50.9</td><td>55.8</td><td>209.9</td><td>136.435</td></tr> <tr><td>February</td><td>39.3</td><td>58.5</td><td>39.7</td><td>60.2</td><td>197.7</td><td>128.505</td></tr> <tr><td>March</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>April</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>Total</td><td></td><td></td><td></td><td></td><td>1701.9</td><td>1106.235</td></tr> </tbody> </table>	Month	SHS 1 [kWh]	SHS 2 [kWh]	SHS 3 [kWh]	SHS 4 [kWh]	Total energy [kWh]	Cost [USD]	July	41.6	35.9	76.7	77.5	231.7	150.605	August	49.8	52	65.4	63.1	230.3	149.695	September	38.4	49.9	47.5	58.1	193.9	126.035	October	23.8	58	58.2	66.4	206.4	134.16	November	50.6	50.6	57	61.3	219.5	142.675	December	38.1	62.4	50.4	61.6	212.5	138.125	January	39.3	63.9	50.9	55.8	209.9	136.435	February	39.3	58.5	39.7	60.2	197.7	128.505	March							April							Total					1701.9	1106.235
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<p>5. Results</p> <p>The output energy is shown on the watt meter for every SHS</p>	<div style="text-align: center;">  <p>Obtain Maximum Output</p> </div>																																																																																				