



Off-grid power supply



## Rural Electrification

Renewable energy technologies for rural areas:

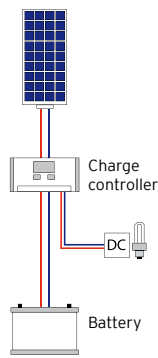
In remote areas far from the public grid, renewable energy power applications are often the lowest-cost option for a basic supply of electrical power.

A huge increase in the electricity demand in developing countries is expected in the near future. Renewable energy systems represent a sustainable solution to satisfy this demand. So called off-grid applications provide households and villages with lighting and communication, power water pumps, and refrigerate medical supplies.

Several German solar companies and institutions offer their broad range of solutions to ensure the technical and socio-economical sustainability of rural electrification programs. The members of BSW-Solar offer quality „made in Germany“; their products and services ensure the longest possible life time for solar modules, electronics, batteries or complete systems.

This brochure offers information about different off-grid applications based on photovoltaics.

Image:  
Village electrification system in Mongolia  
(© SMA Solar Technology AG)



## Technical Applications for Rural Electrification:

### Solar Home Systems (SHS)

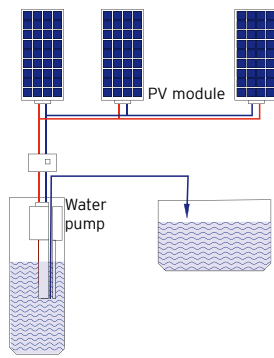
A solar home system includes a solar panel, a charge controller, a lead-acid battery and several lights. It typically operates at a rated voltage of 12 V DC and provides power for lights, radio/cassette players, a small TV or similar low power appliances for about three to five hours a day.

- More than one million SHS have been installed worldwide as of 2008.
- SHS fulfil the basic electricity needs such as lighting, radio and TV or mobile phone chargers .
- SHS reduces greenhouse gas emissions by replacing conventional energy resources (kerosene, paraffin candles, gasoline, dry cell batteries).
- Users enjoy improved health as a result of reduced exposure to indoor air pollution from traditional kerosene lamps.
- SHS provide lighting for home study or evening classes, or working after dark.
- SHS have low operation and maintenance costs.
- And they are affordable for rural households via microfinance schemes on a saved cost basis

Image:  
Mounting of a SHS in Eritrea  
(© Phaesun GmbH)

Image:  
Schematic Solar Home System  
(© Phaesun GmbH)

Image:  
Lighting for a store in Bangla-  
desh supplied by a SHS  
(© PSE AG)



## Solar Water Pumping System

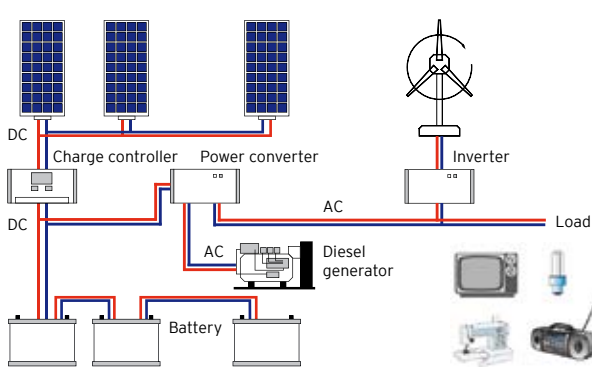
Water access can be an existential problem in remote areas. Solar powered water pumping systems offer a sustainable solution for water supply in developing countries.

- Pumping systems can be easily designed to match individual demand
- Range of application: Small systems with only one 50 Watt PV module as well as large pumping systems
- Solar water pumping systems can operate without batteries. A water storage tank takes over the role of the battery; instead of electrical energy, water is stored and may be used at any time.
- Cost- and time intensive purchase and transport of fuel for a diesel generator is avoided.

Image:  
Solar water pumping  
application in Eritrea  
(© Phaesun GmbH)

Image:  
Schematic PV water  
pumping system  
(© Phaesun GmbH)

Image:  
Installation of solar water pumping  
application in Laghen, Eritrea  
(© Phaesun GmbH)



## Village electrification

Millions of villages in remote areas have no electricity and are not expected to be connected to the public grid in the near future due to uneconomical grid extension.

To take advantage of the renewable energy resources, an attractive possibility for a decentralised power supply for such villages is a photovoltaic, wind, or hydro hybrid plant.

Generated through solar, wind or hydro power, the electricity is distributed in a local village grid. As a buffer for periods with low power generation, energy is stored in a battery bank. Additionally, a diesel generator provides reasonable supply security. The generator can also be operated by bio fuel, i.e. Jatropha oil.

Hybrid off-grid systems can provide electricity for commercial applications as well and therefore actively support economic development.

BSW-Solar member companies have extensive development experience in design and installation of hybrid PV-systems. Combined with the use of the best technology for the components, the hybrid systems meet the highest quality standards and ensure a sustainable long-term operation.

Characteristics of PV village electrification:

- Wide range of system size from 1 to 1000 kW due to modular conception
- AC based power supply
- Grid quality power
- Extendable according to requirements due to modular conception
- Adaptable to the public grid if grid extension is accomplished for the village
- Suitable for stimulating additional income generation opportunities for the customers
- High investment required

Image:  
Schematic hybrid off-grid system  
(© PSE AG; adaption of Phaesun AG image)

Image:  
Village electrification in Uganda  
(© SMA Solar Technology AG)



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