

SOLAR HOME SYSTEMS

WHAT ARE SOLAR HOME SYSTEMS?

The term solar home system (SHS) refers to a standalone system that provides electric power to households to operate lighting and other household appliances like TVs, lightings, computers, washing machines, water pumps etc. [1].

A CLOSER LOOK AT SOLAR HOME SYSTEMS

Normally, the SHS has a low power output of up to 250 Wp [2]. Small solar systems with an output between 1 Wp and 11 Wp are called Pico Solar Systems, offering a promising solution to access reliable energy for rural populations in off-grid locations.

A typical SHS, shown in Figure 1, is generally designed and sized to supply Direct Current (DC) and/or Alternating Current (AC) to electrical appliances. It consists of PV modules connected to a PV charge controller, stand-alone inverter and battery system.

These systems generate DC power, which can be customised and converted to AC power with the help of an inverter. Due to the intermittency in solar energy, the battery is used to store the energy to meet the electricity demand at night and on cloudy days. The charge controller is also used in SHS to regulate the voltage for system batteries.



Figure 1: Solar home system in a village household set-up [11]



Figure 2: Components and appliances for a typical SHS [11]

KEY FACTS

587.7 MILLION USD

is the expected size of the global SHS market by 2023 [14].

In 2018, **4 MILLION HOUSEHOLDS** were using SHS in just developing countries with an annual growth rate of 23% since 2012 [6].

580.1 GWp On-grid solar PV  **3.4 GWp** Off-grid solar PV

Total installed capacity in 2019, according to the International Energy Agency [15].

SHS can generate electricity even without direct sunlight. They can absorb different parts of the sun's light spectrum. **Even on a cloudy day your SHS can still supply electricity.**

CLASSIFICATION OF SOLAR HOME SYSTEMS (SHSs)

Depending on their proximity to the nearest grid and daily needs, SHS can be classified as:

On-grid SHS

This type of SHS is grid connected and has no battery. The system allows switching from the home system to the grid according to the residential needs. If the energy demand exceeds energy generation, the home imports electricity from the grid. In case of higher production on sunny days, the electricity is sold to the grid [3].

Off-grid SHS

An off-grid SHS is not connected to the utility power grid. Hence this system needs battery backup to store the excess energy and to supply during the shortfalls. A generator is also essential as a backup when the batteries drain out [3].

Hybrid SHS

Hybrid SHS functions as a common on-grid SHS with the addition of battery and inverter. Hybrid system refers to the combination of energy storage and generation. They can store energy during the daytime and supply energy when electricity costs are at peak rate [4].

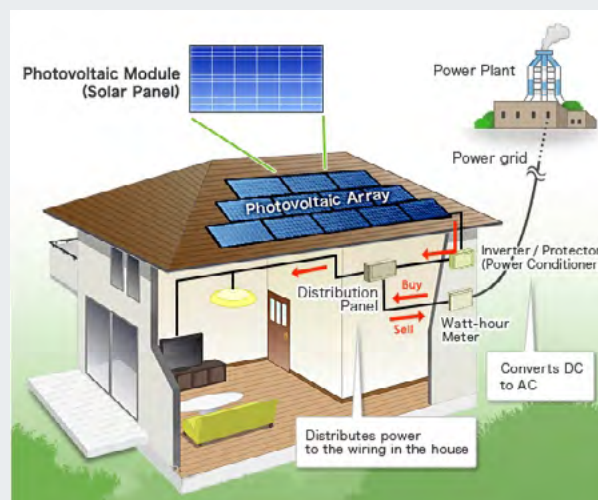


Figure 3: On-grid Solar Home System
Source: Eco Sources [12]

TAPPING INTO ETHIOPIA'S SOLAR POTENTIAL

Ethiopia has rural areas that are densely populated. However, 73% percent of the population living in rural areas lack access to electricity. They use kerosene lamps that are inefficient and adversely affect the environment. SHS has played an important role in providing clean energy to rural households in the country. Households in rural Ethiopia generally have SHS, with up to 4 lamps. One SHS with 2 lamps reduces carbon emissions by 0.25 tCO₂ compared to kerosene lamps. [10]



Figure 4: Solar Home Systems installation in Ethiopia.
Source: International River [13]

KEY FACTS

Studies show that a house with SHS **tends to sell 4.1% faster** than those without. Solar panels **could increase the market value of a house by up to 25,000 USD**. This is as good as saving money in the bank [8].



If 60% of houses install SHS in California, **46 MILLION METRIC TONS** of carbon emissions can be reduced [9].

While taking refuge in Bangladesh, the **Rohingya community** from Myanmar, **carried one set of SHS PV panels on their shoulders** to address their basic electric energy needs (e.g. lighting, mobile charging, etc.) [7].



FINANCIAL FACTS

A complete SHS of 20 Wp capacity costs about \$150–200. In developed countries, the average cost of SHS is about \$6.50 to \$7.50 per watt, including panels, inverters, mounts, and electrical items.

TABLE 1: PRICING OF SHS WITH RESPECT TO CAPACITY STATIONS [5]

Capacity	Brightness (lumens)	Battery	Price (\$) [5]
6.5 W	440 (20x brighter than kerosene)	Up to 6 hours of light per full charge	130
10 W	440	Up to 8 hours of light per full charge	132
12 W	440	Up to 12 hours of light per full charge	152
40 W	1280 (40x brighter than kerosene)	-	195
80 W	1480	-	~600

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