



What is a Sun Generator?

The Sun Generator is a device that makes it possible to use the energy produced by solar PV panels directly, without a battery or connection to the electrical grid. This means that the energy produced is not stored, so it has to be used during daylight hours.

The electrical unit converts the direct current (DC) power produced by the solar PV panels into alternating current (AC) power. Most household equipment runs on AC power, the unit is equipped with a standard plug so the energy produced can be used directly. By using the power of the sun directly when it is there, you can use the full production from the solar PV panel, with no loss of power due to storage and conversion.

Why avoid batteries?

Batteries contain heavy metals and other hazardous substances. This has an impact on the environment both during production and disposal. In addition, the batteries are expensive. This applies particularly to poor communities in developing countries that lack access to public power supply.

Areas without access to public power supply are mostly found in hot climate areas where the life spans of batteries are half of what it is in temperate climate areas like Denmark. In hot climate areas the solar cells will last 20-30 years but the batteries will have to be replaced 3-6 times depending on their quality and care, making the batteries even more costly. Without batteries solar power is both much more affordable, and the likelihood that it will function for many years is much greater.

What can the 250W Sun Generator be used for?

The Sun Generator can be used to run small household appliances for example:

Using:

- Radios
- Sewing machine
- Electrical tools

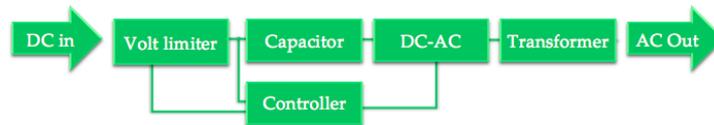
Charging:

- Power banks
- Laptops
- Cellphones
- Led lamps

The Sun Generator is made especially with less developed areas in mind, where the connection to a stable electrical supply is limited. With a Sun Generator the possibility to for example charge up LED lamps are created, the lamps can then be used to light up houses in the evening. This will give people a good chance to improve and develop their lives.

So how does it work?

When the sunrays hit the solar PV panel DC power is produced, the functionality of the Sun Generator is to convert DC to AC this is possible by creating the circuit shown below.



As we can see in the diagram the input of the circuit is the output of the solar PV panel, which is DC voltage. The DC voltage passes through the volt limiter and charges the capacitor giving power to the circuit's output. The output of the capacitor is DC voltage, which goes in to DC-AC converter, that convert the DC voltage coming from the capacitor to AC voltage with a chosen frequency, in this case 50 Hz, which is the frequency that most electrical devices use. In order to use the Sun Generator for providing power to electrical devices here in Denmark the voltage has to have amplitude equal to 230V. So we use a transformer in order to increase the amplitude of the output voltage. The transformer used in this case is a 24V-230V.

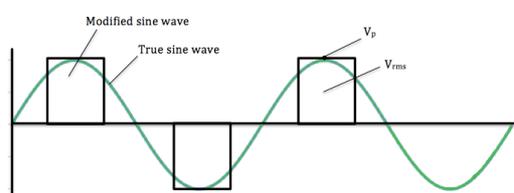
In addition the Sun Generator has two main functions:

First it works as a maximum power point system in order to maximize power output of the solar PV panel. In short, this means that no matter the level of irradiation the Sun Generator will keep the voltage stable at its V_{mp} point (Maximum power voltage).

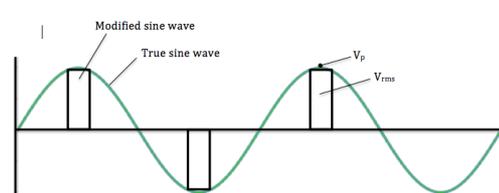
The second function of the Sun Generator is to regulate the power after demand. To accomplish this the Sun Generator uses pulse wave modulation (PWM) to adjust the power provided to the electrical devices, keeping the PV voltage stable at V_{mp} .

The average value of voltage fed to the electrical devices is controlled by switching on and off the power supply at a fast rate, creating a modified sine wave. The usage of PWM has many advantages one of them is that it has close to zero power losses, as it has low voltage drop across the switch and no current when the switch is closed.

When the Solar PV panel produces more power than needed it losses it as heat in the panel rather than in the Sun Generator. This way the Sun Generator is protected from overheating.



(Operation with low and normal demand)



(Operation with high demand)

If the electrical devices ask for more power than the PV panel can deliver, it will decrease the pulse waves to maintain a steady voltage at V_p (Volt Peak). This works on the same principle as a light bulb dimmer. It would let the electrical devices work but slower as we have shorter intervals with power supply.



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