

## **All about Roof-top/ Terrace Solar Systems - PV Solar Module, MPPT Current Controller, Inverter and Battery**

Going for home solar power is a wise decision since solar energy is not only natural but is free to us unlike any other source of electrical power. So you will be helping reducing greenhouse gas emissions! Sun's energy is free but solar power system needs good initial investment. You have to therefore be careful. Unfortunately consumer ignorance about PV Solar power often is an opportunity to cheat for unscrupulous companies. Many vendors indeed are in solar business to chase your money with little interest in the technology or environmental benefits or your needs. Here is some information that will help you fortify yourself from being short changed.

1. Photovoltaic (PV) Solar Modules convert energy from Sun into free and non-polluting DC power. Unfortunately this power cannot be directly used since it is varying in its current and voltage output. So you need to use 'current controller' to convert this into a constant voltage under all conditions of light.
2. Only one type of current controller one should buy is the one that harvests maximum solar energy from the sun. This is called *Maximum Peak Power Tracking, MPPT Controller*. MPPT helps one to harvest nearly 30% more energy from Solar Module as compared to any other type. Solar panels are expensive and MPPT costs maximum 10% of the cost of the panel. Since only MPPT controller gives 30% more energy from the same panel this investment is fully justified. Remember you are getting 30% more solar energy!
3. Sun shines bright during the day. In India, often there is no electricity even during the day for many hours. During day time the MPPT controller can directly feed DC into your Sinewave Solar Inverter and its output AC power of 230V, one can use for feeding lights, electric fans or television or computers. One must however have a suitable battery which will store the excess electrical energy from the Sun which is over and above what you are using during the day time. Thus you need to have a battery. The capacity of the battery depends on the time when you need the power. When one uses it in a commercial office one needs only a small capacity battery because when Sun is present Solar Inverter directly uses solar panel output to give you AC power since one needs power mostly during the day except for some time in the early morning and late evening. Small size battery is good enough for this.
4. However home users need solar energy at night after the sun has set. For this one need to accumulate all available solar energy during the day and then use it at night. In such a case you need battery with big enough capacity to accumulate all available solar energy from the sun and deliver it to the inverter at night feeding your 230V AC loads like lights, fans, PCs and TVs. Depending on your energy need at night your supplier will recommend certain battery capacity; its voltage and its Ampere-Hour (AH) capacity. Small Home Inverters of 1 to 3kVA rating usually work on one or two or three 12V Lead Acid Batteries depending on the inverter power and its input voltage rating.

### **Understanding about Electrical Power (W) and Electrical Energy (WH) is important for choosing correct PV Solar Plant size needed by the user**

5. Electrical Power and Energy are often confusing people. But it is easy to understand. The CFL light or normal bulb or your fan or TV is rated by its power consumption. The unit used for power is Watt (W) (or Volt-Ampere - VA).
6. However for finding Energy one needs from the Sun, one needs how long one needs that power in hours. For instance one needs to light up 100W lamp for 6 hours, one requires

600WH of energy (100W x 6H). If this is needed at night one collect and store in a battery that much energy.

### **Calculation of Maximum Power and Maximum Energy needed by the user**

Let us assume that home has 5 CFL lights of 20W, 3 fans, each of 80W and 500W Iron to press cloths. Now for calculating the energy need one has, one has to multiply the Watt rating of the appliance by the time in hours you need to use it. So in our example, three of 20W CFL lights are used for 5 hours then they need (20W x 3 x 5H) 300WH of energy. If the other 2 are used for 2 hours they will need (20W x 2 x 2H) 80WH. *Total energy for lights is therefore (300+80) 380WH.*

Then it has three fans of 80W or VA rating (This rating is written on the body of the fan) and one fan is used for 3 hours and the other two for say 9 hours; one would need (80W x 3H x 1) 240WH for one fan and (80W x 2 x 9H) 1440WH of energy for the two. *Thus for all the fans total energy needed is (380+1440) 1820WH.*

The 500W Iron is used for 1/2 Hour to press clothes. It will consume (500 x 0.5H) 250WH of energy.

In the above example Connected Load is (20Wx5) 100W for lights, (80 x 3) 240W for Fans and 500W for Iron. So the **total connected load is 840W.**

Whereas the energy needed is 380WH for lights, 1820WH for fans and 250WH for iron. **So total energy need for house is 2450WH**

7. It is important to remember that your battery capacity depends on your energy need. Battery has to be large enough to accumulate from Sun and store 2450WH of energy *and not 840W power as some people often misunderstand.* However since the maximum load is only 840W the inverter power rating can be 1000W or 1kVA. Note that the inverter's power rating has nothing to do with the energy need of 2450WH

### **Storage Lead Acid Battery**

8. Your home inverter generally needs input DC of 12V, 24V, 48V, 96V or 192V as per the power ratings of SUNFED Inverters from MITRAMAX ENERGY. So This is because Lead Acid batteries are of 12V rating. For 24V you connect two of them in series.

The other rating of the battery is its energy storage capacity which is specified in AH. 40AH battery will mean that it can deliver 8A for 5 Hours or 2A for 20 hours etc. In other words the energy storage capacity is (12V x 40AH) 480WH.

So if you need 2450WH as in example given above, you will need 12V/250AH battery which will store (12 x 250) 3000WH energy for night use. Even here it is essential to buy battery with 50 to 60% more capacity since it will ensure longer battery life. Thinking is similar as in choosing the water tank capacity; always more than what you need.

9. So for most economic size of the Solar System you need, calculate how many hours you may want to use each of your appliances and find energy need of each by multiplying by its Wattage rating. For example using 15W CFL light for 4H will need 60WH of energy. 80W Fan that you may use all night for say 10H will need 800WH of energy. Add up all energy needs of each appliance to calculate your energy need in WH.
10. Your PV Solar Modules are rated in peak Watts. But in practice they deliver only 70 to 75% average power over about five hours that you get to accumulate solar energy from Sun. Therefore a panel rated at say 100Wp will give you say 70W for 5 hours that is energy of 350WH (5 x 0.7 x 100). So if your energy need is say 700WH, your PV Module should be of 200Wp.