

Fundamental answers to simple questions

You will often hear the word “**Solar Constant**”. The solar constant is the amount of radiated energy striking a detector of area A head on above the atmosphere of the Earth. Includes all types of electromagnetic radiation, not just visible light.

The solar constant for the Earth is about 1361 Watts/m^2 although it shows slight variations with time of about 6%. The variations throughout the year come from 2 sources: sunspot activity and distance that the earth is from the sun. Earth is closest to the sun in early January and furthest in early July. By the time this energy gets to the surface of the Earth, however, much has been absorbed. The maximum solar intensity close to the surface of the Earth is about 527 W/m^2 (infrared), 445 W/m^2 (visible) and 32 W/m^2 (ultraviolet) for a total of 1004 W/m^2 .

If we had an ideal collector of 1 m^2 , the maximum power it could possibly collect is then about 1000 W ; thus my conservative estimate of 500 W for our 1 m^2 detector. A value of about 700 is closer to reality. Any collector which advertises more than 1004 W/m^2 output is simply wrong! In fact, even coming closer than about 80% is, in my opinion, suspect.

What is different about thermal collectors over PV panels?

Answer:

Over the range of all this energy that is available, pv panels presently obtain only a small region; perhaps 25-35% of the available energy can be collected. However new research with photosynthesis and pv panels is promising because photosynthesis is about 70% efficient.

Thermal panels however use a much wider range of the available energy, perhaps 75-80%. Thus in terms of just pure collecting ability, using thermal panels to heat not only shows great promise for the future but in fact is a practical reality today.

Why might I need more than one panel?

The solar panels we use will have a surface area of about 1 m^2 . Why might I need more solar panels? The answer is that your collected energy and your collector area are proportional to each other: to collect 2x more energy, you need 2x more collector area which means 2x more panels.

I want to put a lens in front of my solar panel to make it collect more energy.

It is easy to be misled here! It is possible to buy large lens that can indeed be put in front of a solar panel. However, your total energy collected will not increase. The total collected energy depends only on your solar panel area and the angle relative to the incoming radiation.

I want to put a motor on my panel to follow the sun.

It will work, however it is really expensive to do. I recommend buying extra collector panels instead. Because of the extra complications involved, it will probably slow down (or stop) the entire project. The important rule of rules here is to keep it as simple as possible and don't shoot for perfection.

Solar panels need to go on your roof always.

Nope. And this leads into the discussion of thermal siphon.

