**Gift from the Sun – So How Do Solar Panels Work?**

It seems counter-intuitive doesn’t it? You put this black, or faintly blueish, object on the roof of your house, attach a couple of mysterious boxes, and all of a sudden it generates electricity. In many ways it’s about as mysterious to us as a sports car would be to King Henry VIII. Let’s demystify it a bit and learn some really elementary physics so you can impress your friends!

We all know that everything is made of atoms. Atoms are really, really tiny. They’re so small in fact that just to give you an idea of how tiny they are, I want you to remember the last time you saw a TV image out of the window from the International Space Station. The planet Earth is so big that you can’t see all of it at once. You have to move your head to see our whole planet.

Remembering how big Earth is, I want you to go find yourself a sunbeam coming in a window and look at one of those tiny motes of dust floating in it. See it – that really, really small one? That speck you see is halfway between the size of our whole planet, and the size of an atom.

Impressed? Don’t be… An electron is 1/1835th of the mass of that, and a photon is even smaller, if it has any physical dimension at all, since we know it has no mass and is comprised of pure energy.

Why did I tell you that? So that when I say if you hold both hands in front of you cupped together, there are quadrillions of photons per second striking your hands. The Sun actually delivers around 2 x 1018 photons per square inch at the Earth’s surface. That averages to 164 watts (W) per square metre per day.

Suddenly it doesn’t seem like such a big surprise that light can give us energy, but how does it happen?

Electronic Sandwich

Commercial [solar cells are generally made from pure silicon](http://solarmakessense.club/a-case-study-solar-panels-in-iceland/), one of most plentiful substances on Earth, and then lightly polluted with carefully selected elements. This deliberate contamination is called “doping” and changes the insulation characteristics of the silicon so that it has conduction properties. Being part insulator and part conductor spawned the name semiconductor.

In one of the more common types of solar cell the first layer gets a few atoms of the substance Boron added to it. Boron is a substance that lacks some electrons so it makes that layer of silicon a bit “positive”. The second layer gets some Phosphorus added to it. Phosphorus has some “extra” electrons so that side is a bit “negative”. With this polarity on each side it’s much like a battery.

Now the negative side has some electrons that would just love to fill in the “holes” on the opposite side, but when you put these two layers together they form a balanced electrical field between them called a junction. This stops the flow of electrons from one side to the other so it stays permanently out of balance.

This is where those solar photons come into play. When they strike the surface they jostle loose an electron on the negative side, and once it’s free it is repelled by all the other electrons because they all have the same charge. It is forced into the junction and once it’s there it gets kicked out to the positive side. And what is that? Electron flow, and thus electricity!

Like a row of dominoes that electron pushes an electron out of the positive side and down one of the wires that’s connected to it. That electron goes off and does some work and then returns to its original side of the panel by way of another wire. Then the whole process is ready to repeat. As long as there’s sunlight to keep kicking those electrons loose the process will continue. As noted, this happens innumerable times per second.

Getting the Juice Out

To calculate power all you need two remember is that Volts x Amps = Watts. A typical 12 volt (V) panel could actually generate as much as 17 V in direct sunlight, at about 3.55 amps (A) which would give you approximately 60 W of power (it’s a small panel in our example). If you wired two of these panels in series, positive to negative, negative to positive, you would generate 34 V at 3.55 A and render 120 W. If you wired two panels in parallel, positive to positive, negative to negative, you would still have 17 V but the current would be doubled to a little over 7 A, and thus you would still be getting 120 W.

Most systems are combination systems where some panels are wired in series and some panels are wired in parallel. This way you can achieve any voltage and current you happen to need for your system.

Conclusion

So now you know how we get electricity out of solar panels. And you’ve got a good understanding of the process, sufficient to explain it to somebody else. Congratulations, you’ve learned something today!

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