What is a solar cell

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Solar power might seem strange or futuristic, but it''s already quitecommonplace. You might have a solar-powered quartz watch on your wrist or asolar-powered pocket calculator. Many people have solar-powered lightsin their garden. Spaceships and satellitesusually have solar panels on them too. The American space agency NASA has even developed a solar-poweredplane! As global warmingcontinues to threaten our environment, there seems little doubt that solar powerwill become an even more important form of renewable energy in future. But how exactly does it work?

Photo: NASA''s solar-powered Pathfinder airplane.The upper wing surface is covered with lightweight solar panels that power the plane''s propellers.Picture courtesy of NASA Armstrong Flight Research Center.

Solar power is amazing. On average, every square meter of Earth''ssurface receives 163 watts of solar energy (a figure we''ll explain in more detail in a moment). [1] In other words, you could stand a really powerful (150 watt) table lamp on every square meter ofEarth''s surface and light up the whole planet with the Sun''s energy! Or, to putit another way, if we covered just one percent of the Sahara desert with solarpanels, we could generate enough electricityto power the whole world. [2] That''s the good thing about solar power:there''s an awful lot of it—much more than we could ever use.

Photo: The amount of energy we can capture from sunlight is at a minimum at sunrise and sunset and a maximum at midday, when the Sun is directly overhead.

But there''s a downside too. The energy the Sun sends out arrives onEarth as a mixture of light and heat. Both of these are incrediblyimportant—the light makes plants grow, providing us with food, whilethe heat keeps us warm enough to survive—but we can''t use either theSun''s light or heat directly to run a television or a car. We have tofind some way of converting solar energy into other forms of energy wecan use more easily, such as electricity. And that''s exactly what solarcells do.

A solar cell is an electronic device that catches sunlight andturns it directly into electricity. It''s about the size of an adult''s palm, octagonal in shape, and colored bluish black. Solar cells are often bundled together to make larger units called solar modules, themselvescoupled into even bigger units known as solar panels (the black- orblue-tinted slabs you see on people''s homes—typically with severalhundred individual solar cells per roof) or chopped into chips (toprovide power for small gadgets like pocket calculators and digitalwatches).

Photo: The roof of this house is covered with 16 solar panels, each made up of a grid of 10×6 = 60 small solar cells. On a good day, it probably generates about 4 kilowatts of electricity.

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Just like the cells in a battery, the cells ina solar panel are designed to generate electricity; but where a battery"scells make electricity from chemicals, a solar panel"s cells generatepower by capturing sunlight instead. They are sometimes called photovoltaic (PV)cells because they use sunlight ("photo" comes from the Greek word for light) to make electricity (theword "voltaic" is a reference to Italian electricity pioneerAlessandro Volta,1745–1827).

Photo: A single solar cell. Picture courtesy of NASA and Wikimedia Commons.

Silicon is the stuff from which the transistors(tiny switches) in microchips are made—and solar cells work in a similar way.Silicon is a type of material called a semiconductor.Some materials, notably metals, allow electricity to flow through themvery easily; they are called conductors. Other materials, such asplastics and wood, don"t reallylet electricity flow through them atall; they are called insulators. Semiconductors like silicon areneither conductors nor insulators: they don"t normally conductelectricity, but under certain circumstances we can make them do so.

A solar cell is a sandwich of two different layers of silicon thathave been specially treated or doped so theywill let electricity flow through them in a particular way. The lower layer isdoped so it has slightly too few electrons. It"s called p-type or positive-type silicon (because electronsare negatively charged and this layer has too few of them). The upperlayer is doped the opposite way to give it slightly too many electrons. It"scalled n-type or negative-type silicon. (Youcan read more about semiconductors and doping in our articles on transistors andintegrated circuits.)

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