# Solar panels

### Abstract

Earth is struck by an enormous amount of potential energy daily by the sun, and solar panels are the answer to convert it. Different types of silicon are used for the conversion process, which consists of multiple single steps as well as other materials to protect the components. During the conversion of solar energy into electrical energy, commercial solar cells still face a staggering inefficiency as well as problems of logistical nature.

### Introduction

Much of the surface of Earth intercepts much solar power daily. About ten thousand times than the planet’s population needs to be exact. To harness the power of the sun, we use solar panels to convert solar energy to electrical energy. This document focuses on the single steps in the process and the components of a cell. Afterwards, a conclusion is drawn whether we can be reliant on solar power only.

### Sunlight emission & Entering a solar cell

Sunlight – photons – are emitted from the sun to the Earth’s surface. Solar panels are set up in a position to capture most of the sun’s light rays. Each solar panel consists of an array of solar cells, which are mainly responsible for the transformation process. A photon, when it hits a solar cell, travels through the first layer of a solar cell which consists of transparent toughened glass. This glass is primarily there to protect the internal components from other solid objects. The next layer improves the efficiency of the solar cell and consists of an antireflection layer. Without this layer, 30 % of the captured sunlight would be reflected and therefore reducing the efficiency of the cell significantly.

### Electron travel

The next layers deal with the conversion of solar power to electrical power. In a solar cell, crystalline silicon, an abundant element on Earth and semiconductor, is used for the top and bottom layers, which are connected with conductive materials. Each silicon atom has four strong connections to its neighbours, keeping electrons in place so no current can flow. However, the silicon also consists of 3 layers. The bottom layer consists of negative-type silicon (n-type) and has extra electrons while the top layer uses positive-type (p-type) silicon and has additional spaces for electrons. A depletion layer sits in between these two, which accelerates electrons from the p🡪n way but blocks the electrons from the n🡪p direction.

### The Photons role

Photons can deorbit an electron in the top layer from their silicon-atoms, creating travelling electrons and empty holes in the n-type layer. An Electron can snap back into an empty hole in the same layer where nothing happens, or they reach the depletion layer, where they are accelerated towards the n-type layer. This creates a potential difference (aka. Voltage) between the n-type layer and the p-type layer as the top layer becomes positively charged while the bottom layer becomes negatively charged.

### Creating electricity

From this position, electrons can pass through the conductive material at the bottom through an external circuit connected. At this step, electrical power is generated: Electrons perform electric power in the external circuit and flow back to the top layer. Currently, a single solar cell can put out 0.5 Volts. For this reason, the conductive material connects multiple cells to create a more appropriate amount of electrical power, which forms the solar panel.

### Conclusion

As we have seen, solar power is a great way to generate renewable power. Is it, therefore, plausible to be reliant on solar power? The two most important aspects of solar power are presented in step Electron Travel. Solar power has both a renewable power source as well as a high life expectancy as the only moving part in a solar panel is the electron itself. However, there are still plenty of problems that need to be solved. For one, current commercial solar systems have a total efficiency of about 20% and very expensive. Secondly, as we have seen in step Sunlight emission & entering the solar cell, solar power is neither evenly distributed, nor consistent because power generation depends on the weather, daytime and geolocation. Solar power might become the new way to power our cities in the coming decades as innovation drives the efficiency of solar cells forward and the cost per cell drops down.