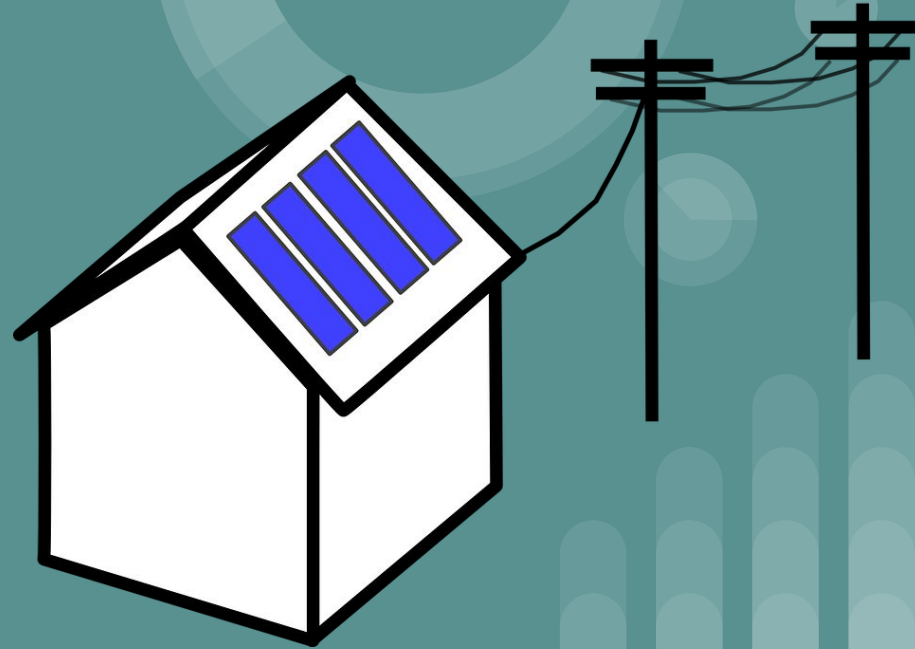




Solar Power

By: Arjun Debnath





Essential Question

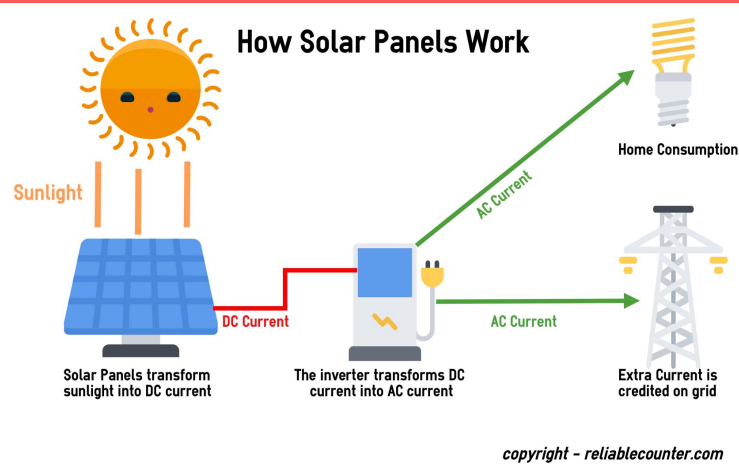
How do solar panels work and what are the advantages of using solar energy?



Prediction

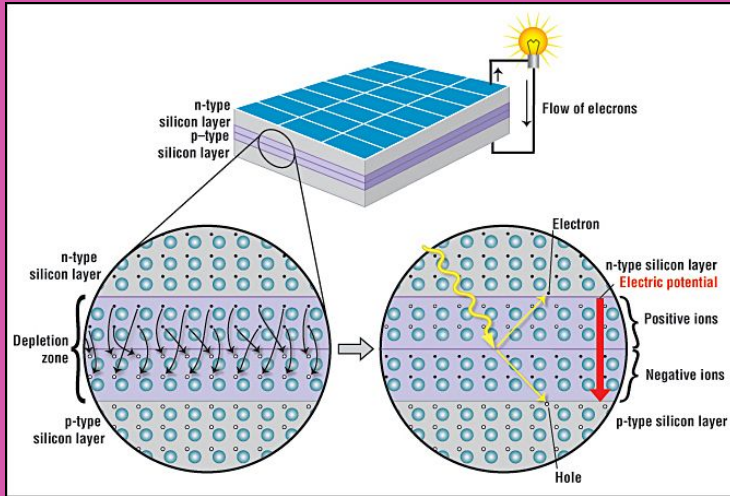
I predict that when sunlight hits solar panels, the solar panels convert sunlight into electricity. Perhaps, the particles of sunlight makes the electrons more energetic. The electrons then flow out of the panels and into electrical devices such as our television or fan. Moreover, I predict that the advantages of solar energy are that it causes no greenhouse gasses to be emitted and it is a renewable energy source.

Research Page 1 (How Solar Panels Work)



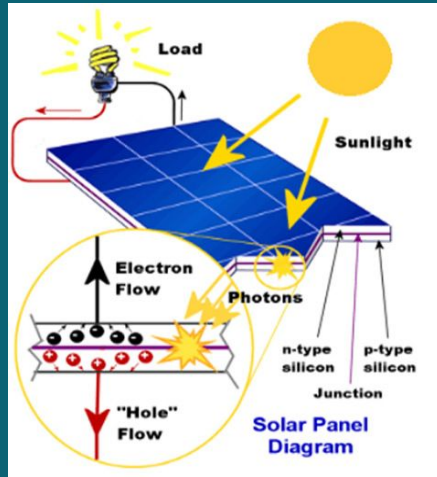
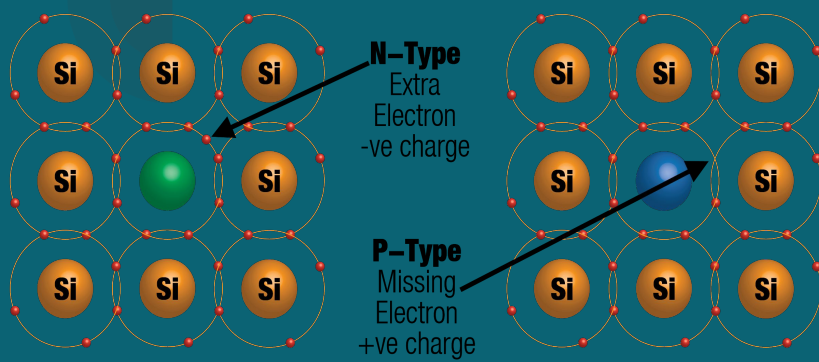
According to Go Solar California, “Every day, light hits your roof's solar panels with photons (particles of sunlight). The solar panel converts those photons into electrons of direct current ("DC") electricity. The electrons flow out of the solar panel and into an inverter and other electrical safety devices. The inverter converts that "DC" power (commonly used in batteries) into alternating current or "AC" power. AC power is the kind of electrical that your television, computer, and toasters use when plugged into the wall outlet” (Paragraph 1, Go Solar California). Any solar power that you don't use will go back into the electrical grid through the meter. There is something called a net energy meter, which keeps track of all the power our solar system produces. During the night, or on cloudy days, our system is not producing excess solar energy, so we will consume electricity from the grid normally.

Research Page 2 (How Solar Cells Work)



Solar cells are small, square shaped panels. When sunlight hits a solar cell, chemical reactions release electrons, creating electric current. Solar cells are energy sources for a wide variety of uses, such as calculators and other small devices. Solar cells that are in the form of large arrays are used to power satellites and provide electricity for power plants. Solar cells are made out of two types of semiconductors, which are p-type and n-type silicon. As particles of sunlight (photons) hit the silicon atoms of a solar cell, they transfer their energy to release electrons. The solar cell then has to herd the electrons into an electric current. To do this, there needs to be an electric imbalance so that the electrons will flow in the same direction. This imbalance is created by the internal organization of silicon. The silicon atoms are arranged together in a tightly bonded structure. As a result of squeezing small quantities of other elements into this structure, two types of silicon are created: n-type silicon which has spare electrons, and p-type silicon which is missing electrons. When these materials are side by side in a solar cell, the n-type silicon's spare electrons fill in the gaps in the p-type silicon.

Research Page 3 (How Solar Cells Work-Contd)



In a solar cell, each silicon atom is connected to one another by four bonds. These bonds keep the electrons in place so that no current can flow. Electrons can wander across the p-type and n-type silicon junction. This leaves a negative charge on one side and a positive charge on the other. When a photon strikes the silicon cell with enough energy, it can knock an electron off its bond, which leaves a hole. The positively charged hole and the negatively charged electron now freely move around. However, due to the electric field at the p-type and n-type junction, they will only go one way. The hole is drawn to the p side while the electron is drawn to the n side. The electrons are collected by thin metal fingers at the top of the cell. From there, they flow through an external circuit doing electrical work. One silicon cell produces only half a volt. If you want more power, you can put them together in groups. The only moving parts in a solar cell are electrons. The electrons come back to where they came from, so solar cells can last for a long time.

Research Page 4 (Benefits of Using Solar Panels)

Environmental and Health Benefits of Achieving SunShot

Quantifying the externalities of fossil fuels would reduce solar costs by 3.5 cents per kilowatt hour.

REDUCE WATER SCARCITY

Water consumption will drop in 36 states, enough to hydrate 1.3 million households



MITIGATE CLIMATE CHANGE

Reducing our carbon footprint could save \$259 billion in global climate change damages



CURB POLLUTION

By decreasing air pollution, solar can prevent \$167 billion in health and environmental damages



BETTER HEALTH OUTCOMES

Reducing pollutants can prevent unnecessary health care costs and save more than 25,000 lives



*PV = Photovoltaic

**CSP = Concentrated Solar Power

According to Energy.gov, “Compared with fossil fuel generators, PV* and CSP** produce far lower lifecycle levels of greenhouse gas (GHG) emissions and harmful pollutants including fine particulate matter (PM2.5), sulfur dioxide (SO2), and nitrogen oxides (NOx)” (Energy.gov). Solar energy is sustainable and renewable. Many Americans are increasingly switching to solar power. Going solar can lower monthly utility bills and allows you to make a long term, low risk investment. Solar panels can also likely increase your home's value. According to Energy.gov, “Studies show that homeowners pay a premium for a solar home; one study by Lawrence Berkeley National Laboratory showed that on average, solar increased the value of a home by about \$15,000. Furthermore, each kWh (kilowatt-hour) of solar power generated can reduce greenhouse gas emissions and other dangerous pollutants. Going solar can also reduce water consumption.

How Can We Improve the Efficiency of A Solar Cell

There are many ways we can improve the efficiency of a solar cell. For example, one way to ensure that we are using less electricity is to use a single device at a time. For instance, we should not keep the television on if we are not using it, and we should not run a vacuum cleaner and dishwasher simultaneously. In addition, we should install a backup battery to keep our electricity usage at night at a minimum. We can also install a solar concentrator, which is a device that allows us to maximize the power of our solar panel. Another way to improve the efficiency of a solar cell is by not keeping our solar panels in shady areas. Placing a solar panel in shade is one of the major factors that affect the efficiency of a solar panel. Finally, keep your solar system clean and maintain it properly. We should clean them every six months to make sure that they are free of dirt and rust.



Conclusion

In conclusion, when photons hit our roof solar panels, the solar panel converts those photons into electrons of direct current electricity. The electrons then flow out of solar panel and into electrical devices such as your toaster or television. Additionally, the benefits of solar power are that it reduces greenhouse gas emission and water consumption. My prediction was somewhat supported since I did correctly state how solar panels work and why they are beneficial, but I did not go in depth. According to Go Solar California The solar panel converts those photons into electrons of direct current ("DC") electricity. The electrons flow out of the solar panel and into an inverter and other electrical safety devices." Also, according to Energy.gov PV and CSP produce far lower lifecycle levels of greenhouse gas (GHG) emissions and harmful pollutants including fine particular matter (PM2.5), sulfur dioxide (SO2), and nitrogen oxides (NOx)." The evidence supports my conclusive statement because they describe how solar panels work and how solar energy is beneficial towards us.

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