Panthers for Panels: Solar Energy for UNI

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Introduction

Energy supply is one of the largest concerns for the future of the world in today's modern age. According to the Energy Institute, most of the world's energy usage comes from sources such as oil, coal, and natural gas respectively, as of 2024. Nevertheless these sources of energy do not have the cleanest backgrounds. When refined each releases harmful greenhouse gases into the atmosphere. These gases can be detrimental to ecosystems, large environments, and the human population as a whole. Fortunately, there is another way to receive the needed energy that powers our generations, renewables.

Renewable energy accounts for 24,592 terawatt-hours out of the 186,383 total terawatt-hours, that's approximately 13% of the world's energy usage. That is a much smaller number than it should be. Renewable energy such as wind, solar, and hydroelectric provide the same energy we get from coal, oil, and natural gas but without the nasty side effects of greenhouse emissions. So why isn't that number higher than the 13% that it is? In this paper, we will be focusing on solar power, the good and the bad that may contribute to that 13%, and ultimately the question: would solar be a perfect fit for the University of Northern Iowa? However, before we can answer such a question, we must first understand the basics.

Solar Panel Anatomy

There are two types of solar energy in today's world, photovoltaic solar energy and thermal solar energy. Thermal solar energy is about what it seems. Solar radiation from the sun is simply used to heat something up. Photovoltaic solar energy or PV, on the other hand, uses solar radiation to create an electrical current. PV is the main focus of this paper as most solar panels are used for more than just temperature changes.

A PV solar panel is made up of smaller solar cells. Solar cells are the component of the panel that does the conversion of photons to electrical energy. The two main components of a solar cell are the n-type and p-type semiconductor silicon. A semiconductor is a material that has properties between a conductor and an insulator. In this case we are talking about silicon, the most popular semiconductor. N-type and p-type refer to the characteristics of the material, which are achieved by doping or adding impurities. N-type materials are made up of molecules that have an excess of free electrons and are willing to give up those electrons. P-type materials are made up of molecules that have an excess of holes and are willing to receive free electrons. This concept is the basis of PV.

When placed together with the n-type above the p-type, the two materials create what is known as a p-n junction. This is a space where the electrons and their holes can be exchanged between the two materials. However, when this happens a diode is formed, which is basically a one way switch current that allows the flow of electrons from positive to negative but not the other way around. When a circuit is connected to both the n-type and p-type sides of the cell the current can then be directed into a load or battery. In addition to the p- and n-type materials there is an anti-reflecting coating on the top as well as layers of electrodes on either side of the cell to help with efficiency and the transfer of energy. This anatomy can be seen in Figures 1.1 and 1.2.

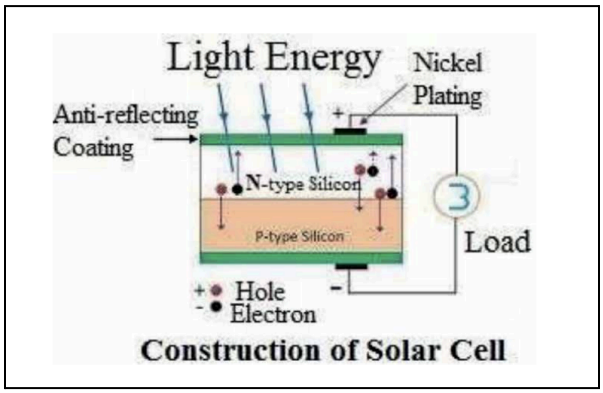

Figure 1.1. Construction of Solar Cell

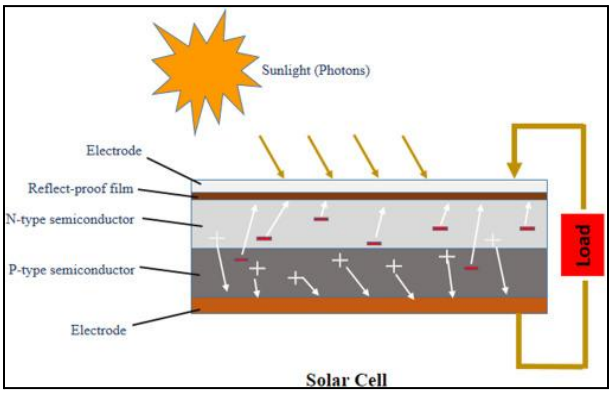

Figure 1.2. Anatomy of Solar Cell

In summary, when photons or solar radiation from the sun hits the solar cells, the molecules that make up the p-n junction are thrown out of equilibrium and start the process of electron exchange. Free electrons from the n-type material are pushed through the circuit, power the load or battery, and are then returned to the p-type side to fill in the holes that were previously created. When solar cells are aligned together they form solar panels and can produce enough energy to power our homes as well as store energy for a rainy day, both physically and metaphorically.

Too Good to be True

These solar panels sound too good to be true, but there are always downsides to innovations such as solar panels. First off, they are not the most efficient way to harvest energy. Most common panels are about 20% efficient, meaning they can convert about 20% of the sunlight that hits them. Another downside is that they can be fairly expensive upfront. It costs about $16,000 for one 5 kilowatt system. It could also cost more in installation depending on where they are set. Another externality is that solar panels, although clean, can have an impact on the environment in the amount of mining for semiconductor elements.

Nevertheless each downside has an upside. They might not be the most efficient but if you have an open area why not get them. Solar panels are basically dormant energy suppliers, they sit there and collect, no burning or refining needed. If they have such low efficiency that also gives them an opportunity to improve and advance the technology in the future. In terms of expenses, this is probably the largest concern, they do cost a lot up front, but in the long run could save lots on electrical bills. Financially there are also many programs and credits that eliminate some of the cost. For example, there is a Federal Clean Energy Tax Credit that gives

you a 30% tax credit. Finally in terms of mining, most if not all solar panels are highly recyclable and when they deteriorate can be disposed of properly and replaced.

Panthers for Panels

So, why the University of Northern Iowa? Well, we may be small, but we can also be mighty. Currently most of our energy on campus comes from the power plant West of Hudson Road. This provides the campus with steam for heating as well as other energy sources. I don't believe that solar panels can completely replace that power plant but I think we can do better for our community and environment by installing solar in some more of our buildings. Maybe the best route is to implement a few and see the effects. Start with Latham and branch outward.

The most important part, in my opinion, is the community on campus and in Cedar Falls. Having the students' best interest should be top of the list. Implementing solar panels could reduce housing costs for on-campus students, creating more incentive to keep living on campus. I think it is also a learning experience for our students, especially the environmental and earth science students and the engineering students. Getting them involved could help them learn more about how they operate and other aspects of the industry.

It is also an initiative that can be taken to set a precedent. If UNI can adopt solar, then other colleges can be encouraged by our story to also take up the power of the sun. Our small community could help to lead the charge into a more renewable future. A more renewable future for not just UNI, but Iowa, and the whole country.

Conclusion

All in all, I believe more solar panels would be a great addition to the University of Northern Iowa campus. Not just for the campus and their expenses, but for the teachers, students, and community members that utilize the campus and its properties. Start small with a few

buildings and grow the idea into more and more. Ultimately being green is beneficial to the future generations of this world. Investing in the long term, although maybe not what is thought to be the best today, will eventually pay off and create a better future for all who care to enjoy it, later in life.

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