Harnessing solar energy

Business, Industries

Harnessing of Solar Energy: Photosynthesis versus Semiconductor Based Solar Cell Photosynthesis and semiconductor-based solar cells are both used to harness solar energy from the sun – photosynthesis for plants and semiconductor based solar cells for human beings. Photosynthesis consists of light reactions and dark reactions. It is a process in which carbon dioxide (CO_2), water (H_2O) and light energy are utilized to synthesize an energy-rich carbohydrate like glucose ($C_6H_{12}O_6$) and to produce oxygen (O_2) as a by-product.

Simply put, photosynthesis is a process that transfers energy from the sun (solar energy) into chemical energy for plants and animals. Photosynthesis is a vital process among plants, algae and some bacteria that are able to create their ownfooddirectly from inorganic compounds using light energy so that they do not have to eat or rely on nutrients derived from other living organisms. A semiconductor-based solar cell is devised to convert light to electric current.

The solar cell directly converts the energy in light into electrical energy through the process of photovoltaics (a field of semiconductortechnologyinvolving the direct conversion of electromagnetic radiation as sunlight, into electricity). Solar cells do not use chemical reactions to produce electric power, and they have no moving parts. Most solar cells are designed for converting sunlight into electricity. In large arrays, which may contain many thousands of individual cells, they can function as central electric power stations analogous to nuclear, coal-, or oil-fired power plants.

The conversion of sunlight into electrical energy in a solar cell involves three major processes: absorption of the sunlight in the semiconductor material; generation and separation of free positive and negative charges to different regions of the solar cell, creating a voltage in the solar cell; and transfer of these separated charges through electrical terminals to the outside application in the form of electric current. Comparisons Photosynthesis and semiconductor-based solar cells both get their energy from the sun and convert it into a form that is needed either by plants or humans (Vieru, 2007). The first two steps of photosynthesis involve capturing photons released from the sun and using that energy to create a flow of electrons. From there, photosynthesis involves using that electrical energy to create chemical energy" (Stier, 2009). The products of photosynthesis are sugars to feed plants. Semiconductor-based solar cells also capture photons that use energy to create a flow of electrons which create electrical energy. A final similarity between photosynthesis and solar cell technology is that " a semi conductor has solar cells that trap energy from the sun and convert it into electricity.

Plants have cells that trap energy from the sun and convert it into useful products" (Haile & O'Connell, 2005). Contrasts The first contrast is in the conversion of energy trapped by the sun – photosynthesis converts solar energy to chemical energy used by plants and semiconductor-based cells convert solar energy into electricity used by humans. The solar panels for semiconductors are manmade and photosynthesis comes from a natural process. Finally, photosynthesis has been around for billions of years making it the oldest technology on earth (Stier, 2009).

Charles Fritts created the first solar panel in 1883 which means the semiconductor has been around for about 229 years – a mere zygote to photosynthesis. Thermodynamics Semiconductor-based solar cells and photosynthesis both use the laws of thermodynamics. Thermodynamics is the study of the conversion of energy between heat and other forms, mechanical in particular and it has three laws. The first law of thermodynamics says that energy is conserved, it is neither created nor destroyed but can change form. This is called energy conservation.

The second law of thermodynamics says that systems always tend to be in states of greater disorder. As disorder in the universe increases, the energy is transformed into less usable forms. The third law of thermodynamics is usually stated as a definition: the entropy of a perfect crystal of an element at the absolute zero of temperature is zero. Thermodynamics apply to photosynthesis by plants transforming sunlight energy into food – this is an example of the first law. During the process of photosynthesis plants also lose energy because they to not convert all of he energy trapped from the sun into food. Some of the energy is lost in the process – this demonstrates the second law of thermodynamics. Plants needing to trap energy from the sun constantly demonstrates the final law of thermodynamics because the cycle is repeated. In semiconductor-based solar cells energy from the sun is converted to electricity – this is the first law. Because energy is lost in the conversion, the second law of thermodynamics is applied here. Finally, the cells have to continually obtain energy from the sun which obeys the third law of thermodynamics (Heckert, 2007).

Solar energy has been around for billions of years whereas semiconductor-based solar cells have only been around a little over 200 years. In writing this, I have discovered that solar energy is harnessed by both photosynthesis and semiconductor-based solar cells to convert energy into food and electricity to be used by plants and human beings. Both photosynthesis and semiconductor-based solar cells utilize all three laws of thermodynamics by converting energy, losing energy, and trapping energy constantly. This shows the many similarities and differences between photosynthesis and semiconductor-based solar cells.