Renewable Energy Task: How The Photovoltaic Process Produces Electricity From Sunlight

In your own words explain how the photovoltaic process produces electricity from sunlight (200 words plus diagrams/images) RS7

The photovoltaic process is the process of converting sunlight into electricity on the molecular level. The diagram below illustrates the basic process of a photovoltaic cell or solar cell. They are made of the same materials, including silicon, as semiconductor materials used in the microelectronics industry. In a solar cell, there is a thin wafer made of semiconductor material with one positive and one negative side. When light energy hits the cell, the electrons from the atoms making up the semiconductor are hit loose. If a conductor is attached to both positive and negative sides of the cell, a circuit is complete. The loose electrons are captured in the form of an electrical current, or electricity. This, in turn, can be used to power a load, such as tools or a light. This can also be used on a larger scale to power things like a house or even a whole city. When multiple modules are wired together, it forms a module or array. Generally, the larger the module, the more electricity is produced. Photovoltaic modules and arrays always produce direct current or ‘dc’ electricity. This means that they can be connected in both a parallel and series circuit.

Why use ‘alternative energy’ systems to generate electricity? Alternative energy sources could include hydro, solar, wind/tidal/wave, geothermal, human. If the current alternatives such as coal and gas are problematic, why not stop using them straight away? (200 words) RS6

Alternative energy or renewable energy sources are defined as sources used to create energy that replaces itself and never run out. These include energy such as hydro, solar, wind and geothermal. The reason that people are trying to phase out more traditional methods of producing electricity and switch over to renewable energy methods is because of the massive impact that the burning of fossil fuels has on the health of the planet. When burning coal or digging up oil, a huge amount of carbon dioxide are released into the atmosphere, which is detrimental to the health of the planet. The reason that these more traditional methods of power can’t be phased out immediately is because of the amount of money these businesses bring people. In the coal and oil business, there are some very powerful people, people who don’t want their main source of income to be overtaken by another energy source, no matter how beneficial it will be to the planet. The two businesses also provide a large number of jobs and although building and maintaining a wind farm or hydro plant requires a large number of people but politicians are scaring the general public saying that if we lose these industries we will destroy our economy which is in no way true.

Complete a short case study on the use of alternative energy sources for either domestic, industrial or commercial applications. Your response should include an explanation as to why the consumer/organisation chose renewable energy over traditional non-renewable energy sources (800 words). RS6

Hydro

Hydropower is a form of renewable energy that relies on the water cycle to work. When water undergoes its cycle, from evaporating from lakes to precipitating on mountains and running down a river to end up back into the lake, a hydropower plant would capture the energy of running water and use it to spin a turbine and create electricity. Since this water cycle is endless, this form of power is renewable. This energy is being utilised by the Australian government in the Snowy Hydro Scheme, a massive hydro plant that is providing around 3 million houses with electricity and 32% of the overall power of the eastern mainland grid. This plant also provides the energy for about $3 billion worth of agricultural needs for Australia every year.

Solar

Solar energy is produced through a specialised cell or array of cells absorbs and transfers the energy that our Sun outputs when undergoing fusion. This energy source is renewable, as the energy we are receiving is just a by-product of the Sun trying not to collapse in on itself. In 2016-17 solar energy accounted for around 3.1% of Australia's total electricity with most of that coming from small scale rooftop panels. Now more than 2 million Australian houses are equipped with these panels. Large scale solar farms are also on the rise in Australia with our large scale farms generating over 1824 MV in 2018. It is planned that 61 additional solar farms will be built in Australia in 2019.

Wind

Wind turbines use the energy of the wind to spin large propellers or turbines to spin an electric generator inside the turbine. This then produces electricity and since wind is a renewable resource, wind energy is considered a clean energy source. As wind is not continuously blowing, researching have found ways to maintain a reliable electricity output by pairing it with a solar farm or storing excess energy in a battery. This energy type is abundant in Australia, accounting for 7.1% or our total electricity. By the end of 2018, we had 94 wind farms in Australia, with nearly 6GW of wind generation capacity.

Tidal/Wave

Wave energy works by converting the kinetic energy of waves into electricity. Although this form of energy is yet to be used in Australia, researchers are discovering new ways to utilise the energy produced from the ocean. One of the main ways that this can be done is setting up an array of tidal stream device, similar to a wind farm and capturing the kinetic energy of currents flowing in and out of tidal areas. The Australian Renewable Energy Agency (ARENA) have invested $2.5 million into researching and developing a way of producing affordable, renewable energy sources for all of Australia.

Geothermal

Geothermal energy uses heat that is found deep inside the earth. It is a renewable energy source that can be used to create electricity through using the heat to boil water, create steam and turn a turbine, just like a nuclear power plant or a coal plant would do. Although Australia may have a considerable amount of untapped geothermal energy that we could extract, the problem is finding and funding a project like this. This geothermal energy would most likely be

found in remote locations and the cost of transporting that energy to a more useful location would be expensive.

Hydrogen

Using hydrogen to power things isn't a particularly new concept, but doing it commercially is. The reason that hydrogen is so good as an energy source is that the universe is abundant in it, holding much more than we could ever possibly use. Also, when hydrogen is burned, it lets of almost no pollution, making it a very clean energy source. These fuel cells would combine hydrogen and oxygen to produce electricity as long as hydrogen is being supplied. These fuel cells would also be very easy to transport, as they would have a similar structure as a battery.

Biomass

Biomass is a renewable source of energy that comes from dead plants and animals. It contains stored energy from the Sun, which plants have absorbed from photosynthesis. When this biomass is burned, the chemical energy that is produced is released as heat which can be turned into electricity through a power plant. Globally, bioenergy accounts for half of all renewable energy in 2017 and in Australia is contributing to 4% of our total energy consumption. Although it doesn't account for too much of the global energy, the byproducts of this energy source are very beneficial including renewable bitumen and biomass-based concrete.

Biofuel

Biofuels are very similar to biomass, as they are both derived from recently deceased animal or plant matter. Biofuel, on the other hand uses the energy to produce fuel such as biodiesel or bioethanol, which is a much greener option for fuel in everyday vehicles. Although the production of biofuels isn't 100% green, as the burning of the fuel still releases CO2 into the atmosphere, biofuel is 80% cleaner than regular fuel, making it a much greener option.

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