Solar Trackers vs Wind Turbines

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Abstract

One of the most debated topics these days is alternate energy resources. Today, most of the people in the world use fossil fuels to produce energy; however, even though fossil fuels are producing energy, it is also damaging the environment. Luckily, there are wind turbines and solar trackers to solve this issue. Both wind turbines and solar tracker depend on the environment to produce energy. Unlike fossil fuels, wind turbines and solar trackers do not produce any pollution that damage our environment. Wind turbines and solar trackers are both clean and efficient, so why don't people use them?

Solar Trackers vs Wind Turbines

What if humans could produce energy efficiently and not use fossil fuels that damages the environment? In some rural areas, people use wind turbines; however, the majority of people around the world have homes that use fossil fuels to provide energy. Fossil fuels are burned to heat water and produce steam. Then, that steam is used to push around turbines in a sort of generator, which spins a magnet that produces an electric current. Fossil fuels are very effective for providing energy, but there is a big downside to using them: they damage the environment significantly. All the fossil fuels that are burned create pollution that ascends to the atmosphere, which is extremely dangerous to the environment. So, when there are thousands of power plants around the world burning fossil fuels, the state of our environment can decrease dramatically, which is what is happening now! On the plus side, there are still other ways people can produce energy without damaging the environment. For example, solar trackers are a very effective and safe way to produce energy. Solar trackers are solar panels that follow the direction of the sun. So, instead of it being stationary like a normal photovoltaic panel (standard solar panel), a solar tracker follows the movement of the sun, which increases its efficiency. Solar trackers do not create any pollution that damages the environment. Another way to safely produce energy efficiently is using wind turbines. A wind turbine is a machine that converts the kinetic energy of the wind to electrical power. Wind turbines do not produce any pollution either. They use the wind around them to produce electrical power. A change is needed in how people produce energy. The best way to change how people produce energy is to replace current polluting methods with a method that is as effective and does not damage the environment, which is what wind turbines and solar trackers are best for.

Solar trackers are one of the best replacements for fossil fuels. Not only do they not damage the environment, they are very effective. Solar trackers can be considered to be an upgraded version of solar panels. Because of the immobility of solar panels, the amount of energy that they produce is limited. But, when solar panels follow the movement of the sun, their effectiveness increases. The solution to the limited energy produced by solar panels is found in nature: the sunflower. Sunflowers mimic the sun's movement, which is exactly what solar trackers do. Using sophisticated electronics and computers, a solar tracker can produce energy with its photovoltaic panels by following the sun’s movement. A common misconception regarding solar trackers is that solar trackers have a very huge disadvantage: it is much more expensive than normal solar panels. Even though this is true, the amount of energy that is gained using solar trackers instead of solar panels is actually very worth it (Zipp, 2013). The benefits that a solar tracker provides far outweigh the costs; the main advantage being that solar trackers produce more energy than standard solar panels will ever produce.

Solar trackers can be considered to be better than wind turbines, because they can be more easily installed in urban areas than wind turbines (Zipp, 2013). Since wind turbines depend on wind, wind turbines require large, heavy-duty propellers in order to produce energy for urban areas (Bushong, 2016). Also, if a day is not so windy, the wind turbines will not produce as much energy; however, solar trackers can be much smaller and still produce as much energy, because they use the sun (Bushong, 2016).

Even though solar trackers may seem complicated, they are a very simple piece of technology. The most interesting part about solar trackers is how the are built. There are two types of solar trackers: single-axis solar trackers and dual-axis solar trackers. A single-axis solar tracker is a solar panel that moves back in forth in one direction. There are four types of single-axis solar trackers: horizontal, vertical, tilted, and polar. The horizontal single-axis solar tracker axis of rotation is horizontal with respect to the ground. A horizontal tube is supported on bearings and attached to pylons or monuments. The panel is placed on top of the horizontal tube. The tube rotates on the axis and tracks the motion of the sun. A horizontal single-axis solar tracker is usually used for large projects. However, for the solar trackers to be efficient, they should be all facing the sun at the same position and time, and the solar trackers have to be equally spaced out (Bushong, 2016). The vertical single-axis solar tracker is another efficient type of single-axis solar tracker. It works the same way as the horizontal single-axis solar tracker, but it has some differences. For example, the vertical single-axis solar tracker axis of rotation is vertical with respect to the ground, so it moves east to west, while the horizontal solar tracker moves north to south. Since the vertical single-axis solar tracker moves east to west, it operate more efficiently than the horizontal solar tracker at high latitudes (Bushong, 2016). Tilted single-axis solar tracker is another unique type of single-axis solar tracker. The concept of it is that any axis of rotation that is between vertical and horizontal is considered tilted single-axis solar tracker (Zipp, 2013). Polar single-axis solar tracker is the most uncommon type of the four; however, it is still used in some places. The unique aspect of polar single-axis solar tracker is that its axis of rotation is aligned with earth’s rotation.

The second type of solar tracker is the dual-axis solar tracker. The dual-axis solar tracker is a solar panel that can move in two directions. This is the only type of solar tracker that can continually face the sun because of its ability to move in two directions (Zipp, 2013). So, since dual-axis solar trackers can continually face the sun and move vertically and horizontally; they obtain the maximum amount of energy (Zipp, 2013). Dual-axis solar trackers appear to be more efficient than single-axis solar trackers, so they are usually used in residential areas where electricity and energy is consumed in a high volume (Zipp, 2013).

There are two types of dual-axis solar trackers: tip-tilt and azimuth-altitude. The tip-tilt dual-axis solar tracker has many different designs. The tip-tilt dual-axis solar tracker is usually built on a support pole, and it includes many mounting bars that help it move around in two directions. The panels are placed on the mounting bars that are connected to the support pole. The mounting bars help the panels move in the direction of the sun. The name tip-tilt is kind of deceiving and can make people think that the solar panel is always tilted; however, that is not the case at all. The panels are sometimes vertical, horizontal, or even tilted (Zipp, 2013). Of the dual-axis solar tracker, the tip-tilt solar tracker is the popular one. One of the reasons why is because it has a very simple build.

The second type of dual-axis solar tracker is azimuth-altitude. Like the tip-tilt solar tracker, the azimuth-altitude solar tracker has many different designs. One of the popular designs of the azimuth-altitude solar tracker has a rotating ring-like structure on which the solar panels are mounted.. One the biggest advantages to this is that the ring can hold more weight than the rotating pole in the tip-tilt solar tracker. So, the azimuth-altitude solar tracker can incorporate more panels that will increase its efficiency.

Even though the single-axis solar tracker and the dual-axis solar tracker may seem totally different, they both have a lot of similarities that increase their efficiency. For example, both types of solar trackers decrease the angle of incidence (the angle that a ray makes with a line perpendicular to the surface) (Zipp, 2013). This will increase exposure of the panel to the sunlight, which will increase the amount of energy the solar tracker produces. Also, some solar trackers will not produce any energy unless the solar panel of the solar tracker is angled and position perfectly, which can be quite difficult at times. However, both the single-axis solar tracker and dual-axis solar tracker will always be more efficient than the standard solar panel because of their mobility (Zipp, 2013).

A wind turbine is another safe replacement for fossil fuels. Wind turbines convert the wind’s kinetic energy to electrical power. This technology has been in use since 1888 unlike solar trackers, which has only been in use for a couple years (“Third Planet Windpower,” n.d.). So, when it comes to wind turbines, people know how efficient they actually are. Smaller turbines are usually used to produce energy for small machines like traffic warning signs or traffic lights. Larger turbines can be used to produce energy for one or two homes. Lastly, arrays of larger turbines can produce enough energy for a block or two of homes.

Wind turbines can be considered to be a more efficient energy source than solar trackers for many reasons. For example, wind turbines are much simpler than solar trackers. Wind turbines only use the wind around them to produce energy; on the other hand, solar trackers require sophisticated electronics for them to follow the movement of the sun, which can be very difficult to acquire. Also, in rural areas, wind turbines would be much easier to use than solar tracker, because wind turbines do not require as much technology. Furthermore, as mentioned before, the technology that runs the solar tracker can sometimes be very expensive. Compared to standard solar panels, solar trackers are more expensive. Another expense to account for since solar trackers include so much equipment and moving parts is regular maintenance. Especially when parts break, repair will be need. If a solar tracker for some reason stops working and it needs to be repaired, the loss of energy production until the solar tracker is repaired is tremendous. So, it can be risky for a building, for example, to run on solar trackers, because at any time the solar tracker can break (especially because there are a lot of moving parts in solar trackers) and there can a huge loss of energy production. Solar trackers can break in many ways. For example, break with the moving parts, and solar trackers depend a lot on technology. So, when there is an issue in the technology, the solar tracker will not be able to operate. Also, solar trackers are more prone to damage from storms. On the other hand, wind turbines usually do not break as often as solar trackers. Wind turbines do not have as many moving parts, and they do not depend on technology as much as solar trackers. So, wind turbines are not as prone to damage as solar trackers. At the end of the day, wind turbines depend mostly on the wind around it, which is more reliable than the technology of solar trackers.

Even though a wind turbine might look like a simple machine from the outside, it is actually very complex inside. A wind turbine is composed of four main parts: the propellor, the gearbox, the generator, and the tower. The tower does not necessarily contribute to making the wind turbine actually produce energy; its main objective is to provide support for the other parts of the turbine. The propellor has a similar configuration the same idea. Without the gearbox or generator, the propellor would not be able to produce any energy. The propellor or the rotor has a pitch system and a brake attached to it. The pitch system is used to prevent the rotor or the blades from turning in high speeds. If the blades turn too fast, it can result in the rotor becoming damaged (“The Inside of a Wind Turbine,” n.d). The brake stops the rotor completely in case of any emergencies that occur. A low-speed shaft (is sometimes considered to be the main shaft) is then attached to the pitch system all the way to the gearbox. The gearbox itself includes high, low, and intermediate speed bearings attached to several gear teeth. The gearbox’s rotational speeds must be between 1000 rpm - 1800 rpm, in order for the turbine to produce energy (“The Inside of a Wind Turbine,” n.d). Lastly, the gearbox connects to a generator, which produces the energy. The wind turbine also includes a controller, which connects to an anemometer that comes outside the turbine. The anemometer is used to measure the wind speeds and transmit that wind speed data to the controller. The controller starts up the machine at speeds between 10-16 mph and stops the machine before it reaches 55 mph (“The Inside of a Wind Turbine,” n.d). The wind turbine cannot take such high speeds, so as soon as the anemometer tells the controller that the wind speed is 55 mph, the controller turns off the generator. The nacelle serves as a housing for the generator, controller, gearbox, and shafts for the wind turbine. There are still a lot more parts in the wind turbines that contribute to producing energy. The wind turbine would not work at all if one of those parts were not included, for example, the rotor or the brake.

A wind turbine can be considered the complete opposite of a fan. A fan uses electricity to produce wind. Whereas, a wind turbine uses the surrounding wind to produce electricity. The wind makes the blades on the propellor move, which is connected to the gearbox. At the same time, the gearbox starts to move, which triggers the generator. The generator is what produces the electricity. So, as long as the propellor is moving, energy is being produced. So, as the wind turbine is producing energy, there are no chemicals or gas going into the air to create pollution.

In addition to the scientific relevance of conserving energy to preserve our plants, there is also a religious connection. In Surah Isra ayah 17, Allah (swt) says: “ Indeed, the wasteful are brothers of the devils, and ever has Satan been to his Lord ungrateful.” According to Islam, someone who wastes is considered to be a brother of the devil, and the devil has always been known to be ungrateful. When there are safe. alternate energy resources that can do almost the same job as fossil fuels and Muslims do not use them, this can be considered to be wasting. Factories are burning fossil fuels and destroying the environment just to produce energy. If fossil fuels were the only energy resource available, then people would be forced to produce energy from them. However, luckily, Allah (swt) has blessed this earth with his wonderful and beautiful creations; for example, Allah (swt) created the sun so that we can benefit from it. Solar trackers are one way to benefit from the sun, because it uses the energy from the sun to produce energy. On the other hand, wind turbines use the nature that Allah (swt) created to produce energy. What better way can people produce energy than using Allah’s (swt) creations without damaging the environment?

In Surah Al-Baqarah ayah 60, Allah (Swt) says: “And [recall] when Moses prayed for water for his people, so We said, ‘Strike with your staff the stone.’ And there gushed forth from it twelve springs, and every people knew its watering place. ‘Eat and drink from the provision of Allah, and do not commit abuse on the earth, spreading corruption.’” When big factories and manufacturers are burning fossil fuels, they are damaging the earth and the environment, which is considered to be abuse. When someone is gifted a present, they will always make sure to take care of it and use it in the right way, especially if it is given from a special person. The earth was a gift given to mankind by Allah (swt), so people should be taking care of it. Unfortunately, the way the humans around the world are producing energy is the opposite of taking care of the world. This is why change is needed all around the world. Factories and big companies have to wake up and realize that the resources on earth are not infinite. There is no infinite amount of oil, water, or oxygen on earth. The best way to change how people produce energy is to replace it with something that is as effective and does not damage the environment, which is where wind turbines and solar trackers come in. These resources are clean and bountiful with the potential to provide vast amounts of energy, so why don't people use them?

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