

It's Easy Being Green

In an era where pollutants caused by the burning of fossil fuels (i.e. petroleum and coal) have created major environmental problems such as global warming, many people are in search of alternative energy sources that will provide an environmentally safe solution while freeing America from its dependency on foreign oil. There are numerous viable options for alternative energy including wind, hydro, solar, tidal, hydrogen, biomass, and nuclear energy, but a combination of these sources has the best chance of replacing fossil fuels as the world's leading energy provider.

Solar energy

Solar energy is one of the alternative energy source with which people are most familiar. Also referred to as photovoltaics, solar energy technology has been around for over fifty years and is a common energy source used in many small electronic devices such as calculators, watches, lanterns, and radios.

Solar energy systems work like this:

Solar panels consist of cells containing two types of silicon. An electric field is generated where the two types of silicon meet each other. When sunlight strikes these cells, the electrical field helps guide electrons resulting in the production of an electrical current (see Figure 1).

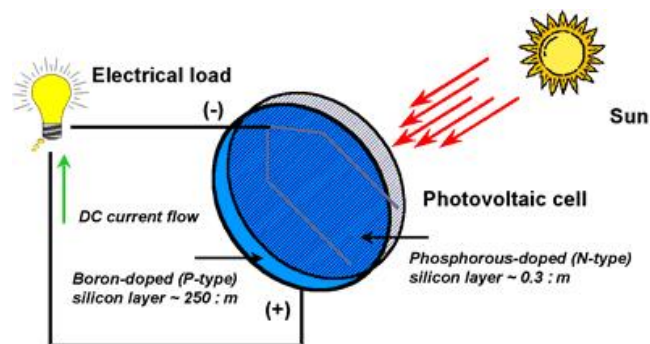


Figure 1: How Solar Cells Work

According to researchers at the Florida Solar Energy Center, there are many positive aspects to using solar energy over traditional energy sources. Some of these advantages include solar energy's easy adaptability to a variety of applications, including localized or distributed power generation. Solar also requires no moving parts, which means no energy is required to start the energy generating process. Additionally, solar can be easily transported and, most importantly, expanded. In other words, if demand for electricity increases, additional panels can be added, rather than having to create another fossil fuel powered generator. Of course, the benefits of solar energy, in addition to being free, include the possibility of eliminating our dependence on foreign oil, as well as reducing atmospheric pollution.

Ironic as it might seem, the cost of building a solar energy system is currently the greatest barrier between the use of solar energy and individual consumers. Even though sunlight is free, the equipment necessary to convert it to energy is still more expensive than the equipment used in conventional energy systems.

Critics of solar energy, such as Walter Youngquist, argue that solar energy is limited in its application. According to Youngquist “an area of sixty square miles in relatively clear central Oregon would have to be covered with solar cells in order to meet the present electrical needs of the State.”

Hydrogen

Hydrogen has been called “the fuel of the future” because of its abundance in approximately 90% of all matter. Furthermore, since it is so readily available, the environmental consequences are little to none (Hydrogen).

Hydrogen is not an energy source; however, it is an energy carrier, and once produced, hydrogen can be used in internal combustion engines or in fuel cells to produce electrical power. However, since hydrogen production is a new technology, many aspects of its use need to be developed before it can be used extensively. Research must be completed to determine how hydrogen would be produced without the use of fossil fuels, whether hydrogen should be produced locally or at a centralized location and then transported elsewhere, and how it would be stored. In addition to solving these problems, developers must also consider the cost of switching from gasoline to hydrogen use in cars; Exxon/Mobil has estimated that the transition would cost \$1 trillion (Hydrogen).

Nuclear energy

Another popular alternative energy that’s being used worldwide is nuclear power. Nuclear power was first developed during the Cold War and reached its greatest popularity during the late 60s and early 70s. However, after a near disaster at Three Mile Island and an environmental catastrophe at Chernobyl, nuclear energy declined in popularity. Now, with a growing desire to cut greenhouse gasses, there has been resurgence in the focus on nuclear energy.

The current nuclear technology is considerably safer than the technology that malfunctioned over twenty years ago. This change is the result of improvements in regulation of the nuclear industry. As a result, proponents of nuclear energy now tout its low emissions and low environmental impact as the biggest advantages to this alternative energy source. In many ways, proponents of nuclear energy are right; nuclear energy, if secure and up to the latest safety standards, creates no emissions and therefore, has no environmental impact. According to the Nuclear Energy Institute, nuclear power currently produces seventy percent of the emissions free electricity in the

United States. The Institute also states that use of nuclear energy in the U.S. alone has kept 8,025.50 million metric tons of carbon dioxide out of the atmosphere over the past decade.

The greatest downside to nuclear energy is that, as with fossil fuels, there is a limited supply of uranium available on Earth. Once we deplete that supply, new technologies and energy sources will have to be developed. As a result, nuclear energy is not effective as a long-term energy solution.

Hydroelectric power

After nuclear energy, the second largest producer of emissions free electricity is hydroelectric power. Hydropower is also the leading renewable energy source, contributing to 97.9% of all electricity generated by renewable sources in the U.S. (Wisconsin).

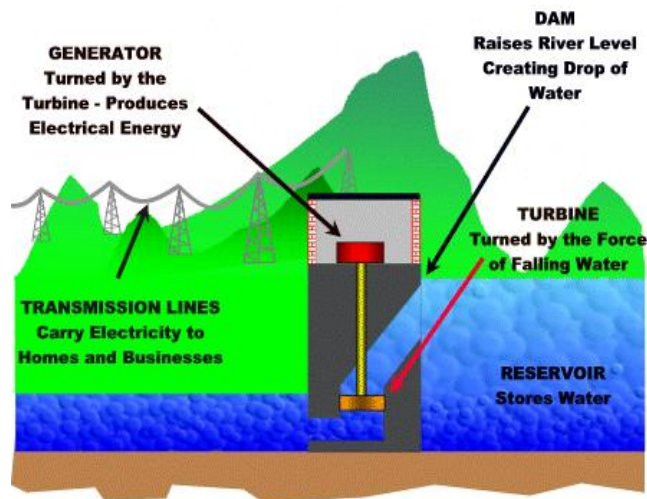


Figure 2: The configuration of electricity producing dams

According to the Wisconsin Valley Improvement Company (W.V.I.C.), hydroelectric plants work as follows: A dam raises the water level on one side of the river to create falling water. The falling water then turns the blades of a turbine. Converting the mechanical energy of the turbine into electrical energy is then done by a generator, which is connected to the turbine by a shaft or by gears. Transmission lines from the generator conduct electricity to consumers (see Figure 2).

Some of the positives of hydropower, according to the W.V.I.C., are that hydropower leaves behind no waste and keeps 120 million tons of coal from being burned each year. Hydropower is also more cost efficient, converting ninety percent of the available energy into electricity at half the cost of nuclear power, forty percent of the cost of fossil fuels, and twenty-five percent of the cost of natural gas.

Of course, hydropower can only be used in areas containing damable rivers. Dams can also lead to flooding of valuable agricultural land, loss of animal habitat, and declines in fish species (Youngquist).

Wind power

The idea of using the wind's energy to create power for humans is far from new. For years, humans have ground grain or pumped water using windmills. Today's modern equivalent, the wind turbine, operates under the same principle as its older counterparts (Renewable).

Wind turbines are erected on towers in order to help maximize the amount of energy captured. Low pressure pockets form beneath the blades, causing them to spin. This motion in turn spins a generator that produces electricity (Renewable).

The pros of wind power are fairly obvious. Wind power has zero emissions, and its source is free and generally reliable. The greatest complaints about the use of wind power are appearance and noise levels. However, both of these issues are subjective, as some people may take greater offense than others to the appearance and noisiness of a wind turbine (Renewable).

Tidal power

The idea of capturing the ebbing of the tides to produce electricity is appealing. Coastal areas worldwide experience high and low tides twice a day. However, in order for it to be an effective alternative energy source, the difference between high and low tide must be greater than sixteen feet. Only forty sites, worldwide, have a tidal range of this amount or greater. Tidal power produces clean, renewable energy at a rate that is equal if not exceeding wind power (Energy).

There are three types of tidal power technologies: barrage or dam, tidal fence, and tidal turbine. Tidal power presents serious problems for those who want to use it consistently, however. These issues include the fact that both dams and tidal fences interfere with the migration of sea life, and silt deposits behind these facilities can impact ecosystems. Tidal turbines are the least damaging of the three technologies, because they don't block migration. However, for all three options the cost of installation is expensive and as a result, not competitive with the cost of fossil fuels (Energy).

Biomass

An increasingly popular idea for reducing oil consumption is the use of biomass. Biomass is the conversion of crops into fuel, and then the subsequent burning of that fuel to produce electricity. Ethanol, which is a type of alcohol, is the most popular biofuel.

There are several types of ethanol: corn, cane and cellulosic. Corn ethanol is most popular in the U.S. where it is sold as a gasoline additive called E85 (eighty-five percent ethanol, fifteen percent gasoline). Corn ethanol has seventy-two percent lower greenhouse gas emissions than gasoline. Cane ethanol is ethanol produced from sugar cane. Mass-produced in Brazil, cane ethanol has fifty-six fewer greenhouse gas emissions than oil. Cellulosic ethanol is an idea that is still in the development stages, but if successful, any number of plant products could become fuel. Cellulosic ethanol has ninety-one percent lower emissions than fossil fuels (Bourne).

Another kind of biomass is biodiesel. Biodiesel is a low emissions alternative fuel that can be burned in diesel engines. Biodiesel is made from chemically altering plant oils. In the U.S., soybeans are used to make biodiesel, but in Germany – the world’s leading producer of biodiesel – canola oil is used to produce biodiesel. However, algae is quickly becoming a prominent player in the biodiesel arena. This is because algae can be grown virtually anywhere at a rapid rate. Biodiesel creates sixty-eight percent fewer emissions than petroleum products (Bourne).

However, all biomass has its downsides, starting with the fact that ethanol in any form packs less bang for your buck than traditional gasoline. The use of crops for fuel instead of or in addition to food also drives up prices at the grocery store. For many, it is hard to justify burning crops when people next door might not have enough to eat. This dilemma is also why algae is an appealing alternative. However, even with algae, the wide scale use of biofuels may be difficult to implement because of the cost associated with transitioning cars and gas stations to run and dispense biomass, respectively.

Conclusion

In order to create a sustainable environment for future generations, an alternative to fossil fuels must be found sooner rather than later. The use of nuclear energy and biomass can serve as a way to help the transition from fossil fuels to a renewable energy source, but neither is a long-term effective alternative. Instead, renewable energy sources like solar, wind, hydro, and tidal power in combination with each other have the greatest chance of eliminating our dependency on oil. Different regions must capitalize on the resources available to them (lots of sunlight, high winds, large tidal ranges, etc.), and focus their energy production around these strengths, supplementing their production requirements with other renewable energy sources wherever possible. If this happens, then sustainable, emissions-free electricity will become a reality for all of us. And if these energy sources are used to create hydrogen, then gasoline will become obsolete for use in cars.

The ability to break America’s dependency on foreign oil is at our fingertips. As long as we play our cards appropriately, then a brighter and more sustainable future will be our gift to future generations of Americans.

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