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The Future of Energy on Planet Earth

When one looks around himself today, one sees machines, cars, computers and machines that can do various tasks. But thinking deeper, one realizes everything that goes into making that particular device and also what keeps that device running for the years to come. A major component of this is called *energy.* Energy in physics is defined as the ability to do work. Work can be anything from moving a huge truck to moving electrons in a computer. Technology has given the human race the edge to acquire this energy required to run these machines. But is current technology sustainable?

Today we use various sources to satisfy the energy requirements of the world. Some examples include coal, oil, nuclear, solar, wind, hydroelectricity and a few more. The conventional sources include coal and oil, and nuclear energy in the recent past (Hagge). Out of these, coal and nuclear energy have primarily been used for electricity production. Oil has been used for running machines and automobiles around the world. Any preliminary physics book would explain that energy can neither be created nor destroyed, but can only be converted from one form to another. Conventional sources of energy have used this knowledge to convert heat energy to electricity, the form of energy that is most extensively used in today’s world. We heat coal, burn oil or split an atom to get the required heat energy. This heat energy is used to produce electricity for different purposes.

Using conventional sources of energy have some major advantages. The Earth’s crust contains coal and oil in an impure form. Current technology can easily refine them into coal and petroleum products for the use of energy production inexpensively. With nuclear power, the fuel (Uranium) for the power plants is very inexpensive and readily available in the earth’s crust (Hagge). The ease with which current technology can access these forms of energies has resulted in them being the most common form of energy production. All these advantages may seem like a perfect solution to the energy requirements of the world but recent research has enlightened us with the dark side of using these sources extensively for our needs.

The population of the world has been on a steep rise in the past two decades and “primary energy has grown by 49% and CO2 emissions by 43%, with an average annual increase of 2% and 1.8% respectively” (Perez-Lombard, Ortiz, and Pout 394-398). Dr. Bo Nordell, in his research report, points out that “the estimated temperature increase during the past century was between 0.4 and 0.8 oC with the 10 warmest years all occurring within the last 15 years” (305-312). Major CO2 emissions come from burning coal and oil/petroleum products. The increasing population has resulted in more people using automobiles, using more machines for construction and burning more oil to meet energy demands. This introduces more greenhouse gases that warm up the atmosphere. The temperature rise may not seem much now, but in the long run it may prove to be significant. Furthermore, as Dr. Hagge states in an interview, this source of energy is not self-sufficient. In the report, *Running out of and Into: Analyzing Global oil Depletion and Transition Through 2050*, the authors compare the current oil situation to the tale of the shepherd boy who cried “Wolf!” The initial boom in oil industry raised many questions about its sustainability, but has always been rising to meet the energy demands of the world. Now, when we can see that it can possibly perish, there are not many resources being allocated to move to a more sustainable energy form. Peaking is a term that has been recently described as a phenomenon where oil production reaches its peak and starts to drop down. With some strong sources and extensive research, the authors of the report claim that oil production can peak any time between 2021 and 2125 with 90% probability of happening before 2050 (Greene, Hopson, and Li 14-20). This is one of the major issues that must be addressed sooner than later since most of our energy comes from these sources. Nuclear energy seemed like a good solution to overcome the drawbacks of coal and oil but there have been issues regarding storage of nuclear waste material. Plutonium, the waste product of a nuclear reactor is a radioactive material that is extremely dangerous to living cells. Although there have been solutions to store this material, politics and fear forces companies to limit themselves to establish nuclear power plants in a few select places. Recycling is another option which would make this nuclear energy fairly expensive, but less dangerous. This is practiced in France, but not in other locations due to economic reasons. Assuming that we devise a good way to store nuclear waste, another issue is with safety of nuclear power plants. Natural disasters and terrorist attacks are unpredictable and could potentially destroy millions of lives close to a nuclear power plant. The Fukashima nuclear disaster in 2011 is a good example of the risks involved with nuclear power production (Hagge). Such high risks and future threats force us to devise a clean, sustainable and safe way of producing energy. Thus, there is a necessity to allocate resources to find a cleaner and safer form of energy production that would help the world move to a more sustainable future.

Realizing the recent threats of our conventional energy sources and production methods, an increasing amount of resources have been allocated for research and development of a renewable source of energy. Dr. Rajagopalan points out that the current demand for energy is rising very fast. The supply is currently able to keep up with this demand but he fears that sooner or later conventional sources may not be enough, keeping in mind the pollution they cause and the limits on the amount of coal and oil available. Hydroelectricity, biomass, wind energy, solar energy, geothermal energy and tidal energy are among the most popular renewable sources of energy. Dr. Hagge describes each one of them as follows:

* Hydroelectricity is the technology of converting flowing water from the top of a dam into electricity. This form of energy production has pretty much reached its saturation point since almost every place that can be dammed has been done. There is very little improvement that can be done to produce more energy from this form.
* Biomass is a renewable form of energy that is obtained from paper and wood waste. This is in its initial stages and could prove to be very useful in the future.
* Solar energy is converting the energy from sun into electricity using solar cells. Although solar energy has been around for a while, the high costs involved cells limits its use.
* Geothermal energy is converting energy from geysers into other useful forms, such as electricity or mechanical. This form limits itself to be used in places with the availability of geysers.

Wind energy production has turned out to be little more advantageous than other sources mentioned, with its drawbacks.

Wind energy, just as one may think, is converting energy in wind into something that we can use, like electricity. This energy was initially used during the industrial revolution for grain grinding. Later, during WWII it was designed to be more of a self-sustaining energy source that produced electricity. Since then there has been some research done, but not much. Today, wind energy is mainly used for producing electricity. A wind turbine is the device used to convert wind energy into electricity. In simple terms, blowing wind turns the blades of a wind turbine which in turn generates electricity. Just like other energy producing methods, wind energy has its advantages and disadvantages.

Wind energy has become more popular in the last decade since it has got some significant advantages. One of the main plus points is the fact that the fuel required for this form of energy is completely free. Furthermore, wind never dies. No matter what, wind will always keep blowing around the world. This means that one of the important raw materials for wind energy production is non-exhaustible (Rajagopalan). Also, just using moving wind to generate electricity or other forms of energy has no emissions or waste products, thus making this a clean form of energy production. According to the research article, *Cost-Effective Wind Energy Utilization for Reliable Power Supply,* wind energy production is an “ideal choice in developing countries where the most urgent need is to supply basic electricity in rural or isolated areas without any power infrastructure” (Karki, and Billionton 435-440). In another research article, *Energy and clean water coproduction in remote islands to face the intermittent character of wind energy,* published in the International Global Energy Issues, points out that wind energy is probably the best solution for islands since they are isolated (Kaldellis, Kavadias, and Kondili 298-311).

It may seem like all problems can be solved from the advantages of wind energy but it has some significant drawbacks too, which prevent it from being among the conventional energy producing methods. The main disadvantage is the variable winds. There is no way one can predict the amount of wind that will blow over a period of time. This factor varies the price of wind energy significantly, according to weather conditions. Also, wind energy production is at its peak during the night time, when there is minimum requirement of energy. Again, shutting down other sources of energy during night to use wind is not feasible because of the variability of wind. Another problem is our current technology to store electrical energy. The variable wind might still be helpful, if we could capture it when it blows and store it for future use. Today, it is extremely expensive and not very effective to store and use energy. Wind energy also requires large chunks of land to set the wind turbines on, to make it economically profitable. For this reason they are set up in unpopulated areas, due to the easy availability of open areas. On the other hand, the major energy requirements are in highly populated areas, often thousands of miles from where the wind farms are set up. This results in some significant energy losses in transportation of electricity (Hagge). Inhabitation in the area where wind farms are set up could cause problem due to acoustic and noise characteristics of wind turbines. Also, recent reports have claimed that wind turbines kill migrating birds which affects breeding of terns in Zeebrugee, Belgium (Everaert, and Stienen 3345-3358).

Wind energy has its positive and negative points but is far away from becoming a major source of energy in the next few years. With current technology, we can allocate 20% of our energy at the maximum, to come from wind energy (Hagge). As of now, wind can only serve as an alternate source of energy, to help us reduce the negative impacts of conventional sources of energy. Although finance is a problem with wind energy, Europe has around 216,769 MW worth of wind energy projects planned for 2012. USA and Canada together are aiming to produce close to a 100,000 MW of energy using wind turbines (McKenna 5-15). These trends prove that the world wants to head to a more sustainable, clean and safe form of energy production. Dr. Rajagopalan notes that the world is already 30 years behind in research for wind energy, and there needs to be more resources and funds allocated for this purpose. With recent advancements, it is very clear that further research and development can significantly improve the application of wind energy, helping the world to move to a better and safer future.

Wind energy is free, clean and sustainable. Recent past has seen wind being used to generate electricity but there have been some suggestions on using wind power for other purposes such as to produce hydrogen or pump water to a height for hydroelectric production. This will enhance the use of wind energy in a variety of fields. There is a necessity for a renewable and clean form of energy. The future of the world is in our hand and it is our responsibility to protect it.

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