

Energy | Environment

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Introduction

Fossil fuels are well known and accepted as the single most important contributor to global warming. Their use has been increasing since the industrial revolution from the late 1700's to the early 1800's as the world demand for energy has sky rocketed and shows no signs of slowing down. At first the effects of fossil fuels on the environment were ignored. But as more studies were done by scientists showing the long-term implications, there has now become a worldwide "green" movement to develop cleaner, more environmentally friendly alternatives to fossil fuels. These include biofuels, fuel cells and ethanol. Each has to be carefully assessed to make sure that in the whole process, they are having a benefit on the environment. These times are exciting as people of the world are now more aware and are prepared to understand and change.

Global Warming

What is global warming?

Global warming as stated by Al Gore and NOAA starts when the sun's energy enters the earth's atmosphere. This energy heats the earth and then some of it is reflected back towards the atmosphere (Gore, 2006; Effect of Global Warming, 2007). Normally this energy is partially blocked by the greenhouse gasses in our atmosphere. Today greenhouse gases are increasing from human activity, which makes them in excess (Effect of Global Warming, 2007; Gore, 2006; NOAA, 2008). The increase of greenhouse gases keeps more and more of the outbound energy. This is the cause of global warming says Gore and Effect of Global Warming.



The Greenhouse Effect

The greenhouse effect is caused by greenhouse gases rising to the atmosphere where they stay (NOAA, 2008; Nave, 2000). Also according to NOAA and Nave the greenhouse gases can also absorb some of the energy producing heat. Greenhouse gases are gases that allow energy through the atmosphere but block some outbound rays as says Gore and Nave. Gore also says that carbon dioxide (CO₂) is 80% of the greenhouse gases. This gas says Gore and Nave is primarily caused by the burning of fossil fuels. In the winter of the northern hemisphere, greenhouse gases go up due to the tilt of the earth (Gore, 2006). Looking at a map you would see that the majority of the land on earth is above of the equator meaning that most of the vegetation is above of the equator. In the northern hemisphere's winter when they are pointed away, the earth has less vegetation to remove the greenhouse gases. In their summer there are more plants to remove the levels of greenhouse gases.

The Ozone Layer

The ozone layer is made up of ozone (O₃) which is in other words three oxygen atoms. The ozone layer today protects us from UV radiation (NOAA, 2008; The APEC Virtual Center for Environmental Technology Exchange, 1998). CFC's which are also called chlorofluorocarbons are a greenhouse gas says NOAA. The CFC's, states NOAA and The APEC Virtual Center for Environmental Technology Exchange, destroy the ozone layer. The atoms of the CFC's approach the ozone layer where the UV radiation is strongest. This UV radiation release chlorine atoms that are inside of the CFC's. The reaction between the rays and the atoms destroys the ozone layer (The APEC Virtual Center for Environment Technology Exchange, 1998).



Biofuels

What are biofuels?

Biofuels the abbreviated term for bioorganic fuel is any plant or animal substance that can burn (Wikipedia, 2008). Wikipedia also says that biofuels are an alternative to fossil fuels. Biofuels can come in many forms including first generation, second generation, and third generation. While all generations use different sources they are all natural. First generation biofuels as said by Shell and Wikipedia are biofuels made from a food crop. Examples of this include vegetable oil and bioalcohols (Wikipedia, 2008; Shell, 2007). Second generation biofuels are biofuels that are made without food crops (Wikipedia, 2008; Shell, 2007). Shell also says that the main advantage of using non food crops is that there is no competition between the food and biofuels crops. Third generation biofuels are made from algae which is biodegradable meaning that it will disappear in a short amount of time as says Wikipedia. Wikipedia also says that third generation biofuels have 30 times more energy than land. This would mean that to replace the all of the fossil fuels in the US we would need 38,849km².

Problems with Biofuels

Although biofuels can be quite beneficial they can also cause some problems. The production of ethanol requires corn which made the food prices in the UK rise 3 times faster than the previous year (Macalister, 2008). Another problem caused primarily by ethanol is the dead zone. This zone which is now 20500km² is inhabitable by aquatic life (Boyle, 2008). At the farm the corn is fertilized by nitrogen. This nitrogen then spills into the Mississippi River which leads to the Gulf of Mexico. Boyle says that the nitrogen causes the growth of algae. When the algae die they take the oxygen out of the water. Boyle also says that rivers that carry the nitrogen can use a process called denitrification which transforms the liquid nitrogen into nitrogen gas. This gas rises out of the water and makes air which is 78.084% nitrogen (Lide, 1997). Another problem with biofuels is that they take large amounts of land to cultivate the crop.



Recently rainforests are being removed to make way for fields for the production of biofuels (Macalister, 2008). Macalister also says that by removing natural habitats to grow crops for biofuels releases 17 - 420 times the amount saved by using biofuels.

Ethanol

What is ethanol?

Ethanol is a form of biofuels that is a grain alcohol (US Department of Energy, 2007). Made from plants, corn and sugarcane ethanol no matter how it is produced still has the same chemical compound (Halperin, 2006; US Department of Energy, 2007; Macalister, 2008). Macalister also says that sugarcane has 10% of fossil fuels carbon footprint while corn is between 80 and 90 percent.

Dry Mill Production

Regular production of ethanol which takes place in a dry mill says Halperin, starts with the grinding of the source into powder (Halperin, 2006; US Department of Energy, 2007). After this Halperin and US Department of Energy say that the powder is then mixed with water and heated. After this an enzyme and yeast is added this causes the fermentation of the mixture (Halperin, 2006; US Department of Energy, 2007). Finally the mixture is distilled to remove the last water leaving pure alcohol says Halperin and US Department of Energy. The US Department of Energy also specifies that there is a chemical added to render the alcohol undrinkable.

Wet Mill Production

Wet mill production is a shorter process but there are more leftovers. First the source is soaked to separate the protein and starch (US Department of Energy, 2007). The starch is then ground and



processed to produce sugars. Finally the sugars are fermented to produce the alcohol, ethanol (US Department of Energy, 2007). The extra leftovers are the protein.

Ethanol's Advantages

Ethanol has many advantages and disadvantages. Starting on the advantages side ethanol is classified as a renewable energy says Halperin and US Department of Energy. Halperin and US Department of Energy also say that ethanol is also produced closer than fossil fuels making the transportation and pollution less. Once the ethanol is successfully transported and being used it burns cleaning than fossil fuels reducing the pollution (Halperin, 2006; US Department of Energy, 2007; Wikipedia, 2008). Wikipedia says that ethanol produces 21% less CO₂ than fossil fuels. The US Department of Energy also states that ethanol is a higher octane fuel letting engines run at higher compression. This means more power from the engine. Ethanol is also the producer of jobs. In rural areas ethanol created over 160,000 jobs.

What is wrong with ethanol?

While ethanol has its advantages it also has its disadvantages. Halperin says that ethanol cannot travel in pipelines because it picks up water in the pipelines. This means that the ethanol must be transported by trucks which adds to the production cost. Halperin also says that since ethanol does not contain as much energy as fossil fuels the end users must stop more often to achieve the same distances. During the production process Wikipedia says that during the fermentation stage ethanol releases a gas know as VOC or volatile organic compounds. This gas must be eliminated by installing thermal or catalytic oxidizers on the plants to burn the gases (Wikipedia, 2008).

Mixtures

Ethanol normally comes in two different mixtures, either E85 or E10 (US Department of Energy, 2007). E85 is a mixture made from 85% ethanol and 15% fossil fuels. This mixture can be used by flex



fuel vehicles (US Department of Energy, 2007). The US Department of Energy also states that the mixture E10 which can be used in most vehicles today, is a mixture of 10% ethanol and 90% fossil fuels. This mixture is the more polluting of the two.

Fuel Cells

What is a fuel cell?

Fuel cells are the future of electric vehicles. While an electric vehicle has to be charged for long periods of time to be used a fuel cell vehicles produces electricity while it is running through the separation of an atoms composition of protons and electrons. A fuel cell is an electrochemical device that splits the fuel, which is generally hydrogen, by using a catalyst (National Renewable Energy Laboratory, 2008). The fuel cell used by general transportation today is called a PEM which is abbreviated from polymer electrolyte membrane or proton exchange membrane (US Department of Energy, 2007; Wikipedia, 2008).

How does it work?

PEM fuel cells are fuelled by pure hydrogen (US Department of Energy, 2007; National Renewable Energy Laboratory, 2008). First the hydrogen is fed into the fuel cell where it meets a platinum catalyst which is used to separate the atoms interior (US Department of Energy, 2007; Wikipedia, 2008). The protons pass through the catalyst while the protons pass in a circuit to provide power (US Department of Energy, 2007; Wikipedia , 2008; National Renewable Energy Laboratory, 2008). More specifically Wikipedia states that the electrons enter on the anode and pass to the cathode to rejoin with the hydrogen protons. Between the anode and the cathode the electricity is used to power an electric motor which moves the vehicle. Wikipedia also says that where the electrons meet the protons oxygen is fed in and takes place in a chemical reaction to form water. This means that the



only waste is water and heat which is produced from the running temperature of 80°C (US Department of Energy, 2007; Wikipedia, 2008).

Disadvantages

Even though hydrogen fuel cells do not have toxic waste there are still some downsides. Firstly, hydrogen is low density which means that it is hard to store (US Department of Energy, 2007). The US Department of Energy also says that since there is not much hydrogen stored it is hard to travel far distances without having to refuel. Another problem as described by the US Department of Energy is that fuel cells can also be fuelled by gases like methanol and ethanol. Gases like these release carbon dioxide which is a greenhouse gas. This said the amount of pollution is still less than fossil fuels. Another disadvantage to using these gases is that to use them hydrogen gas must be extracted from the gases and then fed into the fuel cell. This means that there is other waste and also there must be an extractor onboard which adds to cost and weight (National Renewable Energy Laboratory, 2008).

Conclusion

Global warming is the most important problem facing us today. As weather patterns become more extreme and ice fields melt into the ocean and polar bears face extinction people of the world realize that the world has to change. If we can reduce our dependence on fossil fuels then this will go a long way to reducing greenhouse gases and therefore global warming. Biofuels, ethanol and fuel cells are some of the ideas that are the beginning as the world searches for environmentally friendly energy.



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