Options For Zero Emissions Essay, Research Paper

Air pollution has been a known problem for a very long time. There have numerous measures to try to lower the levels of pollutants that factories, chemical plants, incinerators, and power generating facilities create. These facilities are now regulated strictly by governments around the world. There is still an even greater threat to our atmosphere, the pollutants that come out the exhausts of internal combustion engines (ICE) of automobiles. Cars are our a permanent part of our society, they cannot be eliminated or even substituted. An alternative to the ICE has to be universally accepted and must be used by all of our society.

One Type of Alternative is the hydrogen fuel cell. The hydrogen fuel cell works similar to that of a battery, yet it doesn’t need replacing or charging. Hydrogen Fuel Cells combine elemental H2 gas with oxygen from air to create an electric current and pure H2O. As with the nitrogen, this is a very efficient reaction. The fuel cells, many of which are put next to each other to make a ’stack’, each have two semi-porous electrodes separated by a liquid electrolyte. The interior side of the electrodes are coated in a platinum catalyst. When the two elements come in contact with the catalyst and the electrolyte as they seep through the semi-porous electrode, they each ionize. The H+ ion is is then attracted to the 2-minus charged oxygen ion. They combine to form pure water and this is drained from the fuel cell. The electricity created runs through the circuit connected to the electrodes. One of the biggest developers of the fuel cells is the US Department of Energy. Through the DOE, fuel cells were used on space missions (astronauts could even drink the water produced!) and with their funding, fuel cells are being tested and implemented as stationary power stations.

Ballard Power Systems is one of the largest companies in the field of fuel cells. They develop fuel cell powered vehicles, power stations, portable generators, and marine generators. Ballard has formed an alliance between DaimlerChrysler and Ford Motor company to further advance this very promising technology. With the large amount of funding and research abilities thatthese three corporations have, the future of fuel cells is very bright.

Hydrogen fuel, which can be obtained from fuels such as natural gas, methanol,or petroleum, and oxygen from the air electrochemically combine in the fuel cell to produce electricity. Heat and pure water vapor are the only by-products from the fuel cell’s electrochemical reaction

A single fuel cell consists of a membrane electrode assembly and two flow field plates. Each membrane electrode assembly consists of two electrodes (anode and cathode) with a thin layer of catalyst, bonded to either side of a proton exchange membrane (PEM).Gases (hydrogen and air) are supplied to the electrodes on either side of the PEM through channels formed in the flow field plates. Hydrogen flows through the channels to the anode where the platinum catalyst promotes its separation into protons and electrons. On the opposite side of the PEM, air flows through the channels to the cathode where oxygen in the air attracts the hydrogen protons through the PEM. The electrons are captured as useful electricity through an external circuit and combine with the protons and oxygen to produce water vapor on the cathode side.

The biggest advantage that fuel cells have is that the exhaust that is created from the reaction that takes place in a fuel cell is pure water vapor. This vapor can be condensed and used to cool the fuel cell car’s electric motor. Fuel cell powered cars also have the speed, torque, reliability, and range of a ICE powered car. The fuel cell’s biggest downfall is its cost. A fuel cell powered car’s base price is 35,000 – 40,000 dollars, the cost of a midsize luxury car.

Another alternative is liquid nitrogen propulsion. Elemental nitrogen has a very low boiling point. As a result of this,when liquid nitrogen is stored in a pressure controlled environment, it stores a large amount of potential energy. In the LN2000 liquid nitrogen powered concept car, being developed at the University of Washington, the liquid fuel is let out of a pressurized tank, preheated by an economizer which takes heat from the exhaust before it quickly vaporizes, expanding rapidly in an endothermic reaction. This expanding gas is converted into energy that moves the wheels of the converted mail truck by a 15 hp radial air motor. As nitrogen gas is the main element in air, and pure nitrogen gas is the only product of the reaction involved, there is no pollution produced by running this car.

The main problem that developers of N2 powered cars had to overcome was that when thenitrogen was expanding, it absorbed so much heat, that the pipes that carried the gas would freeze up.This problem has been solved in the LN2000 by preheating the liquid nitrogen in such a way that ice is less likely to form and insulate the pipes and nitrogen from the ambient heat.The motivation behind this invention was that although fuel cells were effective at providing electricity with zero-emissions, the cost of a drive train with fuel cellpower would be seven to ten timesthat of a gasoline engine drive train. The inventors feel that nitrogen,once the process is refined, will have a cost per mile comparable tostandard gasoline.

Another liquid nitrogen concept car is the Cool N2Car is being developed

at the University of Northern Texas. It employs a very similar method tothe LN2000 car.A

possible drawback to this method of propulsion is that energy must be spent in order to compress the nitrogen and this energy may not be available in such efficient forms as nitrogen liquid is. The following is a quote from the inventors of the LN2000 on that subject:

“The process to manufacture liquid nitrogen in large quantities can be environmentally very friendly, even if fossil fuels are used to generate the electric power required. The exhaust gases produced by burning fossil fuels in a powerplant contain not only carbon dioxide and gaseous pollutants, but also all the nitrogen from the air used in the combustion. By feeding these exhaust gases to the nitrogen liquefaction plant, the carbon dioxide and other undesirable products of combustion can be condensed and separated in the process of chilling the nitrogen, and thus no pollutants need be released to the atmosphere by the powerplant. The sequestered carbon dioxide and pollutants could be injected into depleted gas and oil wells, deep mine shafts, deep ocean subduction zones, and other repositories from which they will not diffuse back into the atmosphere, or they could be chemically processed into useful or inert substances. Consequently, the implementation of a large fleet of liquid nitrogen vehicles could have much greater environmental benefits than just reducing urban air pollution as desired by current zero-emission vehicle mandates.” (Hertzberg)

Right now, electric cars are being sold at a car dealership somewhere near you. These cars are in production now. Some are strictly electric and have short ranges and long charge times, while others are hybrid cars, where there is an electric motor and a gas powered generator to supplement the batteries. The batteries in an electric car are similar to the fuel cells in that they use a chemical reaction to generate electricity. The difference is that the batteries have a life span. Eventually they will need to be replaced. The fuel cells will not. They act almost as catalysts themselves, while the batteries act as reactants. Another disadvantage of the batteries is that they take a long time to charge. Drivers could be sitting at the station for over an hour waiting for their batteries to charge. You could fill a tank of hydrogen in about fifteen minutes.

Electric cars, mainly because of their limited range, have limited uses. For long and medium range commuters, the EV (electric vehicles) fall short of the needs of these consumers.

The alternatives are clear and the facts have been presented. All of the alternatives are better than no ozone layer, smog, and cancer. Zero emissions vehicles are the future and we will all breathe easier.