Hydrogen Fuel Cell

New Mexico

Supercomputing challenge

Final Report

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Summary:

Our team is concerned with the future shortage of oil. Our project is to find a new source of fuel through water – which is currently abundant. We will separate water (H20) hydrogen and oxygen with a homemade hydrogen generator. The separated hydrogen can fuel a car. If not, we can give the current fuel a higher oxide content making it more combustible; in turn making less fuel more efficient.

Problem Definition:

The world's oil is running out and we have no other major energy source. Oil sources are running low and will soon be out. We need to create a new form of energy that can be mass produced be for we run out of our current sources.

Solution:

"Many companies are currently researching the feasibility of building hydrogen cars, and some automobile manufacturers have begun developing hydrogen cars. Funding has come from both private and government sources. However, the Ford Motor Company has dropped its plans to develop hydrogen cars, stating that "The next major step in Ford's plan is to increase over time the volume of electrified vehicles". Similarly, French Renault-Nissan announced in 2009 that it is cancelling its hydrogen car R&D efforts. As of October 2009, General Motors CEO Fritz Henderson noted that GM had reduced its hydrogen program because the cost of building hydrogen cars was too high. "It's still a ways away from commercialization", he said. The "Volt will likely cost around $40,000 while a hydrogen vehicle would cost around $400,000. Most hydrogen cars are currently only available as demonstration models for lease in limited numbers and are not yet ready for general public use. The estimated number of hydrogen-powered cars in the United States was 200 as of October 2009, mostly in California." This is off of a wiki page. This shows that hydrogen power is second best compared to electric cars. This does not excuse the fact that we still need electricity. With our hydrogen fuel cell we could make a generator to make the electricity that powers these cars. The hydrogen is combustible and can be used as a fuel like in a diesel generator.

Hyundai revealed its Blue ("Blue Square") fuel cell electric vehicle (FCEV) in 2011, they also planned to have FCEVs available for sale by 2014. In early 2009, Daimler announced plans to begin its FC (Fuel Cell) vehicle production in 2009 with the aim of 100,000 vehicles in 2012–2013. In 2009, Nissan started testing a new FC vehicle in Japan. In September 2009, Daimler, Ford, General Motors, Honda, Hyundai, Kia, Renault, Nissan and Toyota issued a joint statement about their undertaking to further develop and launch fuel-cell electric vehicles as early as 2015. These cars are a hybrid of electricity and hydrogen.

Honda presented its first fuel cell vehicle in 1999 called the FCX. In 2007 during the greater Los Angeles Auto Show, Honda revealed the first production model of the FCX Clarity. The FCX Clarity is available in the U.S. only in Los Angeles Area, where 16 hydrogen filling stations are available, and as of July 2009, ten drivers had leased the Clarity for US $600 a month. Honda stated that it could start mass producing vehicles based on the FCX concept by the year 2020 and reaffirmed, in 2009, which it continues to put resources into hydrogen fuel cell development, which it saw as "a better long term bet than batteries and plug-in vehicles". In December 2010, however, it introduced a BEV version of the Honda Fit, using elements of its hydrogen engine design, stating that the "industry trend seems to be focused on the battery electric vehicle".

How it works:

Fuel cells are simple products of engineering that consist of an electrolyte sandwiched between two electrodes, an anode and a cathode. Two bipolar plates on the sides help disperse gases and serve as currents. With the polymer electrolyte membrane (PEM) fuel cell witch has been found as the most efficient for light transportation, hydrogen travels through channels to the anode, at this point a catalyst causes the hydrogen molecules to separate into protons and electrons. The membrane only lets protons pass through it.

The anode is a negatively charged post where electrons are freed from the hydrogen molecules; these will be used later in an external circuit. The cathode is the positive post of the fuel cell. It has rivets etched into it that will disperse the oxygen into the surface of the catalyst. The cathode will also bring electrons back from the external circuit to the catalyst where they form water. The catalyst is a particularly special material that handles the reaction of oxygen and hydrogen. It is typically made of platinum nanoparticles very thinly coated onto carbon paper or cloth. The catalyst is a very rough and porous so that the maximum amount of surface area of platinum will be exposed to the hydrogen or oxygen.

Fuel cell type	Operating temperature	System output	Efficiency	Applications
Alkaline (AFC)	90-100 c 194-212 f	10kw-100kw	60-70% electric	Military Space
Phosphoric acid (PAFC)	150-200 c 302-392 f	50kw-1mw	80-85% overall with combined heat and power 36-42% electric	Distributed generation
Polymer electrolyte membrane or proton exchange membrane (PEM)	50-100 c 122-212 f	<250kw	50-60% electric	Backup power Portable power Small distributed generation transportation
Molten carbonate (MCFC)	600-700 c 1112-1292 f	<1mw	85% overall with CHP (60% electric)	Electric utility Large distributed generation
Solid oxide (SOFC)	650-1000 c 1202-1832 f	5kw-3mw	85% overall with CHP (60% electric)	Auxiliary power Electric utility Large distributed generation