Report on

The Car that will survive the Energy Problem

submitted to
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Juny 17, 2012

The report looks at our seminar “The Car that will survive the Energy Problem”. It was a lesson about different drives and efficiencies of cars. We compared three types of alternative drives. This topic was introduced by a presentation and was discussed afterwards.

Abstract

We are three students from the University of Applied Sciences Dresden. We are not going to change the world but we will be part of a future that will differ from the present in one point in particular: Energy! It is part of our daily life to be transported by different means. Some of us take the tram or bus to reach the university, some of us go by bike or walk. Others drive their cars over lonely highways to come to work but many get stuck in traffic-jams every day. People need much of their valuable time to get from one place to another spending a far bit of their income. News reports broadcasting that oil resources are continuously decreasing made us think.

As students of computer science and mechanical engineering, we have chosen the topic of alternative drives because we are very interested in this field and it could soon be part of our studies. We are determined that more protection of the environment is needed and we want to explain our motivation to explore new energy sources. This goes hand in hand with the dependency on fossil fuels. We stated that these fuels will eventually run out and we already need other solutions to provide usable energy today. This is important not only for the automobile technology, as shown in our seminar, but also for all other energy-consuming branches.

Our seminar was designed in a way that we could demonstrate different energy sources with the potential to revolutionize the whole transportation sector. We talked about biomass and its secondary products, engines powered by hydrogen and electricity with its storage issues. Parts of the main content were extracted to develop little exercises, which included questions about the seminar itself, a passive-to-active-exercise and, as a third task, a free writing practice. All these exercises corresponded with our topic. At the end of our presentation, we have asked critical questions to find out about the opinions of our fellow students and to solidify our position in a free debate.

The seminar was accompanied by a presentation, created with a free on-line program called PREZI to underpin our spoken words and to visualize them with some pictures and statistics.

We wanted to show that new energy sources are important for the future transportation sector. In the beginning we talked about the current situation, dependencies on oil and other fossil fuels. Then the main focus was set on biomass, Electric Drive and Hydrogen. Biomass was chosen as a first alternative because it is very similar to traditional fuels. It often can be used in the same or only little modified engine.

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Part 1: Introduction

Due to a steady decrease of the oil production and the rise of fuel prices, the world needs to look out for alternative ways of driving. We want to focus on different alternatives that are independent of decreasing mineral fuel. All people are dependent on various means of transport which is a necessary part of the modern daily life. Today our society would not function without it, anymore.

During the process of analyzing our sources, it soon became obvious that there are many potential alternatives. Hours of research have been spent by companies to find and develop new drives that reduce the dependence from mineral fuel. Positive aspects like eco-sensitivity, good energy efficiency and a low noise emission are often paired with high costs, complicated production and little experience in this new field. We decided to choose three ways that could sustain mobility in the future: biomass, electric drive and hydrogen drive. Based on this, we want to compare these new technologies to the old- fashioned ones.

Part 2: Biomass

Considering that burning fossil fuels promotes a greenhouse effect, exploring renewable organic energy seems to be a good idea. Biomass is known as organic material that is burned to produce usable forms of energy. As sources, vegetation, residues from agriculture and forestry, and municipal waste are used. Furthermore secondary products from this material are considered to be used as feedstock for fuels, like alcohol. By using biomass we produce energy that has been stored by the process of photosynthesis. This is a chemical reaction in which carbon dioxide and water are transformed into oxygen and glucose through the input of solar energy. Burning fuels produces carbon dioxide and other greenhouse gases. In the process of photosynthesis carbon dioxide from the air is bound. Therefore biomass is basically self-renewing.

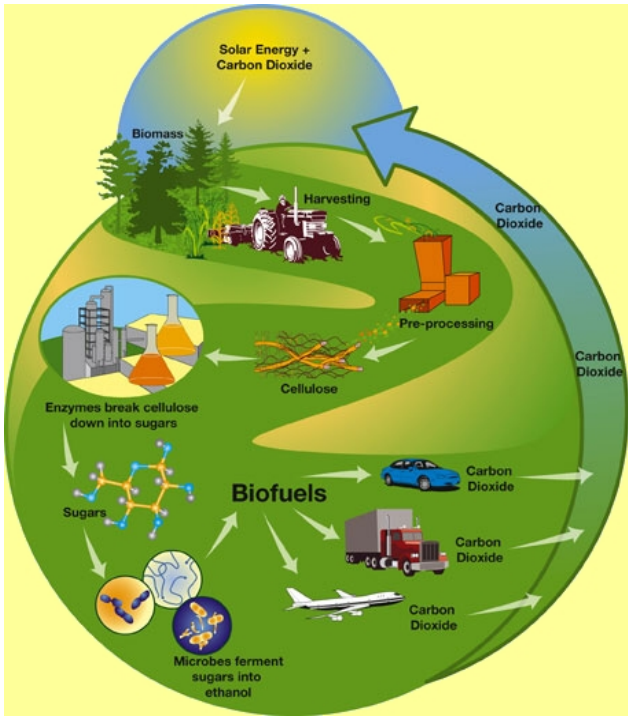

Fig. 1: Carbon Circle

While both biomass and fossil fuels release the same amount of carbon dioxide when they are burned, the gas that comes from biomass was recently captured during photosynthesis and equals itself out.

Some products that can be manufactured from biomass include such things as antifreeze, plastics, acids for photographic film, oil, wood adhesives, foam insulation, glues, and even toothpaste.

Another fact is that the land, which is used to produce crops for biomass cannot be used to produce food. Crops that are harvested for use as biomass can often be immediately replanted and need less quality soil. Trees and grasses that are native to a region often require fewer synthetic inputs and pose less risk of disruption to agro-ecosystems. For that reason, new bio-fuels will become more easily available in the future which in turn will provide an ecological or atmospheric solution.

The energy density is generally smaller in comparison to fossil fuels. Green woody biomass contains as much as 50% water by weight. Therefore harvested biomass cannot be shipped

as cheap as conventional fuel. However, there are ways to increase the energy density of biomass. Drying, grinding and pressing increases its energy density and decreases shipping costs.

As mentioned before the technology to use biomass as an energy source for propelling cars and trucks is already widespread. But there is not enough land to grow the required masses for the production of bio-fuels to maintain a transportation system like we have today – otherwise biomass will not be sustainable anymore.

Part 3: Electric Drive

Searching for another clean and renewable way to power vehicles we came to a system that seems to be newly expored but is not at all.

Electric cars were popular in the late 19th and early 20th century and disappeared, because of the boom of the internal combustion engine. Electric cars were also the first cars that were able to break the 100 km/h barrier. Nowadays the electric engine is booming again, which is caused by the steady decrease of fossil fuels. Hence, therefore there is a need of an alternative engine to improve the cars.

Electric cars are powered by an electric engine, that gains energy out of a 300 Volt battery array. The batteries need much space because smaller batteries that are able to store the same energy do not exist, yet.

We wanted to focus on the difference between the electric engine and the normal internal combustion engine via the aspects of their general facts, energy balance and recharging/ refill. The energy balance of an electric car is much better than that of normal cars since an electric car doesn't exhaust carbon dioxide, because there is no combustion happening inside of the engine. Only the production of electricity creates pollution but with the increase of greener energy this factor will diminish. Shown in the figure below, an electric car is able to drive 1000 miles with 3 gallons, while a normal car needs about 48 gallons. The

3 gallons are converted from electricity that's needed to drive these 1000 miles. Furthermore the energy efficiency of electric cars is better than of normal cars which is caused by the little loss of energy generated at power stations.

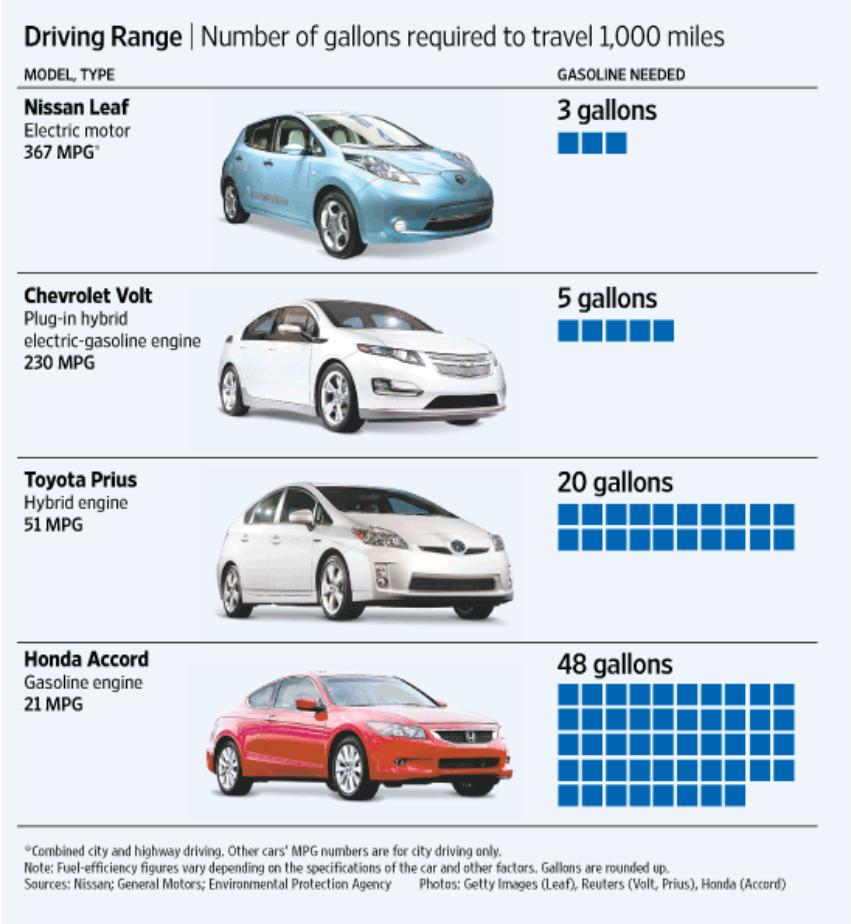

Fig. 2

Nevertheless, electric cars have problems, that is charging for example. It does not happen within 2 minutes as refilling the gasoline tank of a normal car does. You will need at least 30min to recharge the battery. The worst case would be around 4-6 hours for one recharge. Furthermore the infrastructure of charging stations is not widely spread in Germany, so it is almost impossible to find a station in a rural area. Most charging stations are located in cities. Maybe there are technologies available in the future that swap batteries.

Part 4: Hydrogen Power

The hydrogen fuel was the last of the main points in our presentation. This part included the internal combustion engine which runs on hydrogen, fuel cells and thoughts about environmental pollution. (when driving on hydrogen)

At first we briefly described how the hydrogen internal combustion engine works, and then we quickly went to the fuel cell, which was the main focus in this part. The structure and the function was described and we mentioned a number of different fuel cells. The function of a cell was also illustrated by a graphic. A short demonstration was one of our highlights: We brought a model car with a reversible fuel cell, which was explained at first. After a short time the car drove by itself and with no harmful emissions. This model was used to demonstrate the separation of water into oxygen and hydrogen. The reverse process followed immediately and produced an effect. It generates electrical energy so that the model car could drive on its own. We also mentioned the efficiency of the fuel cell and the very high cost of production. However a major advantage of this technology is definitely the low environmental pollution, especially if one looks at a fuel cell as a closed system.

In summary we can say that the hydrogen drive and also the fuel cell have a future. We consider to this technology and it should be further encouraged to make them more efficient and cheaper and thus more interesting and more affordable for all people.

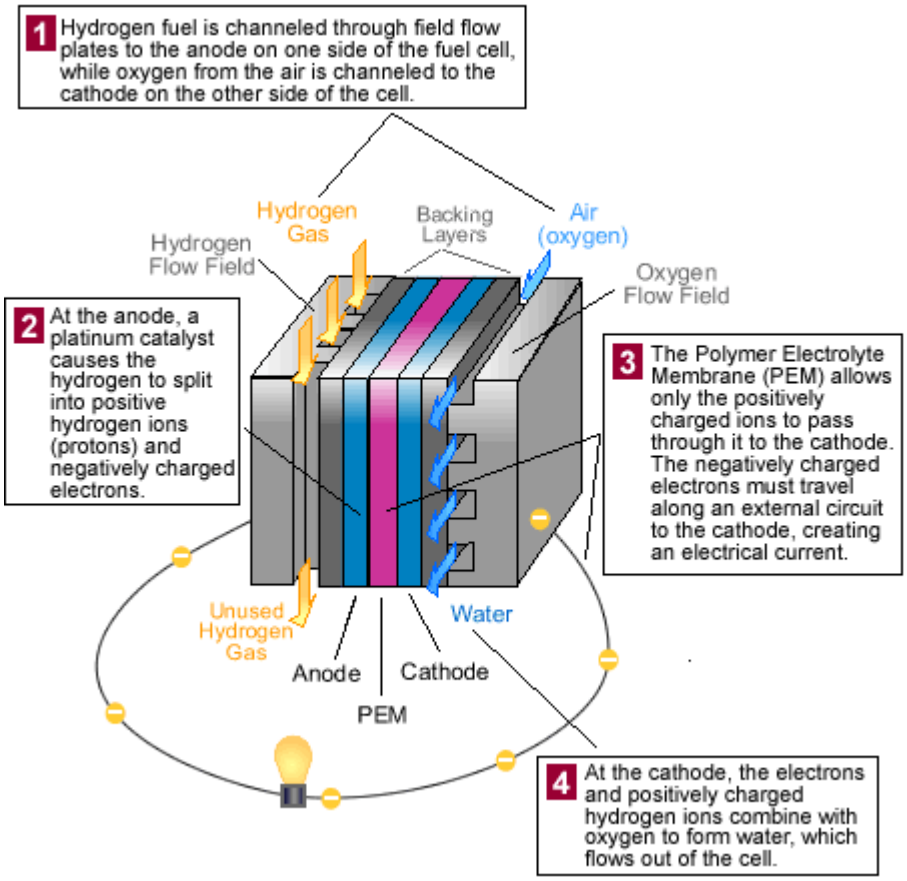

Fig. 3: Fuel Cell

Part 5: Exercise and Discussion

Exercise

The exercises, which we had prepared, were solved to our satisfaction. A few small errors occurred that we corrected. As expected, the first and third tasks were solved without any problems because the attention was very good during the presentation. Therefore, task one - multiple choice - and the free writing was very successful for all. The most difficult, in our opinion, was the “active-to-passive” exercise, because there some errors appeared. One reason for this could have been the lack of time.

Discussion

The discussion part was quite well accepted, despite the small number of listeners. It has strengthened our opinion and support. New aspects were expressed and discussed by he auditorium.

Part6: Summary

We are pleased with our Seminar. Giving a beneficial presentation means gaining more self-confidence. The process of this little lesson and the presentation were in line with our expectations. Unfortunately, we would have needed more time. Working with such a topic, which was not yet exhausted by far, could last a lot longer. We think we had piqued the interest of our audience, and if not done before, they had a chance to take this topic in consideration.

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