Transportation Statement (3 pages): April 11, 2008
By: Marcus Bowman

Vehicles of the Future

What will our cars look like in 15 or 20 years? What is actually available today? This is a short documentation (fact sheet) regarding several different tracks of technology revolutions that are occurring in vehicles. This information makes my optimism in discussing the "Vehicle Technology Improvement Curve" look very, very conservative. We really have a technology revolution on our hands. There are zero emissions vehicles on our roads today. And there are zero emissions cars for sale.

Vehicle technology revolutions:

1) **Fuel revolution**: the U.S. is using more and more ethanol and other forms of biofuel. Congress has mandated that the current level of ethanol use (about 5 billion gallons per year) must rise to over 35 gallons per year by 2020. Two presidential candidates have called for increasing to 60 billion gallons by 2030[1]. The U.S. Department of Energy is aggressively researching and developing capability to use cellulosic feedstocks as a source for biofuels. This is leading to the sale of Flex-Fuel Vehicles (FFV) that can run on various combinations of ethanol (such as E85, 85% ethanol), biofuel, and/or traditional gasoline. Chevrolet has become a leading manufacturer of FFV's.[2]

2) **Natural Gas revolution**: You can now, today, buy a car that can be powered at your home using your existing natural gas supply. Honda sells a Civic GX Sedan that can be filled with natural gas at home using the Phill appliance sold by FuelMaker Corporation.[3] Think fuel cells. Traditional fuels (which would include biodiesel) are giving way to development of hydrogen fuel cell vehicles.
3) **Hydrogen Fuel Cell revolution**: Honda is among the leaders in this area also. In November 2007, Honda introduced the FCX Clarity. This new generation of the FCX is a zero-emissions vehicle powered with a hydrogen fuel cell. The FCX Clarity only emits water.[4] The only emissions possible are traced back to the source for the hydrogen—which itself is undergoing revolutions.

---

[1] Senator Barack Obama and Senator Hillary Clinton. See the following links: http://www.barackobama.com/2007/10/08/remarks_of_senator_barack_obam_28.php and http://www.hillaryclinton.com/files/pdf/poweringamericasfuture.pdf
[2] http://www.chevrolet.com/e85/
[3] http://corporate.honda.com/press/article.aspx?id=2005062944530 and http://www.myphill.com/
[4] http://world.honda.com/news/2007/4071114All-New-FCX/ and photo at http://world.honda.com/news/2007/4071114All-New-FCX/photo/pages/01.html

4) **Diesel revolution**: The Mercedes-Benz line of cars include "Clean Diesel" engines that take advantage of "Common-rail Direct Injection" (CDI) to improve fuel economy by 20 to 40 percent.[5]
5) **Hybrid vehicles (combination electric battery with traditional fuel) Revolution**: Sales of hybrid vehicles are growing about 10% per year (which is a doubling every 7 years).[6] In 2007, 353,000 hybrid cars were sold in the U.S.[7] Currently these cars use nickel-metal hydride batteries. Future technology will use lithium-ion batteries. In the words of an analyst from Frost & Sullivan, "With the advent of lithium-ion battery technology, the automotive industry is set to witness a revolutionary change".[8] And future technology will likely allow multiple types of fuel in conjunction with the battery—such as ethanol or natural gas.
6) **Electric vehicles (charged at home) Revolution**: These are cars with electric batteries that can be charged up at home. They can be entirely electric and/or supplemented with traditional fuel sources. AFS Trinity Power Corporation has what they call an "Extreme Hybrid" that can average 150 miles per gallon—and that's an SUV! ("there exists the possibility its owner will never visit a gas station") [9] Tesla Motors has a 100% electric sports car that gets the equivalent of 135 mpg. Chevrolet is developing an electric car[10], the Chevy Volt, that will have back-up fuel-based power capability. The Chevy Volt will be based on a lithium-ion battery. Road testing for the Volt begins this month (April 2008) with sales targeted beginning in November 2010.[11] Finally, consider that an electric vehicle (charged at home) can also be supplied with electricity generated solely by renewable energy sources (if your electricity provider gives you that option, and/or if you purchase Renewable Energy Credits, like those sold through TerraPass). Within this category you can include so-called Plug-in Hybrid Electric Vehicles (PHEVs): PHEVs have larger batteries than typical hybrid-electric vehicles.[12] Plus, there are whole worlds out there of electric cars in

---

[5] http://www.mbusa.com/campaigns/alternative-fuels/index.do
[6] http://theweeklydriver.com/articles/715/1/Hybrid-Sales-Continue-To-Climb-In-United-States/Page1.html
[7] http://www.thecarconnection.com/blog/?p=1115
[8] http://www.newswiretoday.com/news/32395/
[9] http://blog.wired.com/cars/2008/04/150-mpg-plug-in.html
[10] http://www.chevrolet.com/electriccar/ pictured at http://www.chevy-volt.net/images/Chevy-Volt-Concept-07.jpg
[11] http://www.freep.com/apps/pbcs.dll/article?AID=/20080404/BUSINESS01/804040430/1002/BUSINESS
[12] http://environmentalresearchweb.org/cws/article/futures/33666

development, such as the Xebra electric cars and trucks to ZAP electric cars and trucks.

7) **"Low Speed" Electric Vehicles Revolution**: These vehicles are safe up to a 35-mpg speed limit. Dynasty Electric Car Corp sells cars like this. And, there is the ZENN (Zero Emission No Noise) 100% electric car that uses a standard power outlet to plug in.[13]
8) **Smaller Vehicles Revolution**: Forget your worst fears about China and India. And when you think small, think even smaller. The global rage is with smaller cars. Smaller cars of course mean less pollution. Perhaps the mix of vehicles in the future will contain a growing percentage of these "micro cars". The Apple of the automobile sector might just be a company in India called Tata Motors. In January 2008, Tata Motors unveiled the "Nano"—a pint-sized $2,500 car.[14]
9) **Moped-style; Golf-cart style Revolution**: Chrysler sells "Global Electric Motorcars" (GEM cars)[15]. These are popular to get around in small retirement communities, such as to go visit your friends in the neighborhood.
10) **Unclassified Revolution**: This is a revolution of futuristic cars that are too rare to categorize. In some cases they may be conceptual but in other cases some of these type of cars are actually already marketed. For example:
    a. The Alé by Fuel Vapor Technologies gets 92 mpg based on a new "fuel delivery system".[16]
    b. The "Air Car" which would be based on a compressed air engine.[17]

Finally, I will throw out the concept of a "Carbon-neutral vehicle" (CNV). Volvo at least has a production plant that is carbon neutral.[18] Anyways, we are on the verge of unprecedented changes in how we drive. Driving isn't the problem. Emissions are the problem. And to reduce emissions you don't need to tell people they can't drive to the beach, or to grandma's, or to work, or to the doctor's office. This list is 10 vehicle revolutions where we can focus energy to help improve our planet and reduce the environmental impact of driving while maintaining people's freedom of mobility.

---

[13] http://www.zenncars.com/
[14] http://wheels.blogs.nytimes.com/2008/01/10/tata-nano-the-worlds-cheapest-car/
[15] http://www.gemcar.com/
[16] http://www.fuelvaporcar.com/
[17] http://www.theaircar.com/acf/
[18] http://www.environmentalleader.com/2007/09/25/volvo-opens-carbon-neutral-vehicle-production-plant/