



Global Highlights

May 30th 2008

Energy & the Environment

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Hydrogen cars versus hybrid cars: who will win the race?

➤ By 2050, the size of the global vehicle fleet will be three times that of today (800 million) and the transport sector will account for more than half of the projected rise in global oil demand. These forecasts, together with the urgent need to curb greenhouse gas emissions and concerns about conventional peak oil show that finding alternatives to gasoline and diesel for transportation will be one of the top priorities in the coming decades.

➤ Among the alternatives under consideration are advanced synthetic fuels (obtained from unconventional oil, coal or gas) and first-generation biofuels (obtained from sugar cane, cereals and vegetable oils). These fuels offer similar properties than gasoline and diesel and are compatible with the current infrastructure. However, they do not provide a large scale-sustainable solution. Fossil CO₂ emissions are high and cannot be sequestered (the technology is not suitable for mobile applications) and traditional biofuels compete fiercely with food supplies and are less “green” than expected.

➤ Less harming for the environment are the **Hybrid Electric Vehicles (HEV)**. They combine an internal combustion engine that burns fuel with an electric power train consisting of an electric motor (which has an efficiency conversion rate over 60%, compared to 20% for oil motors) and a battery or capacitor that recharges as the car runs. HEV cars merge the range and rapid refueling of conventional vehicles with the benefits of electrical drive (higher efficiency and zero emissions when electricity is clean) and they don't need new infrastructure either. However, current models, such as the Toyota Prius (of which a million cars has already been sold) cost more than 3000\$ over similar conventional cars and they have low pure electric ranges (typically less than 2km) due to low battery capacity. Development is now focused on [lithium-ion batteries](#) driven, in part, by the electronics industry, particularly laptop and cellphone manufacturers. Experts reckon that there is potential for the batteries to halve their cost by 2025 and [Renault -Nissan](#) have announced they will launch a pure electric car with an expected range of 160 km/h from 2012 globally.

➤ The newest trend in HEVs are **Plug-in Hybrid Electric Vehicles (PHEV)**, which have greater battery capacities and the electronics to allow the car to be charged from the power grid. This increased energy storage capacity provides additional pure electric range. However, their extra batteries add an extra cost of more than 8.000€ per 45km range so progress in battery technology is also needed to reduce the costs. As of today, plug-in hybrid passenger vehicles are not yet being commercialized but Toyota, General Motors, Ford, and Chinese automaker BYD Auto have announced their intention to introduce production PHEV automobiles in the next decade.

➤ Finally, **Hydrogen cars** do not suffer from the storability problem of electric cars and also offer a future with zero emissions (provided the H₂ is produced from “clean” electricity). However, fuel cells costs are still prohibitive and deployment of the H₂ economy would require a completely different infrastructure (from cars to H₂ production, storage and refueling facilities) and most carmakers reckon that H₂ cars are still a decade from commercial availability.

➤ So, who will win the race? As things stand right now it seems that an all electric car would be the winner. While H₂ storability is a big pro, the extra step of using the electricity to produce and compress it appears less efficient than using the electricity directly. PHEV would lead the transition because it provides more range than pure electric battery cars and more efficiency and emissions reductions than EHV cars. By using advanced biofuels in their mechanical power trains they could reduce emissions further until more efficient batteries are developed and they could also offer opportunities to store off-peak power and release to the grid it when demand is high. This would create a sort of “energy bank” for intermittent renewable energy like wind or solar power, allowing these energies to increase their share over the electricity mix. Certainly, this would require investments in the enlargement an adaptation of power grids but this is nothing compared to the new infrastructure that implied by mass H₂ usage.