Power for Mobility
e-motion against emission

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Rising oil prices of 120 $ per barrel and more are indicating that “Peak Oil” was yesterday and that we will have problems in future oil supplies for mobility. We know about the poor efficiency of less than 20 % when burning oil for mobility.We know that liquid fuel for conventional motors will not be available in sufficient quantity, that prices are rising and that burning fuel is polluting.

Where are the alternatives for future mobility? Liquid fuel based on biomass is not yet available in quantity and farming for energy competes with farming for food. While in some countries there might be enough farm land available for energy farming, in other countries there is not. Farming for energy might as well be the cause for rising food prices worldwide. While fuel based on biomass might well be a short term and intermediate solution for the large numbers of existing vehicles, the future is definitive electric.

We know about the far superior efficiency of electric drive systems, which reaches 80 to 90%. Due to the better efficiency, only 20 to 25% of the primary energy is required for mobility, compared to diesel- or petrol motors. Furthermore almost all primary sources of energy can be transformed to electricity and used for mobility. The electric drive system is as clean as its energy source. Ideally the electric energy for mobility comes from clean sources like wind-, solar- or water power. When “farming for energy” the land should be used for wind-power farms or photovoltaic farms. In both solutions, the land can still be used for various kinds of farming. Compared to biofuel from conventional energy farming, the energy yield is 50 to 200 times higher, measured in kWh of energy per land (ha) and year.

With fuel from biomass-to-liquid (BTL), one ha of land (100 by 100 m) will deliver energy for 20.000 to 100.000 km actual driving per year. The same land used for photovoltaik power plants will deliver (in Germany) about 0.5 to 1 GWh p.a. **electric energy for 2.5 to 5 million km per year**, based on electric vehicles consuming 10 to 20 kWh per 100 km . In countries with more sunhine, even more energy is available per land use.

The amount of renewable electric energy in the German grid system was around 67 GWh in 2007. These 67 GWh would be sufficent for all existing 40 million passenger cars in Germany – if they would be electric vehicles. **Thus clean mobility based on electricity from renewable sources is possible now.**

If all 50 million future electric cars (in Germany) would be “solar cars”, i.e. supplied with solar electricity, new photovoltaic power plants of about 100.000 MWp would have to be installed (in Germany). This would require investments of about 400.000 million Euros, based on current prices for solar plants. This is approx. the same amount of money spent in 20 years for oil – based on current oil prices of 120 $ per barrel. Oil prices are expected to rise, prices for photovoltaics are expected to fall.

Large photovoltaic power plants and even larger wind power plants are under construction. Electric cars are built by small manufacturers in very small quantity. But fortunatly almost all major car manufacturers have announced plans for hybrid and for full electric vehicles. The availabilty and the success of electric vehicles is closely tied to the availability and the success of advanced lithium batteries. The demand for electric vehicles and for plug-in hybrid vehicles is there.

Once they are there in quantity, the batteries in these vehicles can be used for the so-called “vehicle to grid” system. Passenger cars are typically used for one or two hours per day only. The remaining 22 to 23 hours per day, the electric vehicle should be connected to the grid. These vehicles are not only consumers of electric energy, they can also supply electric energy back to the grid – much the same as pumped storage devices work. This requires new thinking, new decentralized control systems for the computerized energy management and new control equipment. The new electric mobility systems are not only clean and quite, they serve as well as stabilizers for electric grid systems.

What is true for cars is true for solar mobility on water: solar boats exist in small numbers already, the the amount of battery storage is even larger than in vehicles.