Technology Fact Sheet

Electric vehicles[i] /http://climatetechwiki.org/technology/electric-vehicles/

General description

Electric vehicles are about 2.5 times more energy efficient than their counterparts which are powered solely by internal combustion engines. This high energy efficiency is the main reason why electric vehicles can contribute to lower the CO_2 emission and energy consumption of traffic substantially. Electric vehicles have zero tailpipe exhaust emissions and thus contribute substantially to a better air quality. Additionally, electric vehicles are inherently silent and can help to reduce the noise levels in cities. However, the market share of electric vehicles is currently still very small and consists mainly of small vehicles intended for urban transport. Purchase costs of electric vehicles are high compared to similar sized ICE vehicles. These high purchase costs are predominantly caused by the high costs of the battery pack needed in the vehicle. Moreover a recharging network with sufficient coverage is not yet available in most countries.

Electric vehicles are propelled solely by electric motors. There are three main types of electric vehicles:

- Battery electric vehicles
- Series Hybrid vehicles (see also description of Hybrid Electric Vehicles)
- Hydrogen Fuel cell vehicles. (see also description of fuel cells for mobile applications).

The Battery Electric Vehicle does not have an internal generator to produce electricity, all the electricity has to be obtained from the power grid. Examples are the Citroen EVie, Mitsubishi iMiev and the Think (van Agt, 2010). The Chinese company BYD is planning to produce 100 electric cars in 2010, with the aim of using them as taxis in Shenzhen, where BYD is located. (Bloomberg News, 2010)

The Series Hybrid vehicle can obtain its electricity from the power grid but has additionally a small internal combustion engine which serves as a generator to recharge the battery and offers an extended driving range. The combustion engine does not directly propel the vehicle. Examples are the Opel Ampera, GM Volt and the Volvo Recharge.

The third group of electric vehicles are hydrogen fuel cell vehicles. These vehicles can also obtain their electricity from the power grid but in addition, the fuel cell can serve as a generator to recharge the battery, which also extends the driving range. Examples are the Honda Clarity and the Toyota FCHV.

Implementation

The market share of battery electric vehicles is still very limited and comprises mainly of small vehicles intended for urban transport (van Agt, 2010). Moreover, the purchase costs for electric vehicles are still relatively high due to the high costs of the required battery pack. To lower the purchase costs of the vehicle only relatively small battery packs are installed, limiting the driving range, which makes electric vehicles currently only suitable for urban transport. Nevertheless, the technology used in electric cars is largely proven and a breakthrough can be expected when the costs and weight of the battery pack are lowered sufficiently.

Given the distances the electric vehicles can travel and use of electric vehicles for urban areas only the estimated market share for such transport can be 30% of the total number of cars, which by 2030will be cca.264, 6000 cars.

Implementation barriers

The main barriers for a wider user of electric vehicles are related to the batteries and to the recharging infrastructure:

- batteries for use in electric cars are still expensive and have relatively limited driving ranges. Most existing EV need to be recharged after maximum 150 to 300 km..
- completely recharging the batteries may take 4 to 8 hours. (US Department of Energy, 2010b)
- the widespread use of electric vehicles requires an extensive recharging infrastructure. The absence of this infrastructure may lead to reluctance to buy electric vehicles.

- Lack of standards regarding the cords and connectors used for recharging (Markel, 2010).

GHG emissions reduction (megatons CO_2 equivalent) - 396 thousand tons CO_2 in 2030.

The energy efficiency of electric cars is about 2.5 times better than their fossil fuel counterparts, which is the main reason why electric cars can lower the greenhouse gas emissions of road traffic and reduce the demand for oil. The actual greenhouse gas emission associated with the use of battery electric vehicles depends largely on the way the required electricity has been produced. Employing coal fired electricity plants to generate the electricity will marginally lower the CO_2 emissions. However, using renewable electricity will lower the greenhouse gas emissions considerably. Electric vehicles might even provide a way to make the electricity sector more sustainable, if the batteries in the vehicles could be used to store the variable output of wind and solar-based power generation (Nieuwenhout et al, 2009).

Impact on development priorities:

a) *social*

b) *economic*

- improve energy security, as electric vehicles are more efficient;
- improve balance of payments by reducing imports of fossil fuels.

c) *environmental*

- substantially improve local air quality, especially in urban areas, as electric vehicles have no tail-pipe emission of air pollutants such as NO_x and soot. The global improvement of the air quality however, is determined by the way the electricity used is produced;
- reduce noise.

d) *other*

Investments

The high cost of an electric vehicle over the conventional alternative is mainly determined by the costs of the lithium ion battery pack. Recent developments in lithium-ion batteries make it likely that these additional costs can be reduced from the current level of about €15,000 in prototypes to an expected level of around €3,000 in 2020. This requires the battery to be about €200-250 per kWh (Nieuwenhout et al, 2009). The 2007 prices for high energy batteries range from €800/kWh to €1000/kWh (Pesaran et al, 2009). The medium term cost goals of these batteries are €500/kWh in 2012 and €300/kWh in 2016. BYD's first commercial electric car, the E6 model, is expected to be available for sale in the US for 40'000 USD in 2010. (People's Daily Online, 2010)

In addition, there is a need for investment into the recharging infrastructure. This infrastructure needs to be standardized in a way that every brand of electric vehicle can recharge at every recharging station. A simple recharging point at a private house or at an office site costs about $ 1800,-. However, a public recharging station, with the necessary electronics to make contact with the bank is estimated to cost about $ 18.000,-. (Roeterdink, 2010).

Assuming the application of this technology for 30% of cars or cca.265 thousand units at a price of $ 40,000 per vehicle and construction of 50 public recharging stations, the total investment will be $ 10.6 million.

Operation and maintenance costs– estimated at 10% of the annual investment cost of $ 1.1 million.

GHG reduction costs– 6.825 $/ton CO_2.

Technology lifetime– 7 years.

Other

Source: http://climatetechwiki.org/technology/electric-vehicles

[i] This fact sheet has been extracted from TNA Report - Technology Needs Assessment for climate change mitigation - Republic of Moldova. You can access the complete report from the TNA project website **http://tech-action.org/**