Swedish Electromobility Centre

Advancements in Electromobility research

Dr Elna Holmberg
Director
Swedish Electromobility Centre is...

...a national Centre of Excellence for research and development of electric and hybrid vehicles and charging infrastructure. It is an arena where Sweden’s automotive industry, universities and government agencies meet and collaborate to generate new technology, insights and competence for the future.
# The Past and the Present

<table>
<thead>
<tr>
<th>Plug in LDV vehicles</th>
<th>Market share LDV</th>
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<tbody>
<tr>
<td>2 000 2005</td>
<td>0 – 0.01%</td>
</tr>
<tr>
<td>180 000 2012</td>
<td>0.1-0.5%, 3%</td>
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<tr>
<td>3 100 000 2017</td>
<td>1-2%, 39%</td>
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Electric vehicles in Sweden

Plug in vehicles in Sweden 2012-2018

Ref: Powercircle
Advantages and disadvantages

+ Reduced local emissions, including noise
  + Potential to lower global CO2 emissions
  + Performance
  + Low operating cost
  + Access to energy/ reduced dependence on fossil fuels

- Higher purchasing cost – uncertain resale value
  - Shorter range than conventional fuels
  - Charging possibilities and duration
  - Perceived uncertainty and no experience of new technology
The Future

2020
13 milj plug in vehicles
Sales volume 4 millions

2030
100-130 million plug in vehicles globally
20-30% market share (22-30 millions)
Yearly sales growth rate 24-30%

2040
40% EVs of global stock
55% of sales
The future Future

From product & charging to transport & society
EV Critical Component - the Battery

Production Li-ion batteries
- 26% annual increase
- 2017: 120 GWh, EVs 20%
- Competition
- Growing capacity

Cost
- Battery prices fall faster than expected
- Decreased 73% in 6 years
- Technology
- Oversupply and competition
- Production costs
Ageing mechanisms in commercial Li-ion batteries

- Ageing slower at low SOC (<30%)
- At higher SOC the ageing is accelerating.
- Limiting the time and usage at high SOC will extend the lifetime of the battery. Several ageing mechanisms seem to be accelerated at high SOC.
Fast-Charging of Energy-Optimised Li-ion Cells

- Uneven and severe ageing observed on both anode and cathode, as well as loss of cyclable Lithium and liquid electrolyte
- Ageing rate very dependent on charge rate and SOC range
- Low ageing rate when fast-charging is done in a limited SOC range – room for improvement with respect to battery usage

**PARTNERS:** Chalmers, Royal Institute of Technology, Uppsala University, Scania CV AB, Volvo Cars, Volvo GTT. Partly funded by Swedish Energy Agency through Batterifonden.
Cost analysis of different techniques and applications

TCO Germany Long Haul (€)
7 years, Germany, Long Haul, 500 km between refuelling, 130 000 km/year
Diesel: 0.15 €/kWh, Elec.: 0.22 €/kWh H2: 0.20 €/kWh
Fuel cell: 51 €/kW Battery: 150 €/kWh

Hans Pohl, RISE, Anders Grauers, Chalmers, Magnus Karlström, LSP
TCO Germany Regional (€)
7 years, Germany, Regional delivery, 300 km between refueling, 60 000 km/year
Diesel: 0,15 €/kWh, Elec.: 0,22 €/kWh H2: 0,20 €/kWh
Fuel cell: 51 €/kW Battery: 150 €/kWh

Hans Pohl, RISE, Anders Grauers, Chalmers, Magnus Karlström, LSP
Impact of electric roads

- ERS on all the E- and N-roads in Sweden and Norway would potentially cover more than 60% of the energy demand from all heavy traffic and 50% of the light vehicle traffic.

- ERS of 25% of the total E- and N-road length could connect some of the larger cities in Norway and Sweden with ERS, covering a large part of traffic demand.
Welcome to contact Swedish Electromobility Centre

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