



Picture: Matti Rae/Ensto

Electric vehicle for Finland Challenges and opportunities

Lappeenranta University of Technology
Summer Seminar
19.8.2010

Nils-Olof Nylund
VTT Technical Research Centre of Finland

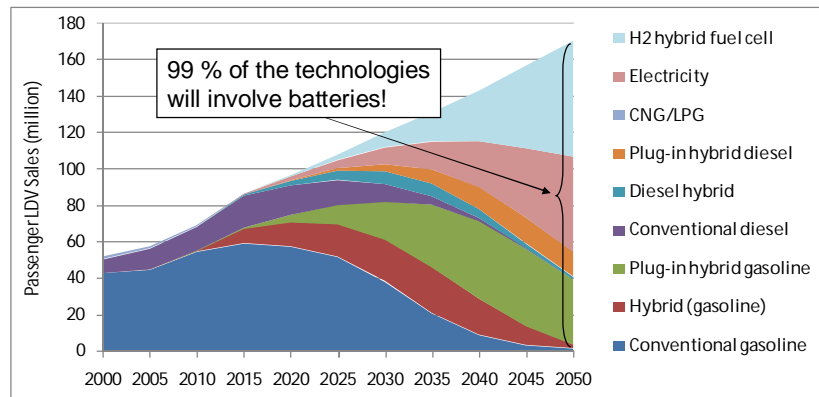
Routes for creating a sustainable transport system The IEA RETD Retrans 2010 report

- To reduce the greenhouse gas emissions from the transport sector and its dependence on imported oil requires a true transition of the transport sector and its energy system
- The main ingredients to realise such a transition are:
 - reducing the energy demand of vehicles
 - shifting towards less carbon-intensive and carbon-neutral, renewable energy carriers
 - shifting towards more energy-efficient or less carbon-intensive modes of transport
 - curbing the growth of transport demand
- The transition should start now!



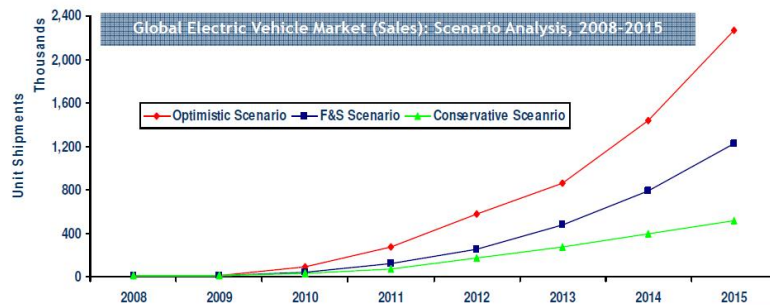
BLUE: advanced technologies must play a major role

Unprecedented rates of change in market penetration of advanced technologies



Lew Fulton 2009

Electric Vehicle Demand Analysis - Potential Sales of 1.2 M in F&S Scenario by 2015



Scenario's	2008	2009	2010	2011	2012	2013	2014	2015	2020 (% of total car sales)
Optimistic Scenario	5,103	7,260	94,985	273,116	574,435	863,160	1,439,147	2,266,450	12%
F&S Scenario	5,103	7,260	41,653	117,385	255,151	471,690	791,961	1,226,607	7%
Conservative Scenario	5,103	7,260	25,884	72,895	168,965	273,244	394,605	520,953	4%

Interest in electric vehicles

- The role of electrification will increase in the driveline and in auxiliaries
- Electrification
 - contributes to energy efficiency
 - applies to ICE vehicles (hybrids) and actual electric vehicles
 - reduces local pollution
 - broadens the energy base of transportation
 - enables oil substitution
 - enables new vehicle designs
- Technology based on charging from the grid is best suited for vehicles in urban surroundings (passenger cars, delivery vans, urban buses, refuse trucks...)
 - long-haul heavy-duty vehicles will rely on the diesel engine for a long time to come

Special characteristics of Finland - general

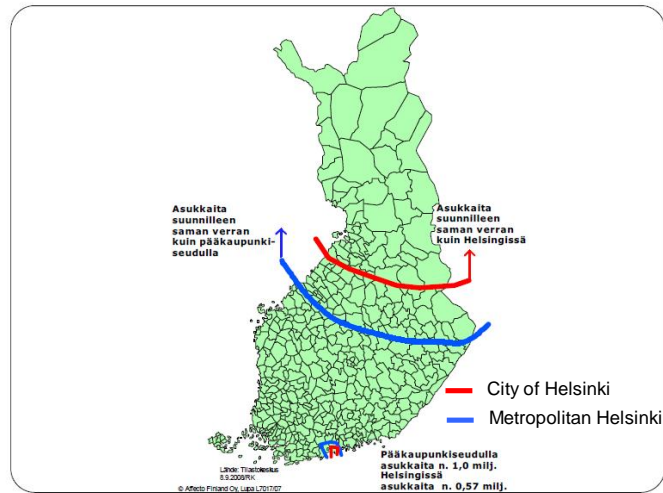
- Cold climate
- Sparsely populated country and long driving distances



Arctic Circle



Should the whole of Finland be kept populated?



Tatu Rauhamäki

Special characteristics of Finland - industry

- No major automotive industry
- Manufacturers of special vehicles
 - working machinery
 - Valmet Automotive car factory
- Strong electrotechnical industry
 - ICT
 - inverters, motors
 - Europe's first factory for large lithium-ion batteries

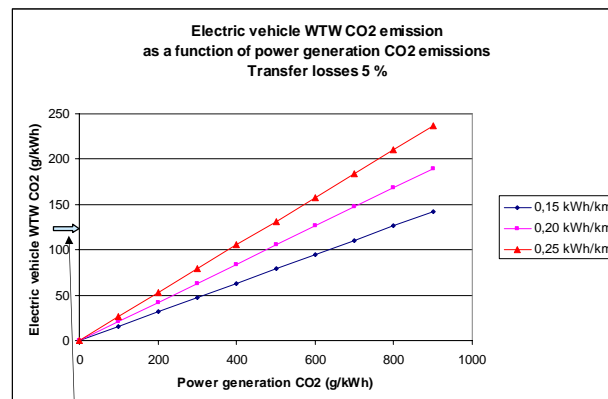


Special characteristics of Finland - energy

- High share of renewable energy (~ 30 %)
- Low-carbon electricity generation (~ 170 g CO₂/kWh)
- Vehicle fleet some 2.5 million units
 - more than 1 million power supplies for electric block heaters
 - could also be used to recharge electric vehicles



CO₂ emissions from EVs

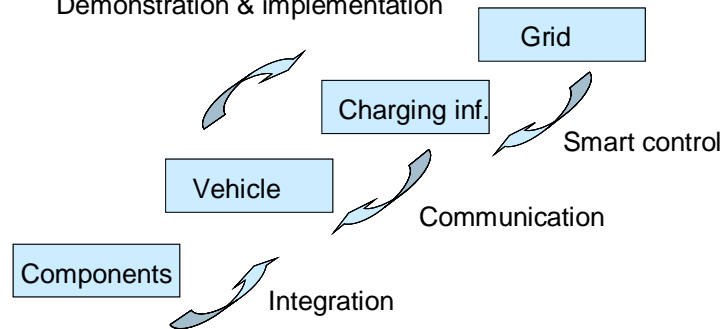


Diesel passenger car tailpipe 100 g/km, WTW 100/0,85= 117 g/km

Elements of the electric vehicle system

New mobility & business models

Demonstration & implementation



Promotion of electric vehicles

Cooperation for RDD&D



Industrial policy

Environmental & transport policy

The 2009 electric vehicle study by the Ministry of Employment and the Economy

- Main emphasis on industrial policy and new business opportunities
- Numerical target (1 - 2 billion €/a) for EV related turnover by 2020

Recommended actions Tier 1:

1. Development and strengthening of an EV cluster (includes competence build-up)
2. EV demonstration projects

Recommended actions Tier 2:

3. Incentives for the procurement of EVs
4. Development of recharging infrastructure and other supportive measures



The 2010 electric vehicle study for the Ministry of Transport and Communication

- Basis for decision making on the promotion and use of electric vehicles
- Implications of electric vehicles on the transport system and the energy system
- Environmental impacts of EVs



Vehicle taxation

- Purchase tax based on CO2 emissions as of 2008
 - purchase tax 12.2...48.8 %
 - cut-off points 60 and 360 g CO2/km
 - the Ministry of Finance is considering full tax exemptions for early EV demonstration projects
- Annual tax based on CO2 emissions as of 2010
 - annual tax 20...600 €
 - cut-off points 66 and 400 g CO2/km
- New taxation system for transport energy planned as of 2011
 - energy component
 - CO2 component
 - effects on local emissions
- Electric vehicles will receive credits in all respects



Tekes' funding for EV cluster related projects in 2010

- Total funding 5.4 million Euros (as of 4.5.2010)
- Appr. 4 million Euros for research institutes and universities
- 1.4 million Euros for projects by the industry
- Topics:
 - battery chemistry
 - material research
 - electric power trains
 - hybridisation
- In 2009, Tekes spent appr. 4 million Euros on EV technology related projects

Martti Korhikoski/Tekes



TransEco Coordinated Research Effort 2009 - 2013

trans^{eco}

Energy Efficiency and Alternative Energies in Road Transport



TransEco objectives and mission

- Create a set of measures to cost-effectively adapt Finnish road transport to EU & national level climate gas reduction and energy efficiency targets.
- Give input for the preparation of EU Directives to reach solutions that are most suitable for Finland.
- Increase energy efficiency and use of renewable (low-carbon) energies in road transport:
 - advanced biofuels
 - **electric vehicles**
- Develop systematic processes and tools for the assessment of potential & performance of energy savings measures and their impacts.
- Assist the Finnish industry to develop business from green transport.

trans^{eco}

E-RA – Electric-RaceAbout

Finnish engineers at *Helsinki Metropolia University of Applied Sciences* and designers at *Lahti University of Applied Sciences* are developing superefficient and clean car as a solution to environmental concerns regarding individual mobility.

The break-through technology never sells cheap. This is why a sports car, - first for those who can afford it, and then when the time is right, put the new concept on market

The Automotive X-PRIZE competition is a perfect forum to demonstrate the performance.



What a wonderful way of building competence!



From the front row to electric vehicles



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24.5.2010 Ilpo Korhonen

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"Eva" electric vehicle concept 2010



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Standard cell modules



Production

- Manufacturing plant in Varkaus, Finland will begin its operations in spring of 2010
 - inauguration June 8th 2010
- First independent large battery manufacturer in Europe
- 100 MWh annual production capacity, which equals the need of 3.000 full-electric cars
- Capacity expansion to 300 MWh is scheduled to be ready in 2012.

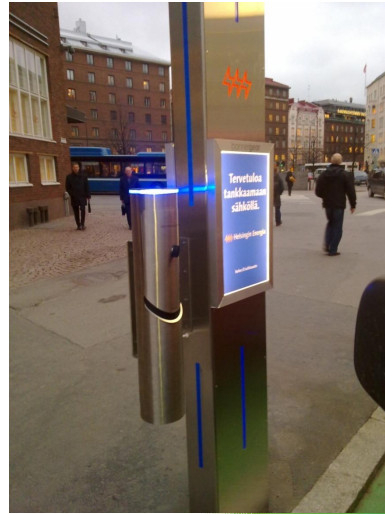
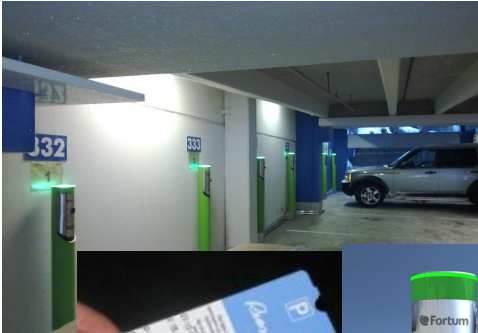




Saves Your Energy

Infrastructure demos in Espoo and Helsinki

Paying by parking ticket or by mobile phone



Matti Rae

24.5.2010

Matti Rae, Director New Technologies

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55 kW photovoltaic system for charging electric vehicles at the depot of the city of Espoo



New research initiatives (examples)

- Pilot production line for battery cells and supercapacitors
- Testing facility for electric energy storage systems
- Industrial EV projects
- Projects by research organisations and universities
- Large-scale field demonstrations (thousands of vehicles)
 - EV performance in the Finnish climate is of special interest