Why are thousands of Norwegians buying EVs?

Ole Henrik Hannisdahl, Project Manager
About the project ”Grønn Bil” ("Green Car")

- Target: 200,000 EVs and PHEVs in 2020
  - Offer hands-on aid and information for users
  - Suggest improvements in regulatory framework
  - Showcase demand to attract EV and PHEV suppliers
  - Be a driving force in the development of next-generation charging infrastructure

- Project owner: Energy Norway

- Steering committee:
  - KS - Norwegian municipalities,
  - ZERO - environmentalists
  - Transnova - government body
EVs are old news..
Macro Trends: National e-mobility drivers

• Environment
  • Local (air quality)
  • Global (CO₂)

• Business / green jobs

• Oil dependency / energy conversion
People react differently to new things…
28,597 BEVs and PHEVs by April 2014

~13% market share of new cars sold >1% of cars on road
New models → increased market share

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<td>i-MiEV</td>
<td>53</td>
<td>38</td>
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<td>43</td>
<td>34</td>
<td>48</td>
<td>5</td>
<td>33</td>
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<td>e-up!</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11</td>
<td>275</td>
<td>294</td>
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<td>379</td>
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<tr>
<td>Model S</td>
<td>2</td>
<td>6</td>
<td>185</td>
<td>616</td>
<td>99</td>
<td>527</td>
<td>553</td>
<td>132</td>
<td>431</td>
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<td>LEAF</td>
<td>337</td>
<td>345</td>
<td>367</td>
<td>535</td>
<td>427</td>
<td>466</td>
<td>389</td>
<td>634</td>
<td>561</td>
<td>956</td>
<td>719</td>
<td>477</td>
<td>811</td>
<td>667</td>
<td>581</td>
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EVs started in the capital, and are now spreading

*Share of EV sales, per year*

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<th>Year</th>
<th>Andre</th>
<th>Oslo</th>
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<td>2008</td>
<td>22%</td>
<td>49%</td>
<td>29%</td>
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<td>2009</td>
<td>40%</td>
<td>32%</td>
<td>36%</td>
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<tr>
<td>2010</td>
<td>39%</td>
<td>23%</td>
<td>38%</td>
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<tr>
<td>2011</td>
<td>51%</td>
<td>18%</td>
<td>49%</td>
</tr>
<tr>
<td>2012</td>
<td>55%</td>
<td>19%</td>
<td>55%</td>
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<tr>
<td>2013</td>
<td>60%</td>
<td>20%</td>
<td>60%</td>
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<tr>
<td>2014</td>
<td>60%</td>
<td>22%</td>
<td>60%</td>
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Norwegian BEV & FCEV incentives:

• No Import Tax
• No VAT
• Very low annual registration fee
• Free parking in publicly owned parking spaces
• No road toll
• Access to bus lanes
• Free admission on national road ferries for the car (not the driver)
• Increased tax-deductable mileage allowance (NOK 4 / km instead of NOK 3.50 / km)
• Only 50% taxable benefit if used as a company car
The economics: Does it add up?

• Duel: i-MiEV vs Fiat 500
• 5 years
• 15,000 km / year
The Scandinavian numbers 2012 *(WARNING: Estimates only!)*

- **Norway**
  - Road tolls, ferries, parking: 5,000 €
  - Capital cost: 10,000 €
  - Annual fee: 15,000 €
  - Fuel: 20,000 €
  - Maintenance: 25,000 €
  - Depreciation: 30,000 €

- **Sweden**
  - Road tolls, ferries, parking: 6,000 €
  - Capital cost: 12,000 €
  - Annual fee: 18,000 €
  - Fuel: 24,000 €
  - Maintenance: 30,000 €
  - Depreciation: 36,000 €

- **Denmark**
  - Road tolls, ferries, parking: 7,000 €
  - Capital cost: 14,000 €
  - Annual fee: 20,000 €
  - Fuel: 26,000 €
  - Maintenance: 32,000 €
  - Depreciation: 38,000 €
The numbers in detail *(WARNING: Estimates only!)*

<table>
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<th>Norge</th>
<th>Sverige</th>
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<td><em>i-MiEV</em></td>
<td><em>Fiat 500 1,2</em></td>
<td><em>i-MiEV</em></td>
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<tr>
<td>Consumption / 10km</td>
<td>1,6</td>
<td>0,51</td>
<td>1,6</td>
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<tr>
<td>Fuel price (€/l/kWh)</td>
<td>0,16</td>
<td>1,9</td>
<td>0,16</td>
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<tr>
<td>Import price</td>
<td>25 000 €</td>
<td>14 434 €</td>
<td>25 000 €</td>
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<tr>
<td>VAT</td>
<td>0 €</td>
<td>3 609 €</td>
<td>6 250 €</td>
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<td>Import fee</td>
<td>0 €</td>
<td>4 349 €</td>
<td>0 €</td>
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<td><strong>Purchase price</strong></td>
<td><strong>25 000 €</strong></td>
<td><strong>22 392 €</strong></td>
<td><strong>31 250 €</strong></td>
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<td>Depreciation</td>
<td>16 250 €</td>
<td>9 418 €</td>
<td>20 313 €</td>
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<td>Maintenance</td>
<td>1 677 €</td>
<td>2 152 €</td>
<td>1 677 €</td>
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<tr>
<td>Fuel</td>
<td>1 920 €</td>
<td>7 268 €</td>
<td>1 920 €</td>
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<td>Annual fee</td>
<td>253 €</td>
<td>1 797 €</td>
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<td>Capital cost</td>
<td>5 250 €</td>
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<td>SUM</td>
<td>25 350 €</td>
<td>26 056 €</td>
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<td>Road tolls, ferries, parking</td>
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<td><strong>Sum ownership and incentives</strong></td>
<td><strong>25 350 €</strong></td>
<td><strong>32 005 €</strong></td>
<td><strong>30 472 €</strong></td>
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6/2/2014
The most important charging point of all..

- Norway:
  - 14 inhabitans / km²
- Ireland:
  - 60 inhabitans / km²
- Portugal:
  - 110 inhabitans / km²
- Denmark:
  - 125 inhabitans / km²
- Germany:
  - 233 inhabitans / km²
Range example: i-MiEV summer
Range example: i-MiEV winter
An EV trip from Oslo to the mountains

- Scenario: Nissan LEAF, -8 degrees, highway speed (100km/h), 211km distance
- Actual consumption: 2.5kWh / 10km
- Fast charging speed limited in cold weather. Real effect: ~19kW = 84km per hour of charging
- Needs a minimum 1h24min of charging along the route
- How to scale a commercially viable infrastructure to meet peak demands?
  - 500 LEAFs depart from Oslo between 16 and 19 on Friday evening
  - Needs a minimum of 233 optimally placed CHAdeMO chargers and ~5,000kW installed effect under listed conditions to avoid waiting.
- What is acceptable to consumers?
However: Larger batteries change the scenario

- Same external conditions as previously
- Car: Tesla Model S 85 kWh (81 kWh available)
- Average fast charge speed: 80kW
- Average consumption: 2.5 kWh /10 km
- Range under prevailing conditions: 324 km
- Fast charge speed: 240km / 45 min
- Driving pattern (100 km/h): First 3h15min. Then fast charge 45min. Then 2h10 min driving, 45min charging, etc.
Fast charger average: ~8% occupied
Average fast charge time increases in winter
Charging time depends (somewhat) on payment model
Norway's most used fast charger
How does the introduction of payment affect usage?

- ABB Alnabru Hurtigladestasjon, Oslo
- ABB Billingstad Hurtigladestasjon, Asker
- Fortum Hurtigladestasjon, Sandvika
Some learning points from the Norwegian market:
Some learning points from the Norwegian market:

• E-mobility vs "Just A Car"
  • Just sell a car – not a revolution. Especially true for B2C
  • Keep it simple!

• Understate, then over-deliver

• Fast charging: Necessary, but not necessarily being used

• The car is bought and payed for by the customer. I.e. business models need to be user-centric.

• Norwegian EV owners are usually very happy with their cars!

6/2/2014
Evolution, or Revolution?

Delivery of first computer to Norwich city, 1957
Evolution, or Revolution?
Last commercial sailing ship, Pamir, 1949

- Built at the Blohm & Voss shipyards in Hamburg
- Launched on 29 July 1905
- Sank in 1957
Predicting the future is hard

Credit: Sjur Dagestad
The future is electric!

- and it starts today
Thank you for your attention!

www.gronnbil.no