“the RekkE Vidde”
Assessing Range and Performance of Electric Vehicles in Nordic Driving Conditions
“the RekkEVidde” Objectives

- Produce realistic performance figures for EVs attributed to Nordic driving and weather conditions

- Agree what kind of additional testing is done for EV’s apart from the regulatory test (ECER No. 101)

Create market acceptance for EV’s
Consortium

Coordination

Laboratory testing

Field testing

Test Site Sweden
Project content

WP0 Coordination and Dissemination
WP1 Duty cycle analysis
WP2 Test protocol tools
WP3 Application of the laboratory test protocol on 3 EV types
WP4 Field test of EV pool

Finding during project: Energy labeling for EV’s will be studied
WP1 Duty cycle analysis

Study of the Driving Cycles

Temperature & road condition variations

Typical trips & loads

TSS: Bilrörelse
WP2 Test protocol tools

Field drive input from 80-100 ICE-vehicles will be logged

Test temperature and charging

Cabin heating & auxiliary energy use

Preheating of cabin during charge allowed at test protocol?

Vehicle load?
Useful range criteria?
Climb home range?
WP3 Application of the laboratory test protocol on 3 EV types

Energy consumption (kWh/km) from the grid and efficiency inside EV are nice to know but not part of the actual test protocol.

Useful driving range in Nordic conditions and accuracy of SOC meter are key figures to be tested!
WP4 Field test of EV pool

Vehicle Movement Database

- 500 ICE
- 20 EV

- Battery requirements
- Vehicle requirements
- Location of charge stations
- Driving cycles for certifications
- City planning
- ...
Lab test performed with 5 driving cycles

3 cycle profiles out of 5 as an example
Citroën C-Zero lab test results
cabin heater off

<table>
<thead>
<tr>
<th>cycle</th>
<th>estimated range</th>
<th>difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+23 °C</td>
<td>-20 °C</td>
</tr>
<tr>
<td>EURO</td>
<td>124</td>
<td>88</td>
</tr>
<tr>
<td>Helsinki City</td>
<td>125</td>
<td>106</td>
</tr>
<tr>
<td>Artemis Urban</td>
<td>99</td>
<td>74</td>
</tr>
<tr>
<td>Road, FIN</td>
<td>91</td>
<td>70</td>
</tr>
<tr>
<td>Artemis Road, EV*</td>
<td>113</td>
<td>90</td>
</tr>
<tr>
<td>Artemis Motorway, EV*</td>
<td>72</td>
<td>53</td>
</tr>
<tr>
<td>average, all cycles</td>
<td>100</td>
<td>79</td>
</tr>
</tbody>
</table>

*EV denotes that warm-up part of the cycle is omitted
Field test NEDC driving cycle

(kWh/km)

Circular track (about 33.5 km)
Energy consumption:
• No heater
  0.20 – 0.21 kWh/km
• With heater
  0.34 -0.36 kWh/km

Conclusions:
4% less energy in higher temp (-13 °C). Without heater (same at -2 °C with cold start)
0% diff at -11 °C due to snow on road..
73% more with heater on from a cold start
Constant speed 80 km/h. Temp -1°C
Range-drop from 78 to 68 km when driving in -13°C

Heater shut off gives 9 km left at chosen speed

<table>
<thead>
<tr>
<th>Cabin temp</th>
<th>15 min</th>
<th>Heater Shut off time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temp -0 °C: feet</td>
<td>+18</td>
<td>+24</td>
</tr>
<tr>
<td>Temp -0 °C: neck</td>
<td>+12</td>
<td>+27</td>
</tr>
<tr>
<td>Temp -13 °C: feet</td>
<td>+4</td>
<td>+12</td>
</tr>
<tr>
<td>Temp -13 °C: neck</td>
<td>+10</td>
<td>+17</td>
</tr>
</tbody>
</table>

insufficient thermal effect
Range testing method has influence on EV system design and market

- Preconditions will have a great importance in the cold testing
  - If vehicle interior preheating from the electric grid is made possible before range testing
    - EV manufacturers will adapt pre heating system in their production EVs

- Nordic climate countries represent a limited market potential for vehicle manufactures
  - If range test is too difficult and varies from normal testing
    - EV manufactures may not apply tests in their vehicles
WP0 Dissemination

Dissemination Policy:

• Protocol development will be open for comments
• Co-operation with electric vehicle manufacturers is welcome

Time schedule:

11/2012  Lab-test protocol
03/2013  Database of lab test results
06/2013  Database of in-field test results
09/2013  Database of in-laboratory and in-field test programme results
11/2013  Final report
Contact Information

Coordinator:

Arto Haakana
Development Manager, Urban Energy Efficiency
Green Net Finland
Pakkalankuja 5
FI-01510 Vantaa
tel. +358 50 3485157
email: arto.haakana@greennetfinland.fi
Skype: greennet_arto
http://www.greennetfinland.fi
http://www.energyandtransport.net