Feasibility analysis and development of on-road charging solutions for future electric vehicles

FABRIC overview

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Electromobility trends (I)

**Electric Vehicles**
Range increases due to battery breakthroughs
New models
Global adoption increases steadily

**Infrastructure**
Static charging infrastructure is deployed fast
Very fast supercharger deployment (>250km range in 20 minutes)

**Batteries**
EV batteries’ price dropping
Battery density increases linearly

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FABRIC Conference, Brussels
Electromobility trends (II)

Investments on dynamic charging technologies

- UK government £500 million investment over the next five years for the creation and testing of electric highways.

- EU R&D project funding focused on dynamic charging
  - FABRIC
  - FASTINCHARGE
  - ...

2/2/2016
FABRIC Conference, Brussels
Objective: to develop, test and evaluate the efficiency of dynamic wireless charging prototypes to assess the feasibility of large-scale deployment of dynamic wireless charging.
FABRIC technical objectives – charging prototypes

Objective: Develop three different **dynamic** charging prototype solutions to assess their efficiency and compare with existing solutions

**Status:** Design complete, development ongoing
- Vedecom/QUALCOMM solution: 85kHz, 20kW
- POLITO solution: 20-200kHz, 20kW
- SAET solution: 80-100kHz, 50kW

Air gaps ~20cm

Expected delivery: Early 2016 (charging pads ready for test sites)
Objective: Create charging “lanes“ >100m to test the functionality and efficiency

Status: On-site civil works are on-going in Italy (Torino) and France (Satory)

Expected delivery: Early-mid 2016 (charging lanes with embedded charging pads)
FABRIC technical objectives – grid infrastructure

Objective: Perform impact studies on the grid, adapt test sites’ micro-grid to support the tests

Status: Impact study complete:
- Power demand simulations for various traffic models (demand fluctuates from 2-8 MW in some milliseconds)
- Harmonics and power flow analysis at the test sites (max power Satory: 100 kW, SITAF: 45 kW, minimal adaptations needed, so as to simultaneously charge 2 vehicles)
- Integration of RES and Energy Storage study (ESS: larger energy storage capacity reduces daily demand peaks but is expensive)

Expected delivery: Early 2016 (grid adaptations at test sites completed)
FABRIC technical objectives – testing

**French test site:**
- VeDeCoM will implement Qualcomm IPT systems on the Satory test track and on electric vehicles provided by car makers
- 100 meters charging lane
- VeDeCoM will incorporate contributions from its members (Renault, Peugeot, et al)

**Italian test site:**
- Motor track, 700 meters long, located in Susa Municipalities
- Two paved lanes about 200m long equipped with embedded induction loops
- Can simulate toll collection system
- Smart grid interface including commercial and industrial (C&I) electricity meter
- POLITO and SAET inductive charging solutions will be tested
FABRIC – comparison with conductive solution

- Volvo heavy vehicles/cars test site in Hällered
- Test track for conductive electrical road tests (DC 750V)
- Test track is 435m long, electrified part of the track is 275m.
- Technology evaluation results
- Demo of the track and system
- EM emissions measurements
- Conductive charging technology benchmarking

E-road in Volvo testing site

Volvo truck with pantograph
A first feasibility study approach examined several large-scale deployment scenarios based on actors’ requirements and FABRIC deliverables.

<table>
<thead>
<tr>
<th>Deployment scenario</th>
<th>Preliminary feasibility assessment</th>
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<tbody>
<tr>
<td>Metropolitan deployment for heavy freight vehicles</td>
<td>Possible, but strong policy involvement needed</td>
</tr>
<tr>
<td>Metropolitan deployment for buses</td>
<td>Feasible if enough incentives given</td>
</tr>
<tr>
<td>Metropolitan deployment for general light vehicles</td>
<td>Economic risks for stakeholders should be considered</td>
</tr>
<tr>
<td>Metropolitan deployment for service vehicles / taxi’s</td>
<td>Economic feasibility uncertain</td>
</tr>
<tr>
<td>International freight corridors</td>
<td>Feasible, some concerns on interoperability and legal agreements</td>
</tr>
<tr>
<td>Long-haul national freight corridors</td>
<td>Feasible but utilisation rates should be examined carefully</td>
</tr>
<tr>
<td>Short-haul freight corridors</td>
<td>Feasible</td>
</tr>
<tr>
<td>National deployment for general light vehicles</td>
<td>With the present conditions feasible is not a given</td>
</tr>
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<td>International deployment for general light vehicles</td>
<td>With the present conditions feasible is not a given</td>
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<tr>
<td>International deployment for all vehicles classes</td>
<td>Requires significant changes to reach feasibility</td>
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FABRIC—next steps

Major activities 2016

- Grid and road adaptations at the test sites – test sites ready for testing
- Vehicle systems integration – vehicles ready for testing
- ICT modules development – On-board and Off-board load and charging management algorithms
- Testing
- Comparison with other dynamic charging solutions (VOLVO-SCANIA)

Technical challenges

- Short range V2I communications
- Load balancing and charging management in real time
- No standardization for dynamic charging
- Vehicle alignment with the charging pads on the move
- Creation of unobtrusive and efficient UI
FABRIC – how to contact us

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Join the ERG

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Thank you!

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