SIS14: Electrification of Road Transport: Opportunities and Challenges

Electromobility & FABRIC IP

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Towards Intelligent Mobility
Better use of space
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

Global Annual Sales of Plug In Electric Vehicles (PEV’s)

THE 2015 GUIDE TO ELECTRIC VEHICLES

Global Annual Sales of Plug In Electric Vehicles (PEV’s)

Tesla Superchargers

Within Two Years (2013)

TOWARDS INTELLIGENT MOBILITY
Better use of space
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
  - ...
Objective: to develop, test and evaluate the efficiency of dynamic charging prototypes to assess the feasibility of large-scale deployment of dynamic wireless charging.
FABRIC - 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)
Objective: Perform impact studies on the grid, perform test site 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 seconds)
- 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 smoothing windows reduce daily demand peak)

Expected delivery: Early 2016 (grid adaptations at test sites completed)
Status: A first feasibility study approach examined several large-scale deployment scenarios based on actors’ requirements and FABRIC 1\textsuperscript{st} year 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 high risks</td>
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<tr>
<td></td>
<td>Strong policy involvement needed</td>
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<tr>
<td>Metropolitan deployment for buses</td>
<td>Feasible if enough incentives given</td>
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<tr>
<td>Metropolitan deployment for general light vehicles</td>
<td>High economic risks for stakeholders</td>
</tr>
<tr>
<td>Metropolitan deployment for service vehicles / taxi’s</td>
<td>Economic feasibility not given</td>
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<tr>
<td>International freight corridors</td>
<td>Feasible but concerns on interoperability and legal agreements</td>
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<tr>
<td>Long-haul national freight corridors</td>
<td>Feasible, but high risks due to utilisation</td>
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<tr>
<td>Short-haul freight corridors</td>
<td>Feasible</td>
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<tr>
<td>National deployment for general light vehicles</td>
<td>Not feasible</td>
</tr>
<tr>
<td>International deployment for general light vehicles</td>
<td>Not feasible</td>
</tr>
<tr>
<td>International deployment for all vehicles classes</td>
<td>Requires large changes, thus unlikely to be feasible</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
• Creation of unobtrusive and efficient UI

Towards Intelligent Mobility
Better use of space
## Electromobility challenges

<table>
<thead>
<tr>
<th>Public support</th>
<th>Needs</th>
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<tbody>
<tr>
<td></td>
<td>- Need for direct investment or incentives by authorities and government</td>
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<td>- Standardisation should also cover dynamic charging</td>
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<td>- Regulations regarding the physical characteristics of the installations and safety levels</td>
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<tr>
<th>New Research direction</th>
<th>Needs</th>
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<td>- Synergies with developers of conductive solutions, to investigate how to utilize the same electric infrastructure and grid connection systems.</td>
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<td>- Promote communications security and reliability.</td>
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<td>- Advance eRoaming, to achieve a sole charging network.</td>
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</table>
Thank you

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