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

Wireless Power Transfer for Electric Vehicles: Interoperability and Standards the critical factors towards mass adoption

International Energy Agency
IA-HEV Task 26 Workshop

28-29 June 2016
Rotterdam, Netherlands
**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
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
  - ...

28-29 June 2016

IEA, IA-HEV Task 26 Workshop, Rotterdam, NL
Lack of interoperability impact

- Diverse, early stage products begin to proliferate due to lack of standardization
- Uncertainty regarding control method (grid/vehicle side), coupling coil field pattern, data communications

  - Limited range
  - Reduced user friendliness
  - International travel impossible
  - Congested charging infrastructures
  - Redundant infrastructure > increased cost
System interoperability parameters

- Operating Frequency
- Magnetic Compatibility
- Power levels
- Misalignment tolerance
- Nominal air-gap
- Various mounting requirements for primary pad
- Vehicle pad position
- Efficiency levels
- EMC and EMF regulatory compliance
- Communications between vehicle and charging infrastructure
Solution (I) – Standardization

- What should standards do?
  - Protect customer
    - Consumer health
      » Magnetic/Electric Field exposure
      » Safety
    - Consumer cost
      » Reliability
      » Operations
      » Maintenance
  - Simplify supply chain and contracts
  - Manage interoperability with non-electric vehicles

- What should standards not do?
  - Stifle competition
  - Limit innovation
### Solution (I) – Standardization

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<thead>
<tr>
<th><strong>STANDARD</strong></th>
<th><strong>FOCUS</strong></th>
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<tr>
<td>IEC 61980-1 <em>IS</em> Electric vehicle wireless power transfer (WPT) systems</td>
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<td>Part 1: general requirements</td>
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<td>electric road vehicle (EV) and infrastructure with respect to wireless</td>
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<td>ISO 19363 <em>PAS</em> Electrically propelled road vehicles</td>
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<td>Magnetic field wireless power transfer – safety and interoperability</td>
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<td>SAE J2954 <em>TIR</em> Wireless charging of electric and plug-in hybrid vehicles</td>
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<td>SAE 2847/6 <em>RP</em> Wireless charging communication between plug-in electric</td>
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<td>vehicles and the utility grid</td>
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Steps toward an integrated vehicle - infrastructure system
ISO - IEC Standard coordination

Proposal for timeline of ISO19363

<table>
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<tr>
<th>documents</th>
<th>2016</th>
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<th>2018</th>
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<tr>
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Presented at ISO Meeting on 19363, Berlin 11-13 May 2016

Requirements for end of 2016:
- only one interoperable reference system description per power class
- one communication and positioning concept
Solution (I) – Standardization

SAE TIR J2954* standardizes:
• Frequency band (81.39-90kHz)
• Safety
• Interoperability
• EMC/EMF limits
• Coil definitions
• For WPT 3.7kW, 7.7kW, 11kW, 22kW

IEEE Standards Organization has initiated a Electrical Vehicle Wireless Power Transfer Industry Connections Activity.

Motivation and goal:

This IEEE Standards Association Industry Connection Activity is related to pre-standardization efforts in the domain of Electric Vehicle Wireless Power Transfer with a particular focus on dynamic wireless charging as these efforts address the range limitation of electric vehicles as well as the cost aspect of the vehicle energy storage and complement the current standardization activities of the SAE (TIR J2954) which is centered on static charging.

* available from the SAE website since May 31st
Solution (II) – Platform interoperability (physical)

Fastned tries to appeal to Model S owners and adds Tesla CHAdeMO adapters to 50 charging stations in the Netherlands
Solution (II) – Platform interoperability (ICT)

USA

New partnership between Blink, ChargePoint and EVgo lets you access all 3 charging networks with a single account.

Blink, ChargePoint and EVgo operate more than 17,500 electric vehicle charging stations or about 91% of all stations in the US.

Europe

Hubject’s eRoaming platform makes it possible to charge electric vehicles across Europe.
Future plan: bring everything together through middleware

- **Vehicles**: OEM backend
  - electroMobility Service Provider
- **Charging**:
  - electroMobility Service Provider
- **Energy**: electroMobility Service Provider
  - (Smart Grid Integration)
- **Business Integration**: 3rd Party Service Provider

**NeMo Hyper-Network**
- Charging Network
- Billing & Payment
- panEuropean eRoaming framework
- Development Tool Kits
- **Common Information Model**
- Service Creation
- Service Management

**Information & Communication Technology**

**Privacy & Security**
- Data Translators
- Actors’ monitoring
- Service optimiser
- Partner Management
- Contract Management
- Standard Protocols
- Business Models
Electric Vehicle Harmonization within the eMobility system

addressing the best use of the energy and the user convenience

The design of the vehicle system with particular regard to the on board storage and to the vehicle use can be considered in relation with the possible application of the new technologies on Wireless Power Transfer, the Information and Communication Technology and the functional support of the Service Providers acting in the Hyper Network.
Thank you!

Angelos Amditis – ICCS
Yannis Damousis - ICCS
Giampiero Brusaglino - ATA