MOBILITY – STRATEGY AND APPROACH OF IEC

Dr. Bernhard Thies
German National Committee of the IEC
Connecting an Electric Vehicle to the Grid

... looks easy but many things to be considered.
Stakeholder of Electro-Mobility

- User/customer
- Vehicle
- Charging infrastructure
  - Energy suppliers
  - Grid operators
  - Charging station manufacturers
  - Suppliers
- Battery manufacturers
- Vehicle manufacturers
- Suppliers

Research

Society

Industry and trades

Citizens

Federal, state, district level

Commerce and services
Challenges for Integration of new Consumers and Energy Sources

- Complex systems / individual developments
  - Complexity
  - Price
- High number of simpler user devices
- Number of devices / systems

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- Number of devices / systems
- Complexity
- Price

- High number of simpler user devices
Example: Electromagnetic Compatibility (EMC)

- standards exist, but may not have been designed for Electro-Mobility
  → need adapting, sometimes complex issues

Limits for harmonic currents according to IEC 61000-3

For connection to the grid the vehicle has to comply with standards for grid connection
Standardization is the Solution – not the Problem!

<table>
<thead>
<tr>
<th>Standardization</th>
<th>Regulation</th>
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<tbody>
<tr>
<td>General</td>
<td>UNECE</td>
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<tr>
<td>Electro-technology</td>
<td>EU</td>
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<tr>
<td>Telecommunications</td>
<td>National (Germany)</td>
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</tbody>
</table>

**International**
- ISO
- IEC
- ITU

**Regional (Europe)**
- CEN
- CENELEC
- ETSI

**National (Germany)**
- DIN
- DKE
- VDE

**National regulation**
- National regulation

**Regulation**
- EU

**Standards Austria**
• IEC: Proposal to establish a strategic group 6 “automotive electrotechnics” (tentative title)

• IEC / ISO TC 22: Memorandum of Understanding (MoU)
  - Different modes of cooperation (mode 1 – 5)

• EU: Mandate M/468 on interoperable charging infrastructure in EU
  - Report finalized in September 2011 by CEN / CENELEC Focus Group on European Electromobility
  - Successor group: eMobility Coordination Group

• National: establishment of joint working groups and a steering committee
Committees involved in Electro-Mobility

B: Battery / Fuel-Cell
K: Communication (PWM, V2G)
SVEF: Energy supply for Electric vehicle
LK: Charging cable

LW: Power electronics
M: Motor
RCD: Residual Current Protective Device
Z: Meter

Symbols:
- ISO/TC 22/SC 3/JWG 1
- NA Auto
- K 331 IEC/TC 22
- K 311 IEC/TC 2
- K 384 IEC/TC 105
- K 371 IEC/TC 21

Standards:
- K 767 CLC/TC 8X EN 50160
- K 261 IEC/TC 8 CLC/TC 8X EN 50438
- TAB (FNN)
- K 373 VDE-V 0126-1
- K 952 IEC/TC 57
- K 373 IEC/TC 82
- K 461 IEC/TC 13 IEC/TC 57
- AK 431.1.7 IEC/SC 17D
- GAK 353.0.2 IEC/TC 69
- GAK 353.0.4 IEC/TC 69
- GAK 542.4.1 IEC/TC 20
- GAK 542.4.3 IEC/TC 20
- AK 411.2.8 IEC/TC 20
- K 353 IEC/TC 69
- K 764 IEC/TC 106 BGV B11
- K 767 IEC/TC 77 IEC/CISPR CLC/TC 210

Motor and Power Electronics:
- K 221 IEC/TC 64 CLC/TC 64
- AK 542.1.2 IEC/SC 23B
- AK 221.1.11 IEC/TC 64 CLC/TC 64 VDE 0100-722
- AK 541.3.6 IEC/SC 23E
- K 767 IEC/TC 77 IEC/CISPR CLC/TC 210

Other Standards:
- AK 431.1.7 IEC/SC 17D
- GAK 353.0.2 IEC/TC 69
- GAK 353.0.4 IEC/TC 69
- GAK 542.4.1 IEC/TC 20
- GAK 542.4.3 IEC/TC 20
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Communication protocols are a key technology for smart-grid integration of electric vehicles – but they are not sufficient. Grid stability has to be maintained by worldwide harmonized principles for grid integration and charging controller behaviour → IEC TC 57, IEC TC 8, IEC TC 20, …
Legal Framework in Europe – the big Picture

**Scope of national wiring rules (e.g. DKE-VDE)**
- Charging modes 1 and 2
  - EN 60309-2 socket outlet
  - Domestic socket outlet

**Scope of LVD (CENELEC)**
- Directive 2006/95/EC
- e.g. EN 61851

**Scope of ISO standards and type approval regulations**
- Often based on UN regulations, e.g. R10, R100

**Legal Framework in Europe – the big Picture**

- Charging modes 1 and 2
  - EN 60309-2 socket outlet
  - Domestic socket outlet

- Charging modes 3 and 4
  - Public charging device

- Charging modes 3 and 4
  - Charging device

- Charging modes 3 and 4
  - ICCB

- Charging modes 3 and 4
  - Public charging device
Safety is a must: the whole system needs to be considered (e.g. DC leakage currents) → IEC TC69, TC 64, TC 23, TC 77, TC 17, …

IEC TC 64 standards describe the recognized state of the art for protection against electric shock: “Safety Pilot Function“ for all domains.
**Proposed Connectors – for AC (IEC 62196-2)**

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<thead>
<tr>
<th></th>
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<th>Type 2</th>
<th>Type 3</th>
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<tbody>
<tr>
<td><strong>application</strong></td>
<td>car only</td>
<td>car and infrastructure</td>
<td>infrastructure</td>
</tr>
<tr>
<td><strong>designs</strong></td>
<td>1</td>
<td>1 (for mode 3)</td>
<td>3 different</td>
</tr>
<tr>
<td><strong>voltage</strong></td>
<td>230 V</td>
<td>500 V</td>
<td>500 V</td>
</tr>
<tr>
<td><strong>Number of phases</strong></td>
<td>only 1</td>
<td>1 or 3</td>
<td>1 or 3, different design</td>
</tr>
<tr>
<td><strong>current</strong></td>
<td>32 A</td>
<td>16 A / 32A / 63 A; 70 A*</td>
<td>16 A or 63 A</td>
</tr>
<tr>
<td><strong>power</strong></td>
<td>up to 7.2 kW</td>
<td>up to 43 kW</td>
<td>up to 43 kW</td>
</tr>
<tr>
<td><strong>IP degree mated</strong></td>
<td>IP XX D</td>
<td>IP XX D</td>
<td>IP XX D</td>
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<tr>
<td><strong>IP degree unmated</strong></td>
<td>IP XX B (D optional)</td>
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<td>IP XX D</td>
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*) up to 70A for single phase use

Standards should remove market barriers and not create new ones – why should we accept national requirements for a new infrastructure to be build up?
Seven big car manufacturers have agreed on standards for DC fast charging: Audi, BMW, Daimler, Ford, General Motors, Porsche and Volkswagen.

Several coordinated standardization projects (IEC & ISO) for combined charging system are ongoing – German NC is a driving force.

→ No need for proprietary (or national) solutions!
The German Standardization Roadmap for Electro-Mobility Version 1 has been published end of 2010 …

• … and will be updated by autumn 2011 (to be published soon)

http://www.vde.com/en/dke/std/Pages/EMobility.aspx (also in English)