DOE Perspective on the Codes & Standards Landscape for Electric Vehicles

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Role of Codes & Standards

Enabler of Market Penetration

Safety

Usability

Interoperability

Acceptance
Support development & Validation

1) Utility/Grid Operator

2) Home Energy Management/Home Area Network (HAN)

3) Electric Vehicle Supply Equipment (EVSE)

4) Plug-In Electric/Hybrid Vehicle (PEV)
DOE (VT) Support

- SAE standards committees participation
- Development and validation of standards
- Technology development
# SAE Standards Committees

<table>
<thead>
<tr>
<th>Category</th>
<th>Standards</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Safety</strong></td>
<td>J2344</td>
<td>Electric, HEV &amp; Plug-in Vehicle Safety</td>
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<tr>
<td></td>
<td>J1766</td>
<td>Crash Integrity Testing</td>
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<td></td>
<td>J2578</td>
<td>FCV Safety</td>
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<tr>
<td><strong>Connector/inlet &amp; EVSE</strong></td>
<td>J1772™</td>
<td>PEV Conductive Charge Coupler</td>
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<td></td>
<td>J2954</td>
<td>PEV Wireless Charge</td>
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<tr>
<td><strong>Communications</strong></td>
<td>J2836™</td>
<td>General Information (use cases)</td>
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<tr>
<td></td>
<td>/1</td>
<td>interface with utilities</td>
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<tr>
<td></td>
<td>/2</td>
<td>off-board charger communications</td>
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<tr>
<td></td>
<td>/3</td>
<td>reverse energy flow</td>
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<tr>
<td></td>
<td>/4</td>
<td>diagnostics</td>
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<tr>
<td></td>
<td>/5</td>
<td>customer/HAN</td>
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<td></td>
<td>/6</td>
<td>wireless charging/discharging</td>
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<tr>
<td></td>
<td>J2847™</td>
<td>Detailed Information (messages)</td>
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<td></td>
<td></td>
<td>(same sub-categories as J2836)</td>
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<td></td>
<td>J2931</td>
<td>Protocol (requirements)</td>
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<td></td>
<td>J2953</td>
<td>Interoperability</td>
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Tools for Standards Verification

EVSE-EUMD-HAN Connectivity (SAE J2836/2847)

Vehicle-Grid Interoperability (SAE J2953)

Initial Operation Demo

Utility Messages
900MHz to back haul
2.4GHz to Zigbee to HAN
(Storion or SilverSpring)

Home Gateway
HAN/Zigbee/ethernet
(Ogil, Greenwave)

EVSE w/Compact
Metrology
and Vehicle-EVSE Router
Pass through HAN/Zigbee/ethernet

Emulated/Physical Vehicle
Connected to J1772 or
(BMS, Pseudo Batt, Charger,
CAN network/convert to DUT)

Test Fixtures to Verify
Compliance with SAE J2953 –
Interoperability Between Key
Elements of Vehicle Charging
Infrastructure
EUMD with Universal Communication

**End-Use-Measurement Device (EUMD)**

- Flux gate magnetometer sensor proof-of-concept
- REV1: Custom board, off-the-shelf sensors, Xbee radio
- REV2: Integrated FGM current sensors and PLC communication
- Lab/field test at ANL, DTE Energy and SCE
- Field test at ORNL solar EV charge station
- Field test in Europe/Asia
- Expand application to smart energy grid
- Field test in Europe/Asia

**Software-Defined Radio**

- SDR in one-chip communication solution using flexible baseband chip (PLC, Zigbee/HomePlug SEP, SUN radio, etc.)

**Field Verification of Performance and Communication Standards**
Summary

- Codes and Standards Enable Market Acceptance
- DOE Supports Industry & SDO Efforts
- DOE Supports Global Harmonization