PEV/EVSE Communication
SAE Task Force Status

Rich Scholer
December 3rd, 2012
Outline

• Background
  – Major Documents, Summation, Interaction

• Use Case Summary
  – U1 – U5 (Utility programs)
  – U6 & U7 (PEV as DER)
  – U8 & U9 (Customer to PEV/HAN)

• DC Charging
  – Status, Next steps

• Wireless Charging

• Interoperability

• Security

• Diagnostics
1. J2836™ - Use Cases (establishes requirements)
   - ISO/IEC 15118-1
2. J2847 – Messages, diagrams, etc. (derived from the use case requirements)
   - ISO/IEC 15118-2
3. J2931 – Communication Requirements & Protocol
   - ISO/IEC 15118-3
4. J2953 – Interoperability
   - ISO/IEC 15118-4 (PHY/MAC) & -5 (upper layers)
Summation of SAE Communication Standards

**J2836™ – General info (use cases)**
- Dash 1 – Utility programs *
- Dash 2 – Off-board charger communications* 
- Dash 3 – Plug-in Vehicle Communication as a Distributed Energy Resource 
- Dash 4 – Diagnostics 
- Dash 5 – Customer to PEV and HAN/NAN 
- Dash 6 – Wireless charging/discharging

**J2931– Protocol (Requirements)**
- Dash 1 – General Requirements* 
- Dash 2 – InBand Signaling (control Pilot) 
- Dash 3 – NB OFDM PLC over pilot or mains 
- Dash 4 – BB OFDM PLC over pilot or mains* 
- Dash 5 – Telematics 
- Dash 6 – DSRC/RFID (wireless charging/alignment) 
- Dash 7 - Security

**J2847– Detailed info (messages)**
- Dash 1 – Utility programs *
- Dash 2 – Off-board charger communications *
- Dash 3 – Plug-in Vehicle Communication as a Distributed Energy Resource 
- Dash 4 – Diagnostics 
- Dash 5 – Customer to PEV and HAN/NAN 
- Dash 6 – Wireless charging/discharging

**J2953– Interoperability**
- Dash 1 – General Requirements 
- Dash 2 – Testing and Cert 
- Dash 3 – * Published
Document Interaction

Use Cases
- Utility Programs (U1 – U5)
- DC Charging
- PEV as Distributed Energy Resource (DER) (U6 & U7)
- Diagnostics
- Customer to PEV and HAN/NAN (U8 & U9)
- Wireless Power Flow

Applications & Signals
- J2836/1™
- J2836/2™
- J2836/3™
- J2836/4™
- J2836/5™
- J2836/6™

Requirements
- J2847/1
- J2847/2
- J2847/3
- J2847/4
- J2847/5
- J2847/6

Protocol
- J2931/1
- J2931/4
- J2931/5
- J2931/6
- PLC (BB OFDM)
- Internet
- DSRC (& RFID)

J2953/1 Interoperability, J2953/2 Test Procedures

J2931/7 Security
UTILITY PROGRAMS

U1 – U5

Price (TOU, RTP, CPP) – U1, 3 & 4

DRLC – U2

Optimized Charging – U5
Use Cases U1 – U5

Detailed Use Case Summary

Customer selects
one or more

U1: TOU
U2: Direct Load/Price Control
U3: RTP (Active Management)
U4: Critical Peak Pricing
U5: Optimized Charging

(Why)

General Registration/Enrollment Steps
Initial Setup for PHEV-Utility Communication & Authentication

Utility Programs
(Awareness, Specific Enrollment)

Customer uses
only one

S1: Cordset EVSE
(120V AC to vehicle)
S2: Premise EVSE
(240V AC to vehicle)
S3: Premise EVSE w/Charger
(DC to vehicle)

(How)

Binding/Rebinding
(Startup, VIN Authentication, Basic Charging per enrolled program, Shutdown)

Customer uses
only one

L1: Home:
    Connects at premise
L2: Another's Home
    Inside the utility’s service territory &
A: premise pays tariff
B: customer pays tariff
L3: Another's Home
    Outside the utility’s service territory
L4: Public:
    Curbside, workplace, business, multi family dwelling

(Where)

Connection Location
(VIN Authentication, Basic Charging per enrolled program)

(What)

PR1: Charge
PR2: Discharge
PR3: Diagnostics
PR4: VM Specific

V2G, V2H, V2L, V2V
Use Cases 1 thru 5 - Status

J2836/1™ - Use Cases
• No updates planned

J2847/1 – Signals/messages/sequence diagrams
• Slav Berezin is new lead
• Dan Mepham updated with SEP2 DRLC, need to continue with other SEP2 function sets.

J2931/1 - Requirements
• No changes planned
PEV AS A DISTRIBUTED ENERGY RESOURCE (DER)

U6 & U7
Use Case Summary

Customer selects one or more
U1: TOU
U2: Direct Load/Price Control
U3: Active Management
U4: Critical Peak Pricing
U5: Optimized Charging

Customer uses only one
S1: Cordset EVSE (120V AC to vehicle)
S2: Premise EVSE (240V AC to vehicle)
S3: Premise EVSE w/Charger (DC to vehicle)

Customer uses only one
L1: Home: Connects at premise
   A: premise pays tariff
   B: customer pays tariff
L2: Another’s Home
   Inside the utility’s service territory
L3: Another’s Home
   Outside the utility’s service territory
L4: Public: Curbside, workplace, business, multi family dwelling

General Registration/Enrollment Steps
Initial Setup for PHEV-Utility Communication & Authentication

Utility Programs
(Awareness, Specific Enrollment)

Binding/Rebinding
(Startup, VIN Authentication, Basic Charging per enrolled program, Shutdown)

Connection Location
(VIN Authentication, Basic Charging per enrolled program)

(What)
PR1: Charge
PR2: Discharge
PR3: Diagnostics
PR4: VM Specific

(Where)
L1
L2
L3
L4

(How)
S1
S2
S3

(Why)
U1
U2
U3
U4
U5
U6
U7
U6 & U7

Use Cases
- Utility Programs (U1 – U5)
- DC Charging
- PEV as Distributed Energy Resource (DER) (U6 & U7)
- Diagnostics
- Customer to PEV and HAN/NAN (U8 & U9)
- Wireless Power Flow

Applications & Signals
- J2836/1™
- J2836/2™
- J2836/3™
- J2836/4™
- J2836/5™
- J2836/6™
- J2847/1
- J2847/2
- J2847/3
- J2847/4
- J2847/5
- J2847/6

Protocol Requirements
- J2931/1
- J2931/4

Internet
- J2931/5
- J2931/6

DSRC (& RFID)

J2953/1 Interoperability, J2953/2 Test Procedures

J2931/7 Security
Use Cases U6 & U7 Status
Hank McGlynn

J2836/3™ - In Formatting, expected publication Nov, 2012

- U6 - Basic Distributed Energy Resource (active power or bidirectional power conversion)
- U7 - Advanced Distributed Energy Resource (adds the communications required to take advantage of four quadrant power conversions)

J2847/3 – starting soon

- Include DER Function Set (SEP2)
- Add any DER functions in OpenADR & others - for HAN (if not SEP2), both public & private EMS

J2931/1 – no changes
CUSTOMER TO PEV AND HAN

U8 & U9
Use Cases U8 & U9

Detailed Use Case Summary

General Registration/Enrollment Steps
Initial Setup for PHEV-Utility Communication & Authentication

Utility Programs
(Awareness, Specific Enrollment)

Customer Programs
(Mobile apps, Special OEM features)

E

U1 U2 U3 U4 U5 U6 U7

(Why)
Customer selects
one or more
U1: TOU
U2: Direct Load/Price Control
U3: RTP (Active Management)
U4: Critical Peak Pricing
U5: Optimized Charging

(How)
Customer uses
only one
S1: Cords ECSE
(120V AC to vehicle)
S2: Premise EVSE
(240V AC to vehicle)
S3: Premise EVSE w/Charger
(DC to vehicle)

(Where)
Customer uses
only one
L1: Home:
Connects at premise
L2: Another's Home
Inside the utility's service
territory &
A: premise pays tariff
B: customer pays tariff
L3: Another's Home
Outside the utility's service
territory
L4: Public:
Curbside, workplace, business,
multi family dwelling

(Want)

PR1: Charge
PR2: Discharge
PR3: Diagnostics
PR4: VM Specific
V2G, V2H, V2L, V2V

Connection Location
(VIN Authentication,
Basic Charging per
enrolled program)

Binding/Rebinding
(Startup, VIN
Authentication,
Basic Charging per enrolled program,
Shutdown)
U8 & U9 Status

Use Cases
- Utility Programs (U1 – U5)
- DC Charging
- PEV as Distributed Energy
- Customer to PEV and HAN/NAN (U8 & U9)
- Wireless Power Flow

Applications & Signals
- J2836/1™
- J2836/2™
- J2836/3™
- J2836/4™
- J2836/5™
- J2836/6™
- SEP2
- J2847/1
- J2847/2
- J2847/3
- J2847/4
- J2847/5
- J2847/6

Protocol Requirements
- J2931/1
- J2931/4
- J2931/5
- J2931/6
- J2931/7 Security

Industry standard API
- PLC (BB OFDM)
- Internet
- DSRC (& RFID)

J2953/1 Interoperability, J2953/2 Test Procedures
Use Cases U8 & U9
George Bellino & Venkatesh Donthy

J2836/5™
- U8 – Customer to PEV
- U9 – Customer/PEV to HAN/Utility (premises)

J2847/5
- SEP2
- Include signals for advanced PEV/Customer functions
  - SoC info, Start/stop charge control, Preheat/cool cabin/battery
  - More...

J2931/1 – any changes?

J2931/5 – include the Application Interface (API)
- Complete the Use Cases 1st, then the API.
DC CHARGING
## Document publication status

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## SAE Communication Document Summary

### SAE Task Force Topic

- **J2847/2 (DC Charging)**
  - Started 4-20-12, ended 5-4-12
- **J2931/1 (Stack Info)**
  - Started 5-17-12, ended 5-31-12
- **J2931/4 (PLC Protocol)**
  - Started 5-17-12, ended 5-31-12
- **J2847/2 Comments**

### SAE Hybrid Committee Ballot - DC Charging

- **J2847/2**
  - Started 5-11-12, ended 6-8-12
- **J2847/2 Affirmation**
  - Started 6-8-12, ended 6-21-12
- **J2931/1**
  - Started 6-4-12, ended 7-1-12
- **J2931/4**
  - Started 6-1-12, ended 7-5-12

### SAE Formatting

- **J2847/2**
  - Started 6-22-12 ended 7-23-12

### Publish

- **J2847/2 (DC Charging) - Recommended Practice (RP)**
  - Started 7-2-12 ended 9-9-12
- **J2931/1 - Technical Information Report (TIR)**
  - Started 7-2-12 ended 7-26-12
- **J2931/4 - Technical Information Report (TIR)**
  - Started 7-24-12 ended 8-19-12

*Dates marked with stars indicate final publication dates.*
DC Charging Documents

Use Cases
- Utility Programs (U1 – U5)
- DC Charging
  - PEV as Distributed Energy Resource (DER) (U6 & U7)
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- J2847/6

Protocol Requirements
- J2931/1
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- J2931/5
- J2931/6

Internet
PLC (BB OFDM)
DSRC (& RFID)

J2953/1 Interoperability, J2953/2 Test Procedures
J2931/7 Security
Status

- Documents are published
- Combo connector/inlet is UL certified
- We are moving into the implementation phase
  - Effort is included in the interoperability plan
WIRELESS CHARGING

J2954 – Jesse Schneider’s Task Force
J2936/6™, J2847/6 - Mark Klerer is lead
Wireless Charging

Use Cases
- Utility Programs (U1 – U5)
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- J2836/5™
- J2836/6™

Protocol Requirements
- J2931/1
- J2931/4
- J2931/5

Networks
- PLC (BB OFDM)
- Internet
- DSRC (& RFID)

J2953/1 Interoperability, J2953/2 Test Procedures
J2931/7 Security
Status

- J2836/6™ Use Cases almost ready to ballot
- J2847/6 will start upon completion of use cases.
  - Reference /1 for Utility
  - Reference /2 for base charging (not unique to wireless interface)
  - Reference /3, /4 /5 as applicable
INTEROPERABILITY

J2953/1, /2 – Ted Bohn is lead
J1772™ Control Pilot
& DC Charging are 1st priorities
The new FY2011 Vehicle Technologies Program Wide Funding Opportunity Announcement (DE-FOA-0000239) addresses the development of key technologies in eight areas of interest (AOI), each with specified subtopic areas: advanced fuels and lubricants; lightweighting materials; multi-material lightweight vehicle demonstration; advanced cells and design for electric drive batteries; advanced power electronics and electric machines (APEEM); thermoelectrics and enabling engine technologies; fleet efficiency; and advanced vehicle testing and evaluation

**AOI 7: Fleet Efficiency**

- The goal of this effort is to develop and demonstrate technologies that will positively affect efficiency of the fleet of passenger cars and commercial vehicles.

**Area of Interest 8: Advanced Vehicle Testing and Evaluation**

- The objective of this area of interest is for projects to conduct laboratory and field evaluations of advanced technology vehicles and their associated infrastructure and the development of new test procedures and/or modifications of existing test procedures necessary to accomplish these performance evaluations.
- The scope of the work shall include baseline performance, accelerated reliability, and fleet testing of state-of-the- art light-, medium-, and heavy-duty advanced technology vehicles and the required vehicle-to-infrastructure interface required for fueling/charging the vehicles.”
- The rest of the RFP on the FOA is at [http://www.greencarcongress.com/2010/12/doevt-20101216.html#more](http://www.greencarcongress.com/2010/12/doevt-20101216.html#more)
ECOtality Project Role:

- Primary Contractor / Project Manager
- Develop final test procedures for review and approval by SAE J2953 Committee
- Conduct testing
- Procurement of Test Properties

SAE Project Role:

- Subcontractor
- Recruitment of project participants
- Interface to SAE J2953 Committee
- SAE J2953 Committee to develop draft test procedures based on J1772 & J2953
- Quarterly and Final Reports
- SAE Standards for AC and DC level 1 & 2 Interoperability
• DOE/Dept of Commerce endorsed activity with Argonne National Lab (ANL) as the North American PEV Smart Grid Interoperability Center being the US side of the activity.

• ANL built the interactive demo/display shown in the article, at the event in Washington DC (Dec, 2011).

SECURITY

J2931/7
Security

- J2931/7 posted to task force (Hina Chaudhry)
- Plan to restart meetings and update soon (Robert Cragie is the new lead)
DIAGNOSTICS

J2836/4™ – Control pilot and Proximity failures are documented

- Do we ballot, then re-open to include more
- or wait for team to work more into the initial release?
CoS Status

- Included:
  - J1772™ - SAE Electric Vehicle and Plug in Hybrid Electric Vehicle Conductive Charge Coupler
  - J2836/1™ - Use Cases for Communication between Plug-in Vehicles and the Utility Grid
  - J2847/1 - Communication between Plug-in Vehicles and the Utility Grid Using Smart Energy Profile 2.0
CoS Status

• Ready to be added:
  2. J2836/2™ - Use Cases for Communication between Plug-in Vehicles and Off-Board DC Charger
  3. J2847/2 - Communication Between Plug-In Vehicles and Off-Board DC Chargers
  4. J2894/1 - Power Quality Requirements for Plug-In Electric Vehicle Chargers
  5. J2931/1 - Digital Communications for Plug-in Electric Vehicles
  6. New J2931/4 - Broadband PLC Communication for Plug-in Electric Vehicles
  7. New J2836/3™ - Use Cases for Plug-in Vehicle Communication as a Distributed Energy Resource
THE END

Questions?