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<tr>
<th><strong>Docket Number:</strong></th>
<th>16-TRAN-01</th>
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<tbody>
<tr>
<td><strong>Project Title:</strong></td>
<td>SB 350 Transportation Electrification (Publicly Owned Utilities)</td>
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<tr>
<td><strong>TN #:</strong></td>
<td>214655</td>
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<tr>
<td><strong>Document Title:</strong></td>
<td>Presentation - Kn-Grid - CEC VGI Workshop</td>
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<tr>
<td><strong>Description:</strong></td>
<td>By Stephen Davis, 12/7/16</td>
</tr>
<tr>
<td><strong>Filer:</strong></td>
<td>Tami Haas</td>
</tr>
<tr>
<td><strong>Organization:</strong></td>
<td>Kn-Grid</td>
</tr>
<tr>
<td><strong>Submitter Role:</strong></td>
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<td><strong>Submission Date:</strong></td>
<td>12/7/2016 8:36:04 AM</td>
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<td><strong>Docketed Date:</strong></td>
<td>12/7/2016</td>
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CEC VGI Workshop

December 7th, 2016
California’s Smart Charging Vision: A future where

> the highest level of cybersecurity is maintained at all times

> any PEV owner can safely plug in (Level 2) anytime and anywhere and be dispatchable as a ‘certified resource’

> that helps electric system operators:
  > maintain reliable service
  > cost-effectively
  > while achieving our State RPS and GHG reduction goals

> seamlessly without confusing the consumer

> or impacting their transportation needs

> in a way that lowers their total cost of ownership.
Key Attributes of ISO 15118

- Cyber security analysis: Digital Certificates
- ISO 15118 and other DER protocols
- Implementation costs of ISO 15118
- Current work on ISO 15118 Edition 2
<table>
<thead>
<tr>
<th>ISO/IEC V2G CI PT structure</th>
<th>ISO/IEC Vehicle to Grid – Communication Interface</th>
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<tbody>
<tr>
<td>Layer</td>
<td>TC69 Paul Bertrand (for EDF)</td>
</tr>
<tr>
<td>7  Application</td>
<td>TC22/SC3/JWG1 Michael Schwaiger (BMW) Secretary: Eric Wern (VDA)</td>
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<tr>
<td>6  Presentation</td>
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<td>5  Session</td>
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<td>4  Transport</td>
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</tr>
<tr>
<td>3  Network</td>
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</tr>
<tr>
<td>2  Data Link</td>
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<td>1  Physical</td>
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<tr>
<th>PT 1:</th>
<th>PT 2:</th>
<th>PT 3:</th>
<th>PT 4:</th>
<th>PT 5:</th>
<th>PT 6:</th>
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<tbody>
<tr>
<td>Use-cases Sven Jundel (RWE)</td>
<td>Messages, Sequences &amp; Timing</td>
<td>Protocols Andreas Heinrich,</td>
<td>Communication technologies</td>
<td>security analysis and measures</td>
<td>Conformance Test</td>
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<tr>
<td></td>
<td>Stephan Voit (RWE)</td>
<td>(Daimler)</td>
<td>Hervé Szychter (Renault)</td>
<td>Sebastian Kaluza (BMW)</td>
<td>Jens Schmutzler (TU Dortmund)</td>
</tr>
</tbody>
</table>

*Wireless Communication is developed within Project Team (PT) 7.*
ISO 15118 DER Model

**Primary Actors**

- Electric Vehicle
- Supply Equipment Communication Controller
- Electric Vehicle Supply Equipment
- Electric Energy Meter
- Contactor
- Paying Unit
- HMI
- Vehicle User

**Secondary Actors**

- Charge Station Operator
- Demand Clearing House
- Automaker
- Fleet Operator
- Microgrid
- Local Utility
- EVSP
- Electricity Service Provider
- Transmission System Operator

**ISO 15118 DER Model**

- Electric Vehicle Communication Controller
- ECU
- Charger
- HMI

**Transmission System Operator**

**EVSP**

**Electricity Service Provider**

**Local Utility**

**Fleet Operator**

**Demand Clearing House**

**Charge Station Operator**

**Automaker**

**ISO 15118 DER Model**
The Foundation of Vehicle-Grid Integration

- Reliability
- Scalability
- Low Cost
- Cyber Security
- Simplicity for consumer

Single Certified Distributed Energy Resource (DER)

- Vehicle conditions
- Mobility needs
- Grid conditions
- Grid needs
Broad Spectrum of Participants shows high acceptance for expected Market – ISO/IEC 15118 in Figures

- Registered experts: 138
- Active countries: 13
- Passive ("reading") countries: 14
- Number of official comments to 15118 documents: ~ 6000
What’s CCS?

The key features of the Combined Charging System include the following:

**AC charging:**
With the electrical interface specification for power transmission, which includes safety-related signaling for AC charging that complies with the international IEC 61851-1 standard
With a Type 1 connector (Type 2 in Europe) that is compliant with the international IEC 62196-2 standard

**DC charging:**
With the electrical interface specification for power transmission, which includes safety-related signaling for DC charging that complies with the international IEC 61851-23 standard.
With the connector Combo 1 (Combo 2 in Europe), compliant with the international IEC 62196-3 standard

The communication interface between the electric vehicle and the charging point, based on the international standard ISO/IEC 15118.
Intelligent infrastructure talking to intelligent vehicles
Smarter…Faster…Simpler…for the consumer

Cable safety test successfully completed.

I can deliver up to 11 kW

Here's my ID, I am an authenticated PEV and I would like to charge

Valid ID, please go ahead, power will be activated

I need 12 kWh to fully recharge by 9 a.m. tomorrow morning

So far I delivered 5 kWh to you, please confirm

O.K. I'll adjust my plans and will charge from 3 a.m. to 5 a.m. at 6 kW

I confirm to have received approx. 5 kWh

I want to leave, please unlock the charge cord

**Demand Clearing House**
Here are power levels & prices over time for your needs & special rate for wind-power of up to 10kW between 3 a.m. to 6 a.m. at 3 cents/kWh

**The heart and soul of smart charging**
How do we deliver *this* to the PEV?

<table>
<thead>
<tr>
<th>Market</th>
<th>Date From:</th>
<th>Date To:</th>
<th>HASP Locational Marginal Prices (LMP)</th>
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<td>HASP</td>
<td>05/28/2015</td>
<td>05/28/2015</td>
<td>LMP</td>
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<td></td>
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<td></td>
<td><strong>42.49382</strong></td>
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<td></td>
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<td><strong>19.84151</strong></td>
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<td><strong>22.05677</strong></td>
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</table>

**LMP**

**Congestion**

**Energy**

**Loss**

**Greenhouse Gas**

Report Generated: 05/28/2015 12:07:13

Kn·Grid®

Harnessing the Power of the Market
Avoiding ‘Back-feed’ on circuits w/ high PV penetration

Figure 3. Rooftop PV systems (black) and USI (yellow) in substation service territory (red)

Figure 17. Net load curves with different number of vehicles used to “valley fill” on April 1st.
How does a ‘Demand Clearing House’ work?

Local Utility (or other “Secondary Actor”) sends information to the DCH

Sample proposed grid profile:
contains available power & prices in following CSV format:

DemoTariffTable;
1;TARIFFID_1;Standard;
0,0,0;30;6600;100%;
0,15;0;3700;50%;
(32A starting from Sunday Morning 0.00 for 100% of the costs; 32 from 15.00 (3p.m.) Sunday, at 50% of the costs)...

Prices over next 24 hrs

Renewable Energy & Other Power plant info

Load forecast - Transmission & Substation

Load forecast - Distribution & Substation

Load forecast - Transformer & other EVCC Grid Profiles

Consolidate to Grid Profile and Propose to SECC/EVCC

Supply Equipment Communication Controller

Electric Vehicle Communication Controller

PLC on pilot wire

Demand Clearing House (agnostic to utility or EMS protocol)
# Grid Profiles

<table>
<thead>
<tr>
<th>TariffStart</th>
<th>[Seconds from now]</th>
<th>0</th>
<th>7.200</th>
<th>14.400</th>
<th>21.600</th>
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</thead>
<tbody>
<tr>
<td>EPrice</td>
<td>[relative, in %]</td>
<td>100%</td>
<td>70%</td>
<td>80%</td>
<td>100%</td>
</tr>
</tbody>
</table>

**max. Amp per max. Watt**

<table>
<thead>
<tr>
<th>Amp</th>
<th>Watt</th>
</tr>
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<tbody>
<tr>
<td>32</td>
<td>22.170</td>
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<tr>
<td>16</td>
<td>11.085</td>
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<tr>
<td>10</td>
<td>6.928</td>
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</table>

Source: According to Committee Draft ISO/IEC 15118-2
World’s First Demand Clearinghouse

Energy Resources

Independent System Operator

Utility

Coordinates PEV Charging with Grid Conditions and Pricing

Demand Clearing House

15118-Capable Charging Stations and PEVs

Kn·Grid®
Harnessing the Power of the Market
IEC 61850 DER Model created to withstand changes over time

Simplicity at the edge of the network

- Large-scale power generation from renewable energy
- PEVs and charging infrastructure
- System service provided by distribution system operators
- Pooling (virtual power plant)
- Decentralized generation and private consumption
- ICT systems
  Data exchange regarding demand and availability of electricity
Germany and California vow to expand cooperation on climate and environment

For Immediate Release
November 17, 2016
Contact: Alex Barnum (916) 324-9670

MARRAKESH—Meeting at the United Nations Climate Change Conference (COP22) in Morocco, California Secretary for Environmental Protection Matthew Rodriquez and German State Secretary for Environment, Building and Nuclear Safety Jochen Flasbarth agreed to expand cooperation and redouble their commitment to reaching the goals of the Paris Agreement and keeping the global temperature well below 2 degrees Celsius.

At their meeting, State Secretary Flasbarth and Secretary Rodriquez discussed the need for decisive climate action now to avoid the worst impacts of climate change on the environment, as well as on people’s health and livelihood. They also discussed how solutions to climate change, like investing in renewable energy, energy efficiency and climate smart technology, will help grow our economies and create jobs.

- See more at: [http://www.calepa.ca.gov/PressRoom/Releases/2016/CAGermany.htm#sthash.DUyi7jKm.dpuf](http://www.calepa.ca.gov/PressRoom/Releases/2016/CAGermany.htm#sthash.DUyi7jKm.dpuf)
Successful Movements and Companies start with why…
POWERING RENEWABLE CHANGE

Oxygen Initiative offers a full-service suite of products and services to help you install and maintain electric vehicle charging stations at your home or business.

Stephen Davis - CEO
sdavis@oxygeninitiative.com