California Multi-Agency Update on Vehicle-Grid Integration Research

Second Annual Staff Workshop

EPC-14-077:
Vehicle-Grid Integration and the ISO/IEC 15118 Global Interoperability Standard

December 14, 2015

Mike Ferry, Principal Investigator

Center for Sustainable Energy®

EPC-14-077: VGI using ISO/IEC 15118

- $1.5 million of CEC funds + $100,000 in match
- Term: July 2015-June 2018 (3 years)
- Partners & Supporters:

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Kn·Grid Harnessing the Power of the Market

RWE The energy to lead

DAIMLER

ENERGY SOLUTIONS

University of California San Diego

SDGE A Sempra Energy utility

PG&E

SIEMENS

STRATEGEN STRATEGIES FOR CLEAN ENERGY

California ISO Shaping a Renewed Future

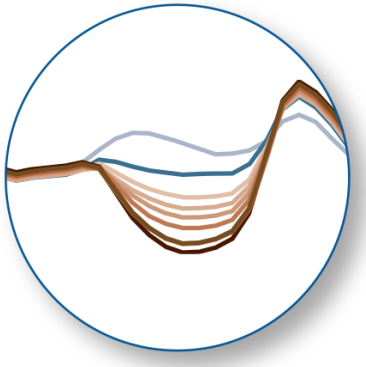
BMW GROUP

Why Vehicle-Grid Integration?

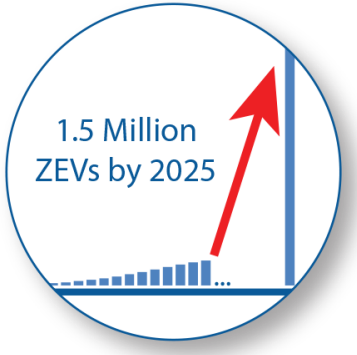
Why Vehicle-Grid Integration?

SB 350
50% RPS

"Duck
Curve"



ZEV
Goals



High-Penetration
DERS

Why Vehicle-Grid Integration?

45 million MWh annual consumption

6,000 MW of daily load (20% average CA)

Why Vehicle-Grid Integration?

45 million MWh annual consumption

6,000 MW of daily load

How?

How?

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The Foundation of Vehicle-Grid Integration

How do we turn this into a certified, validated grid resource?

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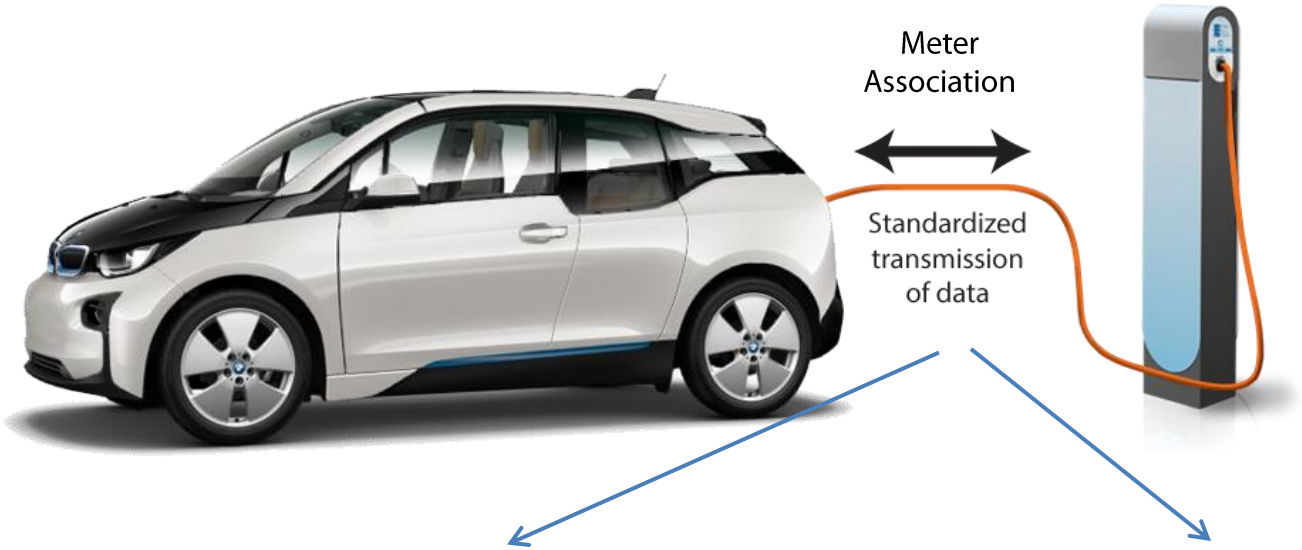
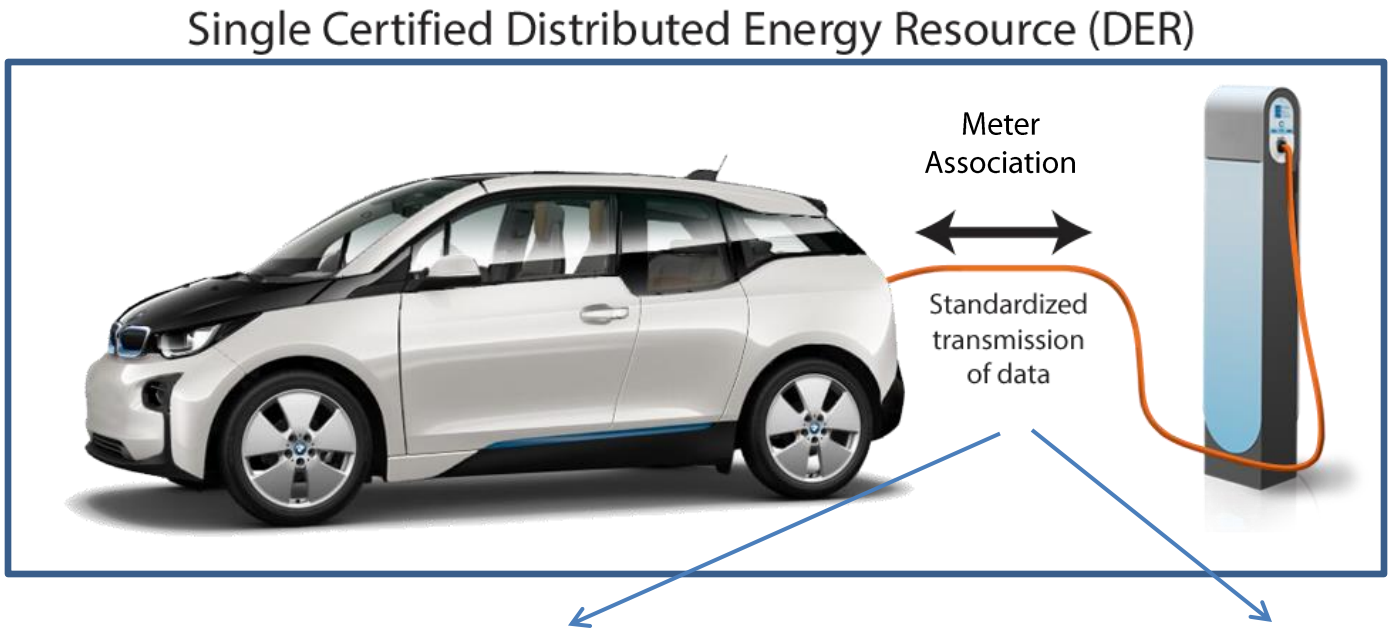


- Vehicle conditions
- Mobility needs

- Grid conditions
- Grid needs

The Foundation of Vehicle-Grid Integration



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- Grid conditions
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The Foundation of Vehicle-Grid Integration

- Reliability
- Scalability
- Low-Cost
- Cyber-Security

Single Certified Distributed Energy Resource (DER)

- Vehicle conditions
- Mobility needs

- Grid conditions
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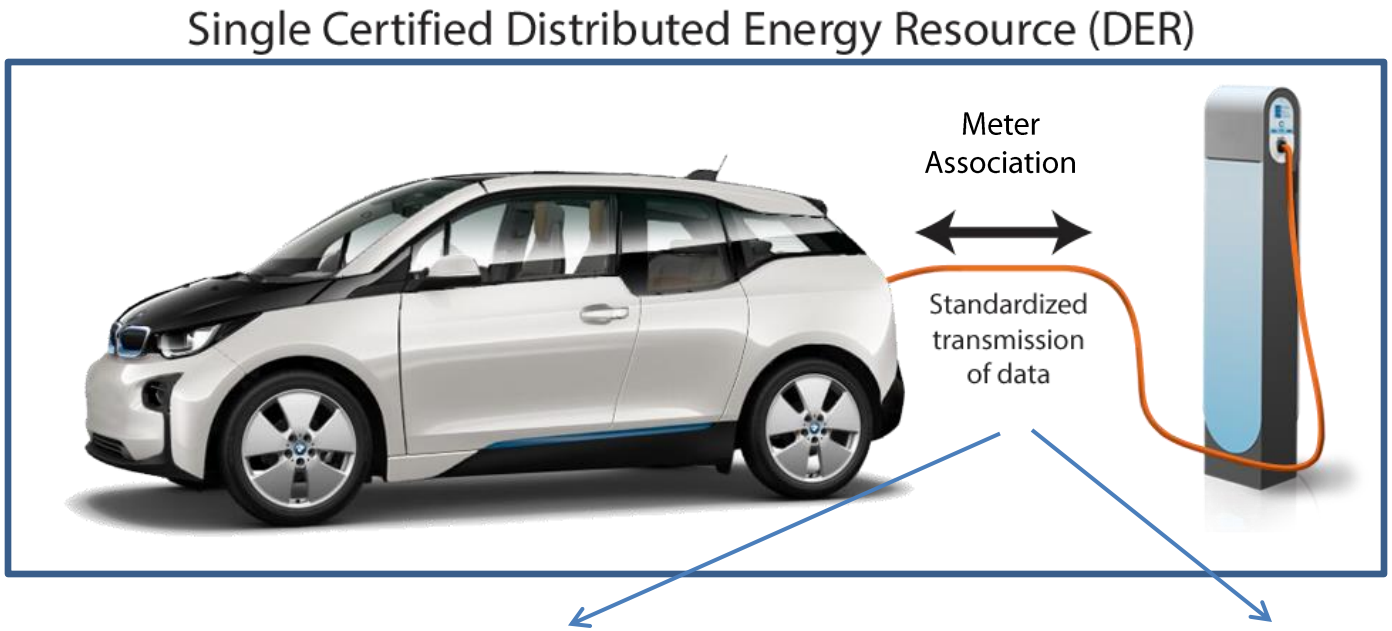
The Foundation of Vehicle-Grid Integration

International Organization for Standardization

ISO/IEC 15118

INTERNATIONAL ELECTROTECHNICAL COMMISSION



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Foundation of VGI : ISO/IEC 15118

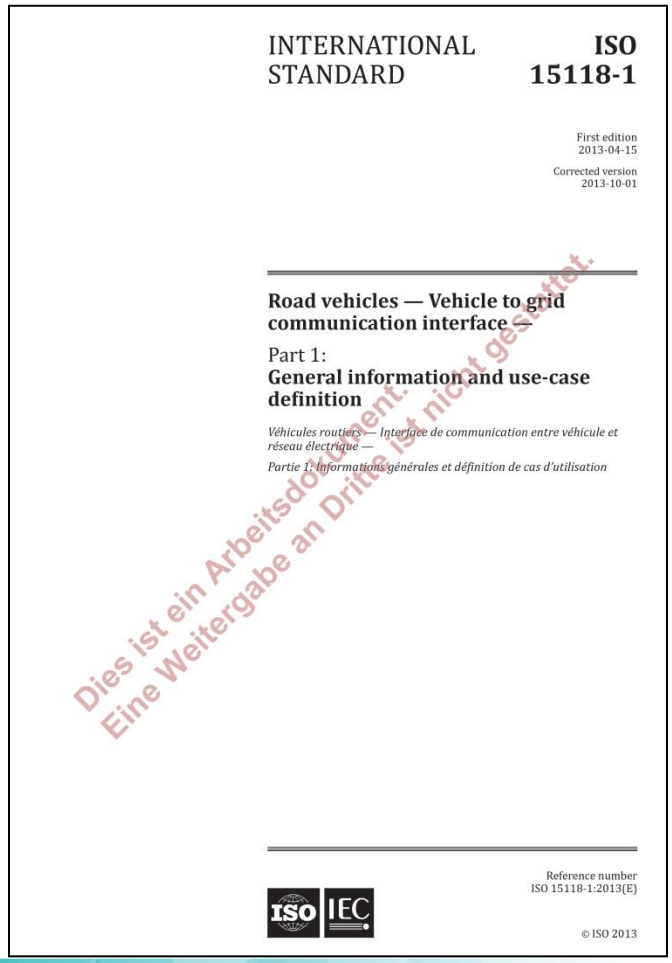
International Organization for Standardization

INTERNATIONAL ELECTROTECHNICAL COMMISSION

- Developed over the past 7 years through consortium of OEMs, utilities, and standards bodies
- Specifies the communication protocols for integration of electric vehicles with the electrical grid
- Over 5,000 ISO/IEC-capable 15118 charging stations installed in over 21 countries
- Standard already implemented on all vehicles with SAE J1772 DCFC connection (CCS)
- Currently being adopted by major European OEMs for Level 2 AC charging

EPC-14-077 : Key Tasks and Deliverables

- Development of “Demand Clearing House”



INTERNATIONAL STANDARD **ISO 15118-1**

First edition
2013-04-15

Corrected version
2013-10-01

Road vehicles — Vehicle to grid communication interface —

Part 1:
General information and use-case definition

Véhicules routiers — Interface de communication entre véhicule et réseau électrique —

Partie 1: Informations générales et définition de cas d'utilisation

Reference number
ISO 15118-1:2013(E)

ISO 15118
International Standard

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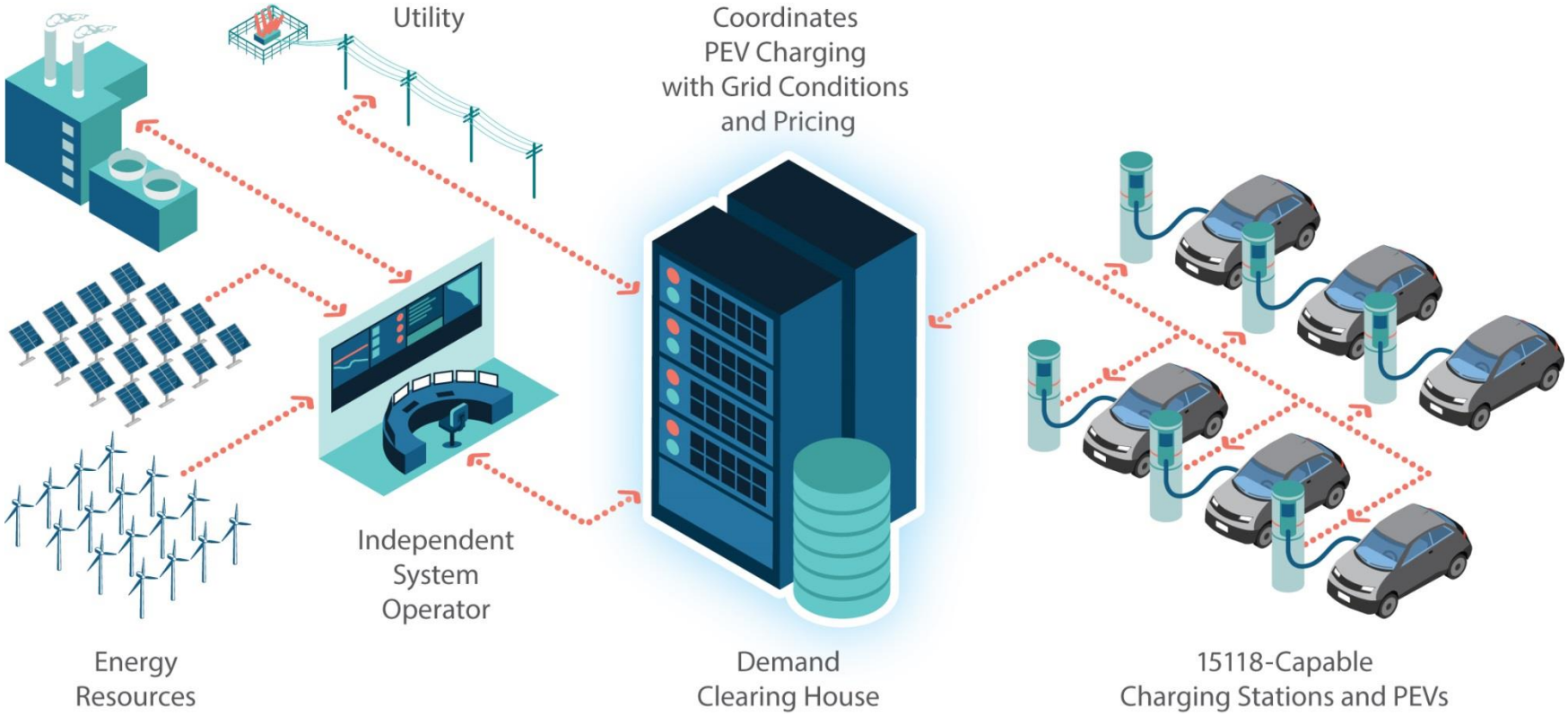
EPC-14-077 : Key Tasks and Deliverables

- Development of “Demand Clearing House”
  - Defined in the ISO/IEC 15118 Roadmap as a “secondary actor”
  - “Collect(s) all necessary information from parts of the power grid … and predicted charging schedules submitted by [electric vehicles].
  - “Consolidate the collected grid information to a ‘grid profile’ and offer it to [EVSEs and EVs].”
  - “Inform the [EVSE] as to the necessity for an updated charging schedule if the grid profile has changed.”

Demand Clearing House (DCH)



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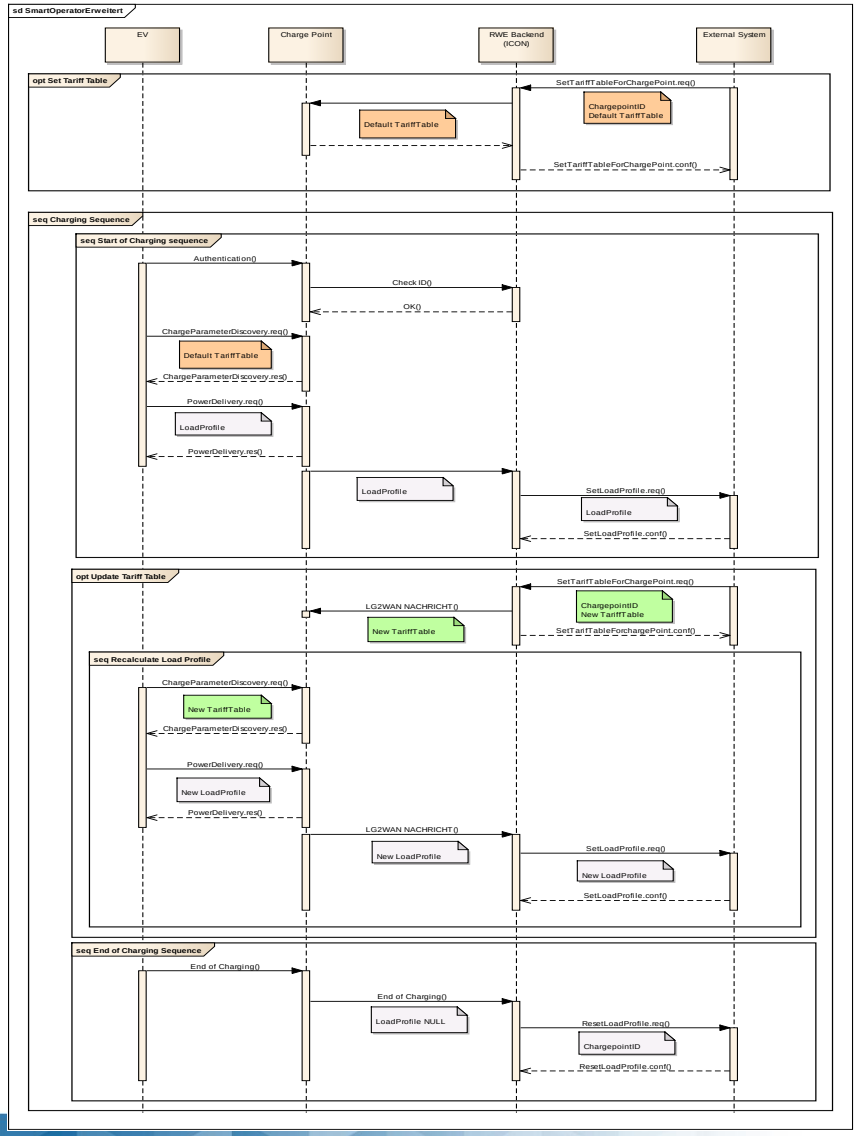
ISO/IEC 15118: Smart Vehicles talking to Smart Infrastructure



Courtesy of RWE

ISO/IEC 15118
Process Flow Diagram

(1)EV
(2)EVSE
(3)EVSP
(4)DCH

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ISO/IEC 15118: Smart Vehicles talking to Smart Infrastructure

	EV	EVSE	EVSP Backend	Demand Clearing House
1	Cable safety test successfully completed. →			
2		← I can deliver up to 6.6 kW		
3	Here's my contract ID, I am an authenticated PEV and I would like to charge →	→	→	
4		← Power activated	Customer validated. OK to charge.	
5	I need 12 kWh to fully recharge by 5 p.m. →	→	→	→
6		←	←	← Here are power levels & prices over time for your needs.
7	OK. I'll adjust my charging profile to achieve lowest price. →	→	→	→
8		←	←	← Here is an updated real-time market price based on your P-node
9	OK, I've adjusted my charging profile.. →	→	→	→
10	I've received 12 kWh. My charging session is complete. →	→	→	→
11		Vehicle is unplugged. →	→	
12			Calculate customer billing.	

Courtesy of KnGrid and RWE

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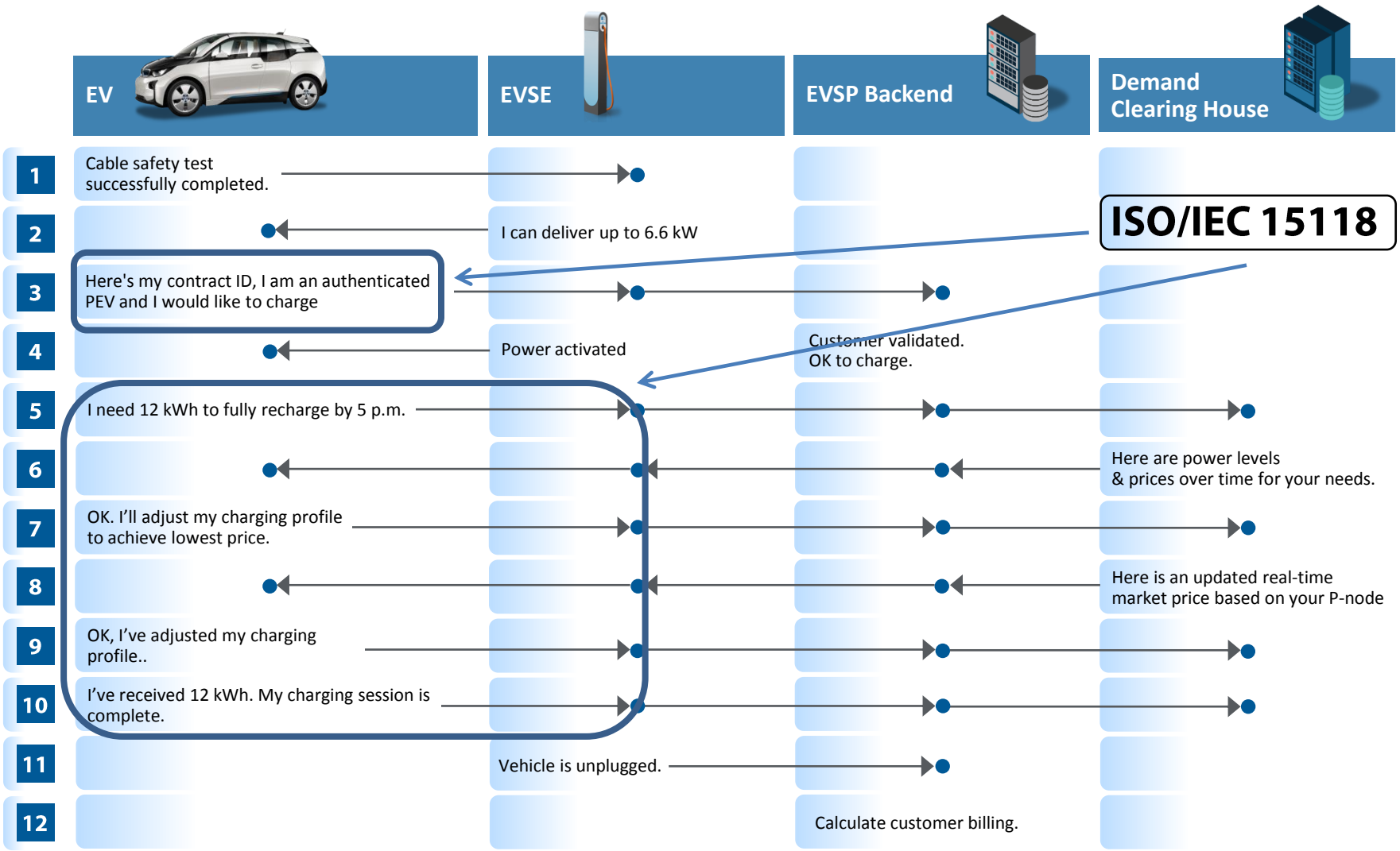
ISO/IEC 15118: Smart Vehicles talking to Smart Infrastructure



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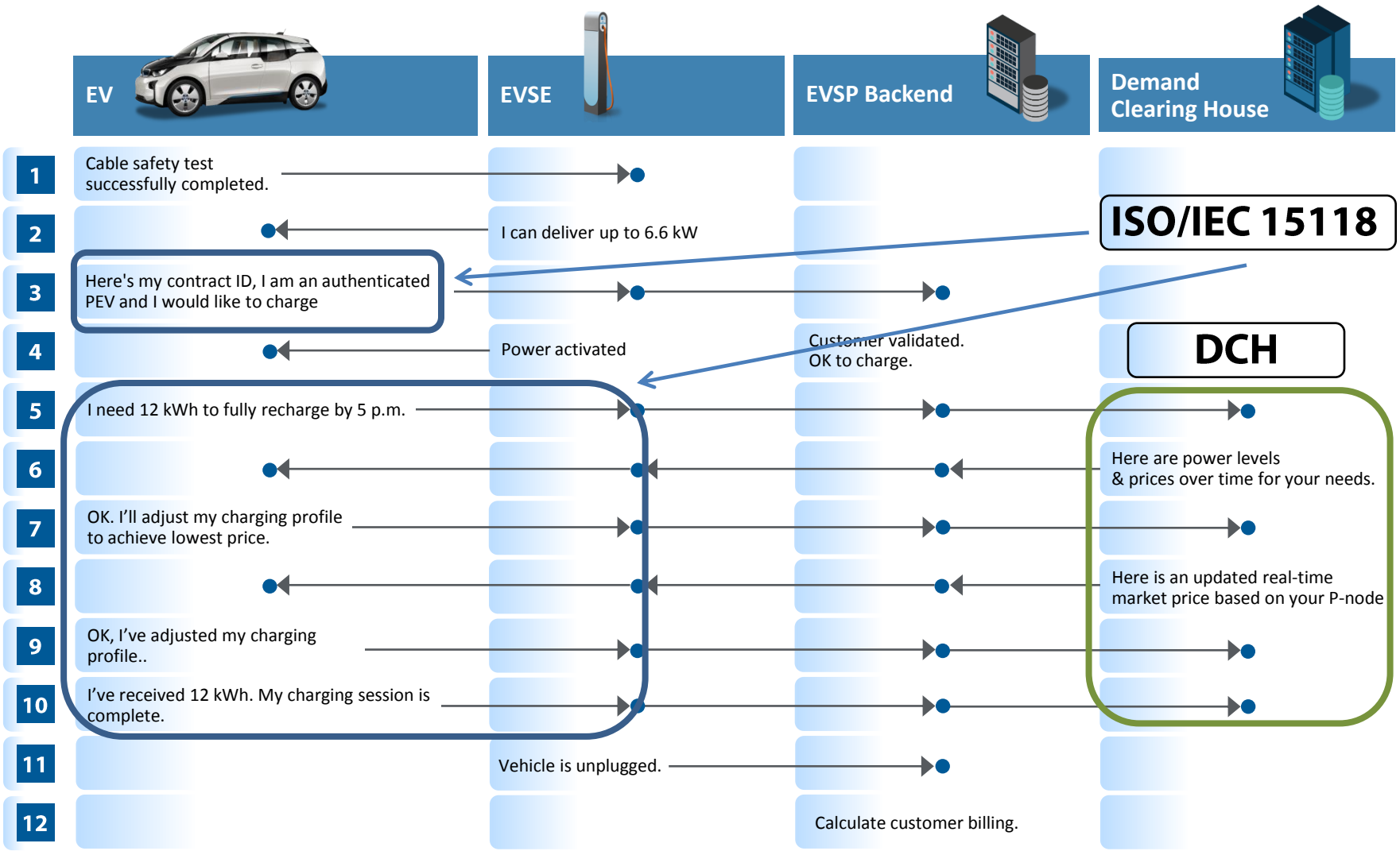

Courtesy of KnGrid and RWE

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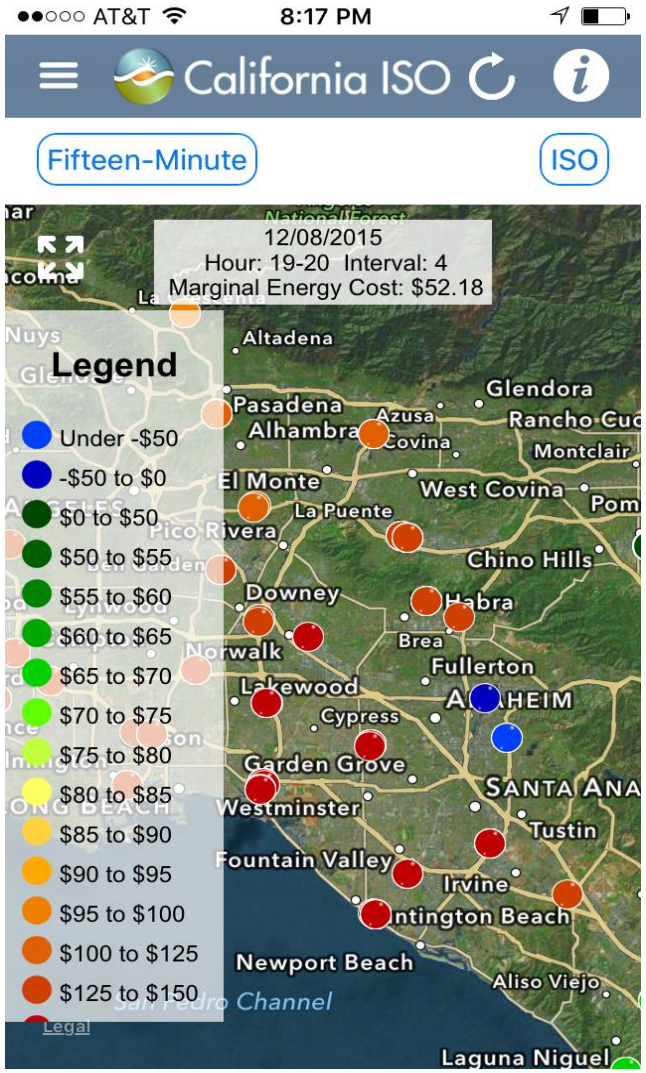
EPIC Grant: Key Tasks and Deliverables

SDGE
A Sempra Energy utility®

Demand Response Aggregation Servers

OpenADR 2.0b

PG&E®



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EPIC Grant: Key Tasks and Deliverables

- Development of “Demand Clearing House”
- 6-month Technology Demonstration at UC San Diego
- Evaluation of Project Benefits, Measurement & Verification, and Policy Recommendations

6-month Technology Demonstration at UCSD

- **26 ISO/IEC 15118 L2 Stations at UC San Diego**
- **Daimler Smart ED3 vehicles**

Photo credit Rhett Miller, UCSD

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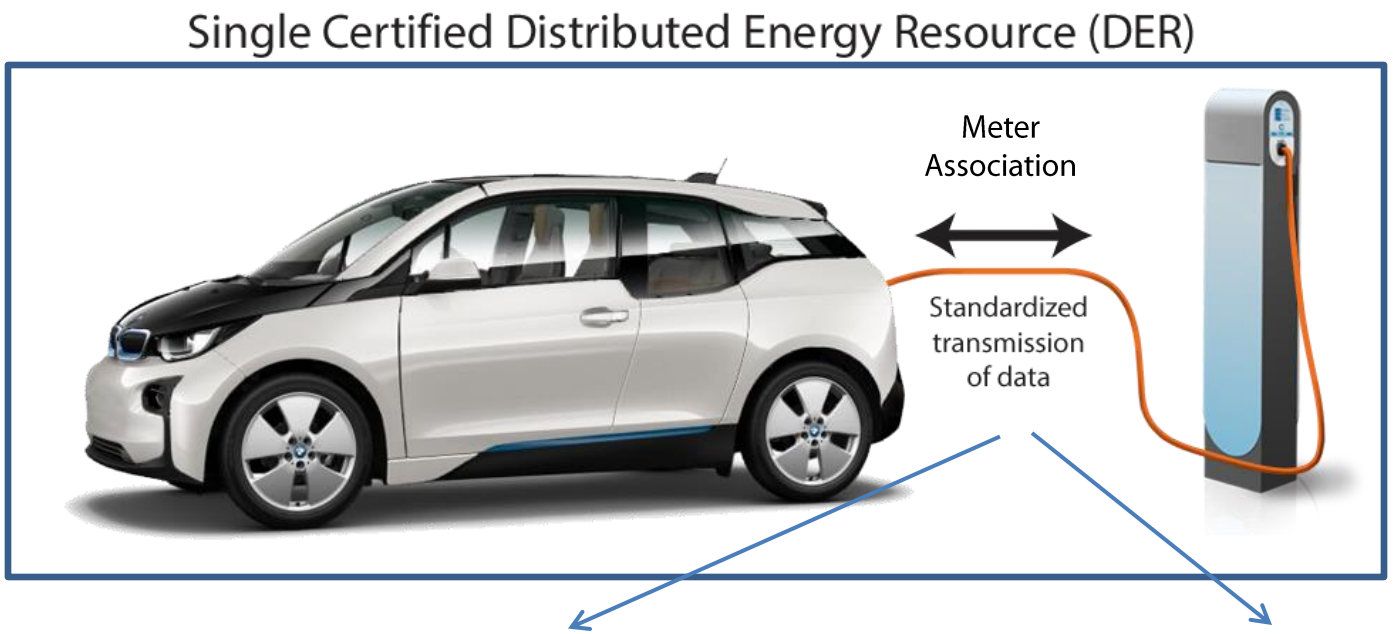
The How of Vehicle-Grid Integration

International Organization for Standardization

ISO/IEC 15118

INTERNATIONAL ELECTROTECHNICAL COMMISSION



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