DOCKETED

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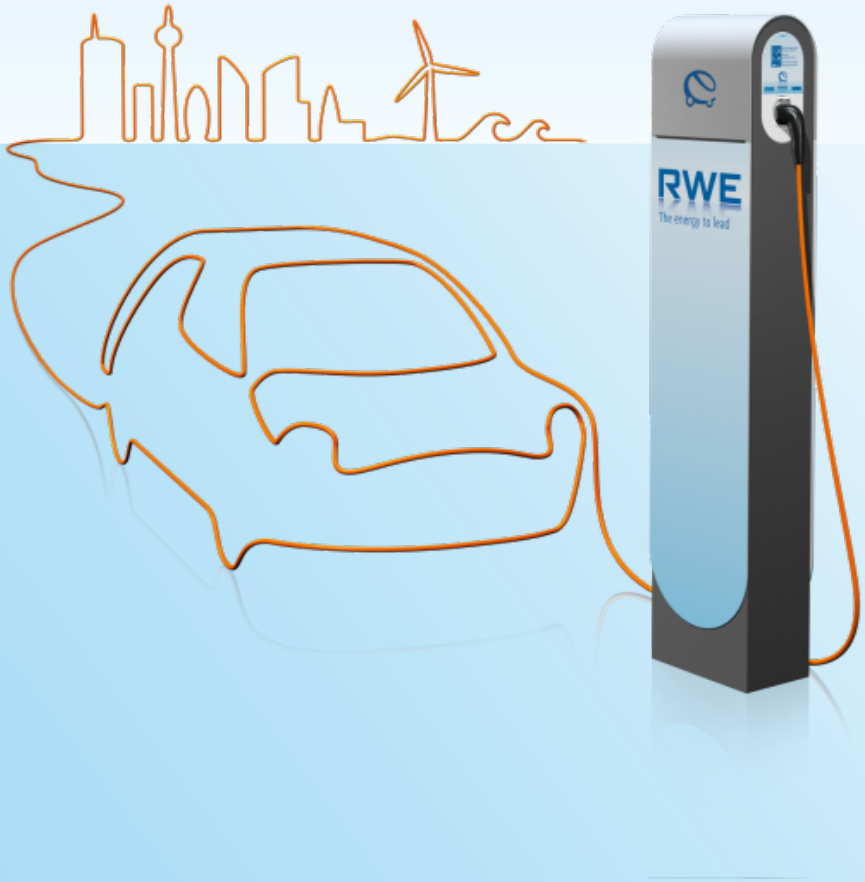
CEC VGI Workshop

December 7th, 2016



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California's Smart Charging Vision: A future where

- the highest level of cyber-security is maintained at all times
- any PEV owner can safely plug in (Level 2) anytime and anywhere and be dispatch-able 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

ISO/IEC V2G CI PT structure

ISO/IEC Vehicle to Grid – Communication Interface

Layer	
7	Application
6	Presentation
5	Session
4	Transport
3	Network
2	Data Link
1	Physical

IEC TC69
Paul Bertrand (for EDF)

ISO TC22/SC3/JWG1
Michael Schwaiger (BMW)
Secretary: Eric Wern (VDA)

PT 1: Use-cases
Sven Jundel (RWE)

PT 2: Messages, Sequences & Timing
Stephan Voit (RWE)

PT 3: Protocols
Andreas Heinrich, (Daimler)

PT 4: Communication technologies
Hervé Szychter (Renault)

PT 5: security analysis and measures
Sebastian Kaluza (BMW)

PT 6: Confor-mance Test
Jens Schmutzler (TU Dortmund)

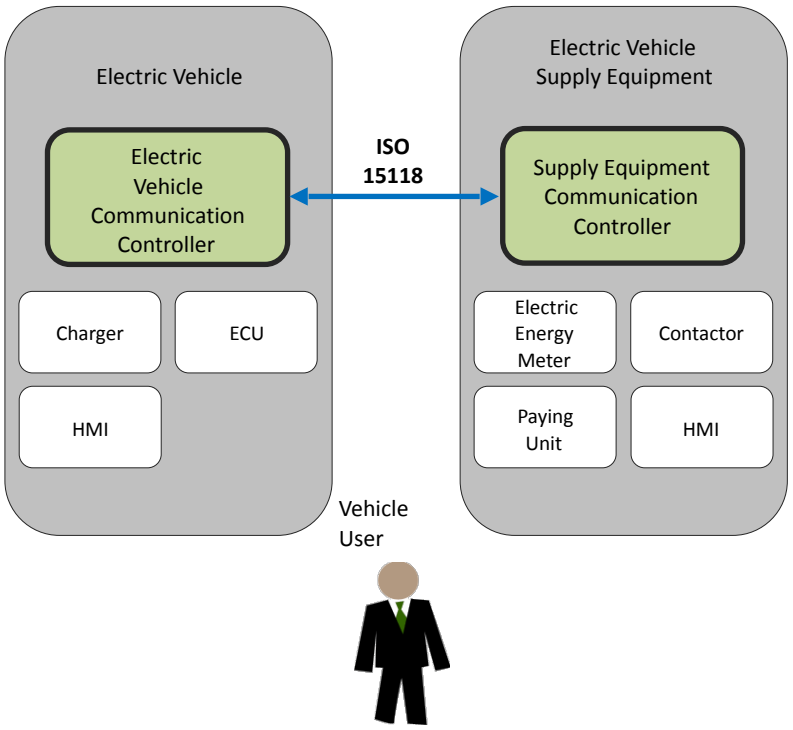
Wireless Communication is developed within Project Team (PT) 7.

International Organization for Standardization

Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

ISO 15118 DER Model

Primary Actors



Secondary Actors

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

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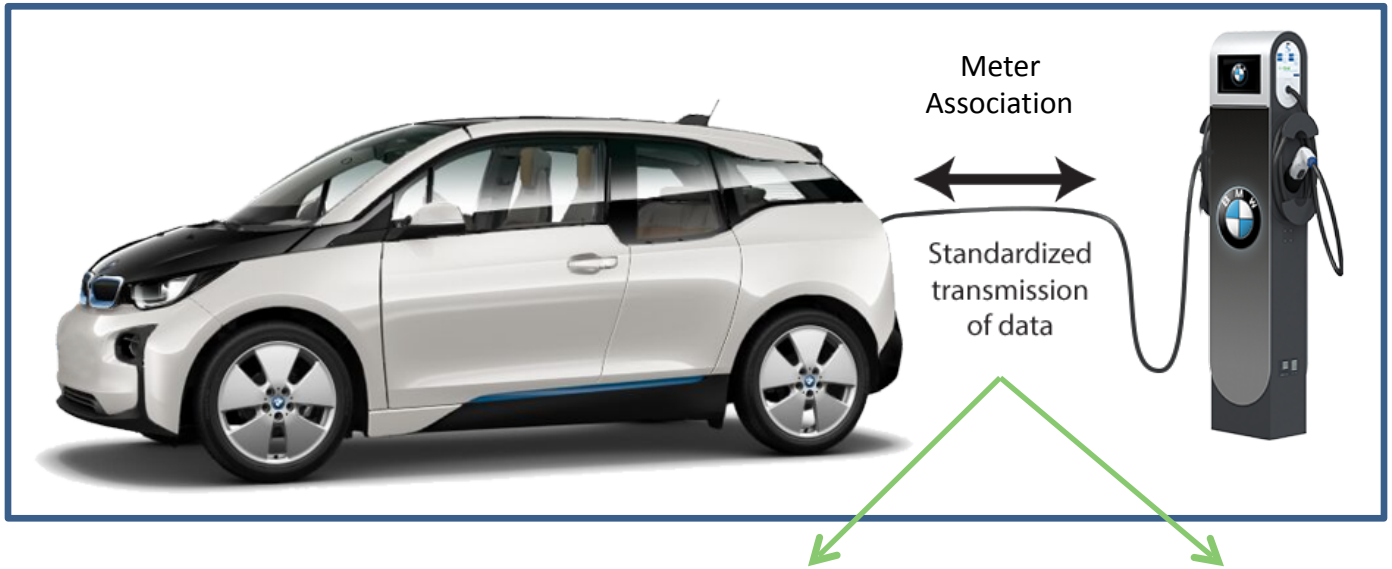
The Foundation of Vehicle-Grid Integration

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

Single Certified Distributed Energy Resource (DER)



- Vehicle conditions
- Mobility needs
- Grid conditions
- Grid needs

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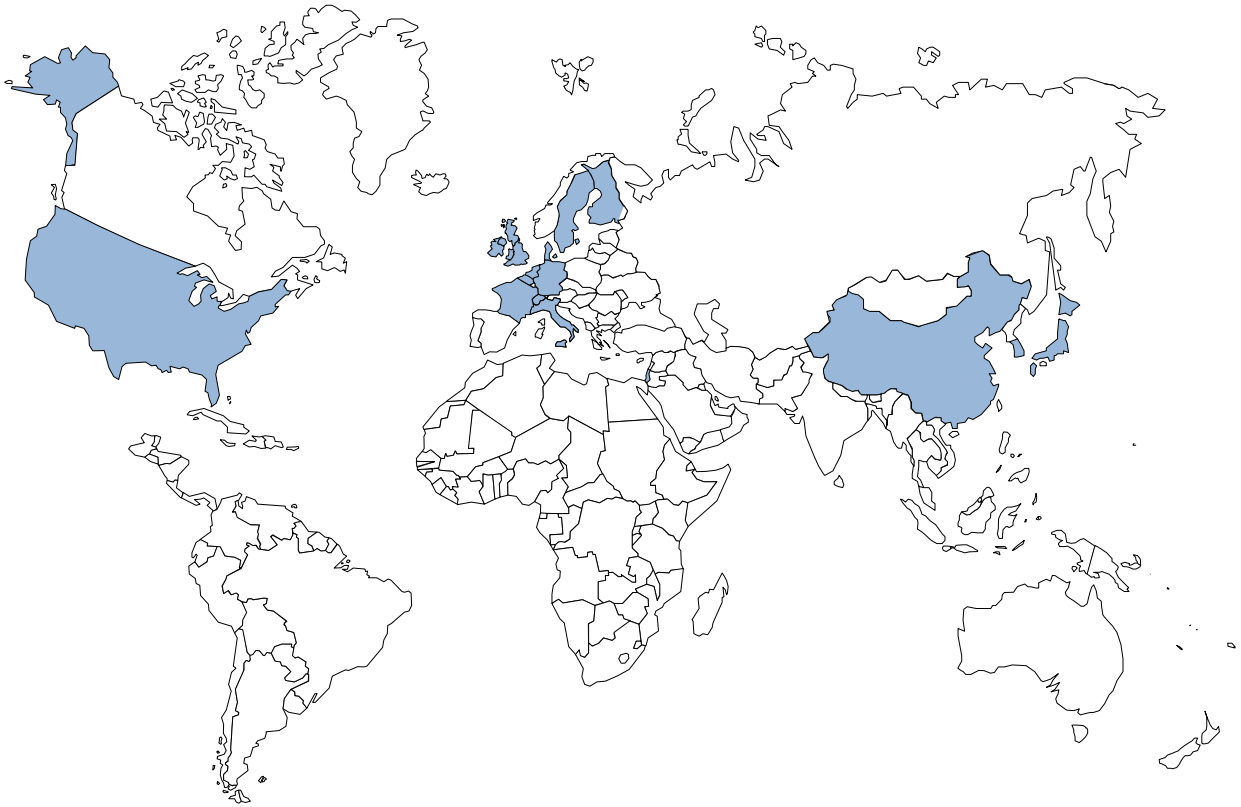
Broad Spectrum of Participants shows high acceptance for expected Market – ISO/IEC 15118 in Figures

- Registered experts:
  138
- Active countries:
  13
- Passive („reading“) countries:
  14
- Number of official comments to 15118 documents:
  ~ 6000



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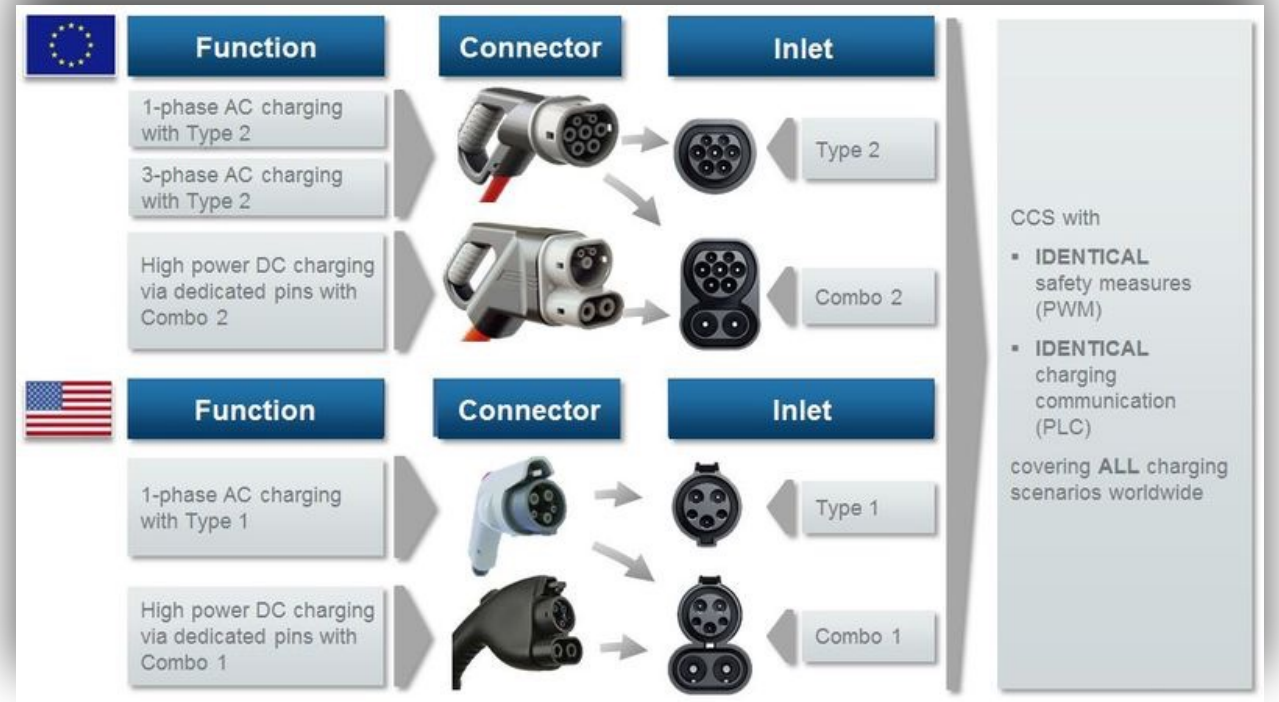
What's CCS?



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.

International Organization for Standardization

Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

ISO/IEC 15118

Intelligent infrastructure talking to intelligent vehicles
Smarter…Faster…Simpler…for the consumer

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

1 — Cable safety test successfully completed.

I can deliver up to 11 kW — 2

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

Valid ID, please go ahead, power will be activated — 4

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

6

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

So far I delivered 5 kWh to you, please confirm — 8

9 — I confirm to have received approx. 5 kWh

10 — I want to leave, please unlock the charge cord

The heart and soul of smart charging

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How do we deliver ***this*** to the PEV?

Date From: 05/28/2015 To: 05/28/2015

Download XML Download CSV

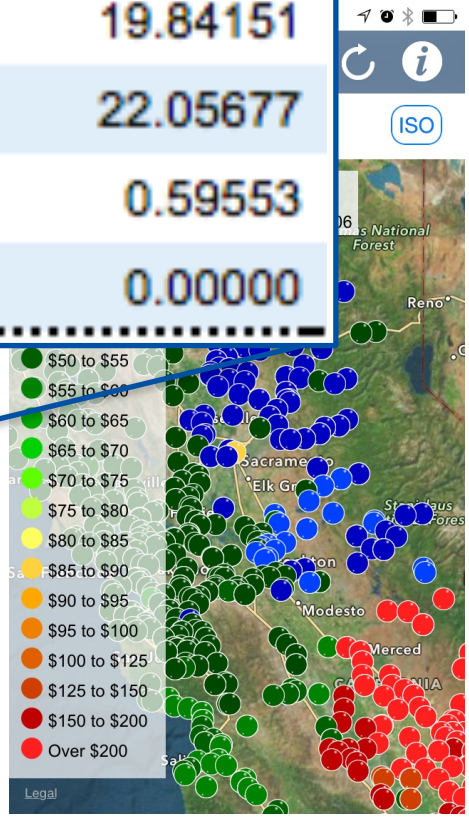
HASP Locational Marginal Prices (LMP)

1 - 20 of 3105

Market	Opr Date/Hour	Node	LMP Type				
HASP	05/28/2015 - Hour Ending 12	AGRICO_6_PL3N5-APND	LMP				
HASP	05/28/2015 - Hour Ending 12	AGRICO_6_PL3N5-APND	Congestion				
HASP	05/28/2015 - Hour Ending 12	AGRICO_6_PL3N5-APND	Energy				
HASP	05/28/2015 - Hour Ending 12	AGRICO_6_PL3N5-APND	Loss				
HASP	05/28/2015 - Hour Ending 12	AGRICO_6_PL3N5-APND	Greenhouse G				
HASP	05/28/2015 - Hour Ending 12	AGRICO_7_UNIT-APND	LMP	42.49382	42.54091	40.18952	36.94500
HASP	05/28/2015 - Hour Ending 12	AGRICO_7_UNIT-APND	Congestion	19.84151	19.91299	17.06997	12.74627
HASP	05/28/2015 - Hour Ending 12	AGRICO_7_UNIT-APND	Energy	22.05677	22.03732	22.51831	23.57631
HASP	05/28/2015 - Hour Ending 12	AGRICO_7_UNIT-APND	Loss	0.59553	0.59060	0.60124	0.62241
HASP	05/28/2015 - Hour Ending 12	AGRICO_7_UNIT-APND	Greenhouse Gas	0.00000	0.00000	0.00000	0.00000
HASP	05/28/2015 - Hour Ending 12	ANTLPE_2_QF-APND	LMP	5.19900	5.17722	7.89118	12.35398
HASP	05/28/2015 - Hour Ending 12	ANTLPE_2_QF-APND	Congestion	-15.78378	-15.78759	-13.52741	-10.06018
HASP	05/28/2015 - Hour Ending 12	ANTLPE_2_QF-APND	Energy	22.05677	22.03732	22.51831	23.57631
HASP	05/28/2015 - Hour Ending 12	ANTLPE_2_QF-APND	Loss	-1.07399	-1.07250	-1.09973	-1.16215
HASP	05/28/2015 - Hour Ending 12	ANTLPE_2_QF-APND	Greenhouse Gas	0.00000	0.00000	0.00000	0.00000
HASP	05/28/2015 - Hour Ending 12	BIGCRK_2_EXESWD-APND	LMP	8.03334	7.99895	10.67456	15.03661
HASP	05/28/2015 - Hour Ending 12	BIGCRK_2_EXESWD-APND	Congestion	-14.93064	-14.95458	-12.78548	-9.52803
HASP	05/28/2015 - Hour Ending 12	BIGCRK_2_EXESWD-APND	Energy	22.05677	22.03732	22.51831	23.57631
HASP	05/28/2015 - Hour Ending 12	BIGCRK_2_EXESWD-APND	Loss	0.90721	0.91621	0.94172	0.98832
HASP	05/28/2015 - Hour Ending 12	BIGCRK_2_EXESWD-APND	Greenhouse Gas	0.00000	0.00000	0.00000	0.00000

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

LMP	42.49382
Congestion	19.84151
Energy	22.05677
Loss	0.59553
Greenhouse Gas	0.00000



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Avoiding ‘Back-feed’ on circuits w/ high PV penetration

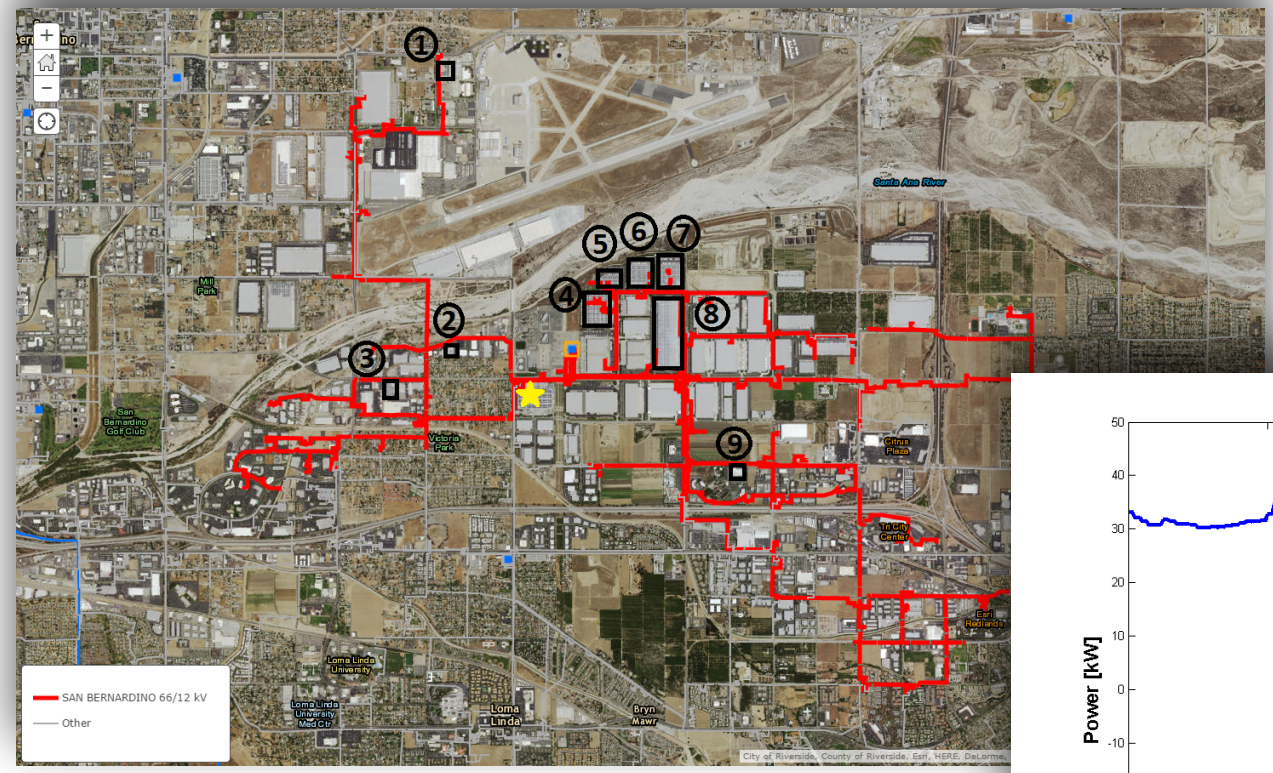

Figure 3. Rooftop PV systems (black) and USI (yellow) in substation se

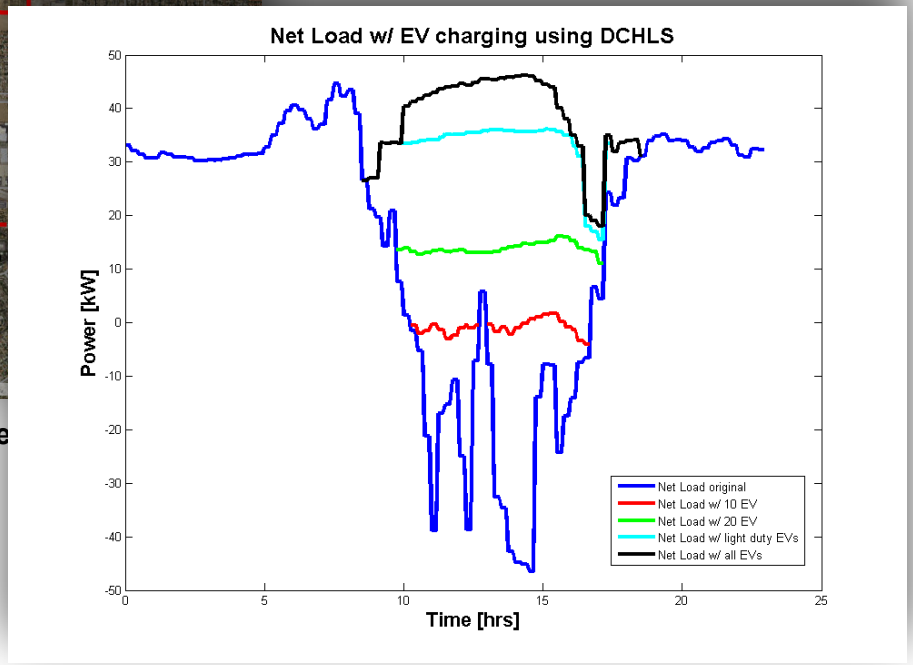

Figure 17. Net load curves with different number of vehicles used to “valley fill” on April 1st.

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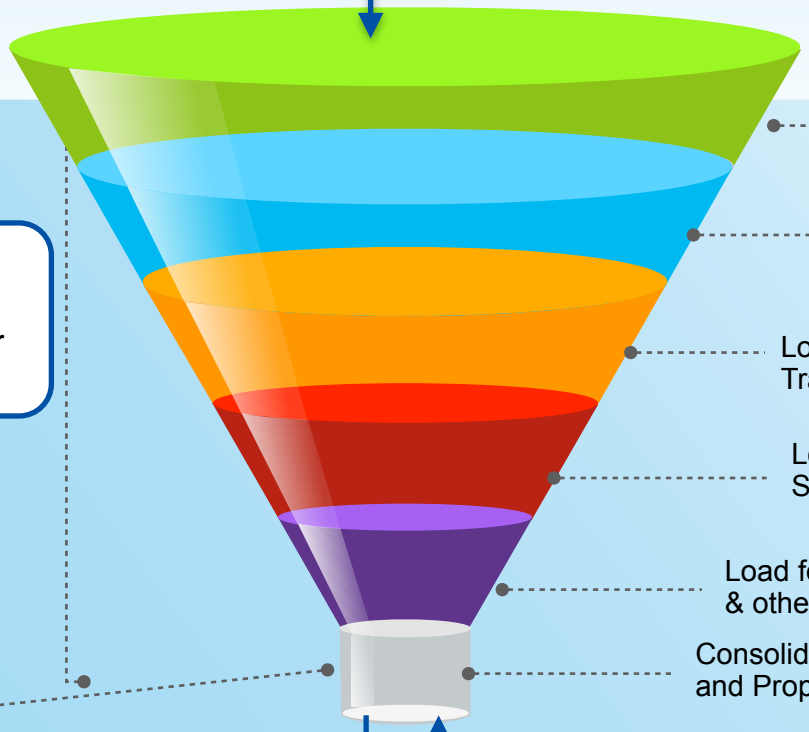
How does a 'Demand Clearing House' work?

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



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

Demand Clearing House (agnostic to utility or EMS protocol)

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;30;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)...

PLC on pilot wire

Supply Equipment Communication Controller

Electric Vehicle Communication Controller

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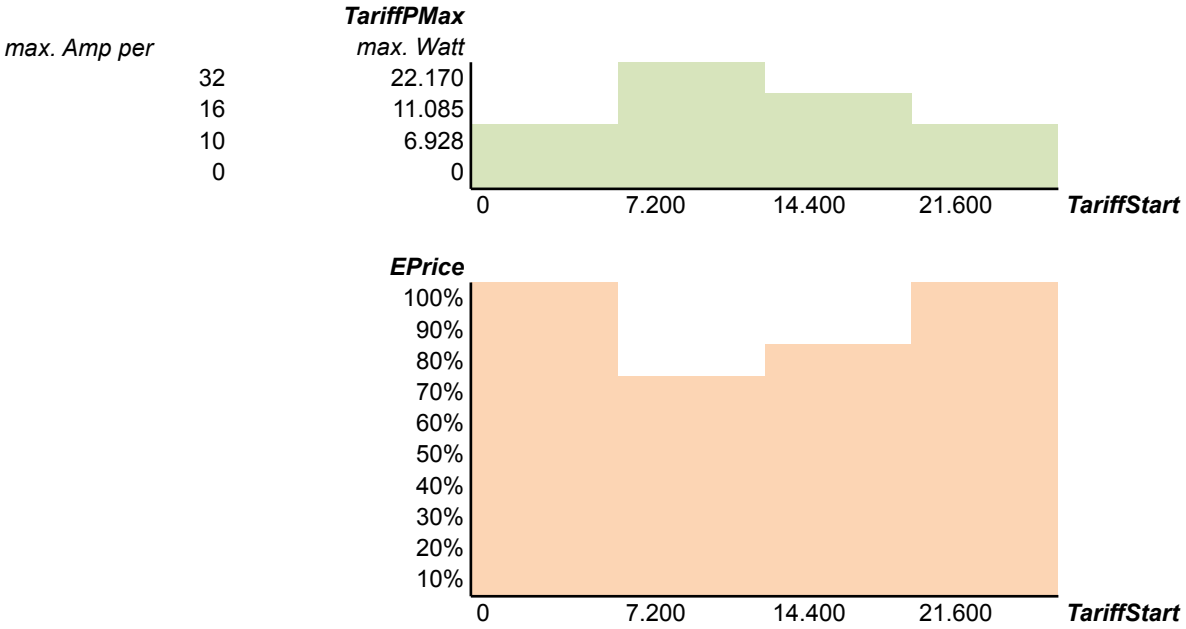
Grid Profiles

Grid and Power Production Tariff Table

TariffStart	[Seconds from now]	0	7.200	14.400	21.600
TariffPMax	[Watt]	6.928	22.170	11.085	6.928
EPrice	[relative, in %]	100%	70%	80%	100%

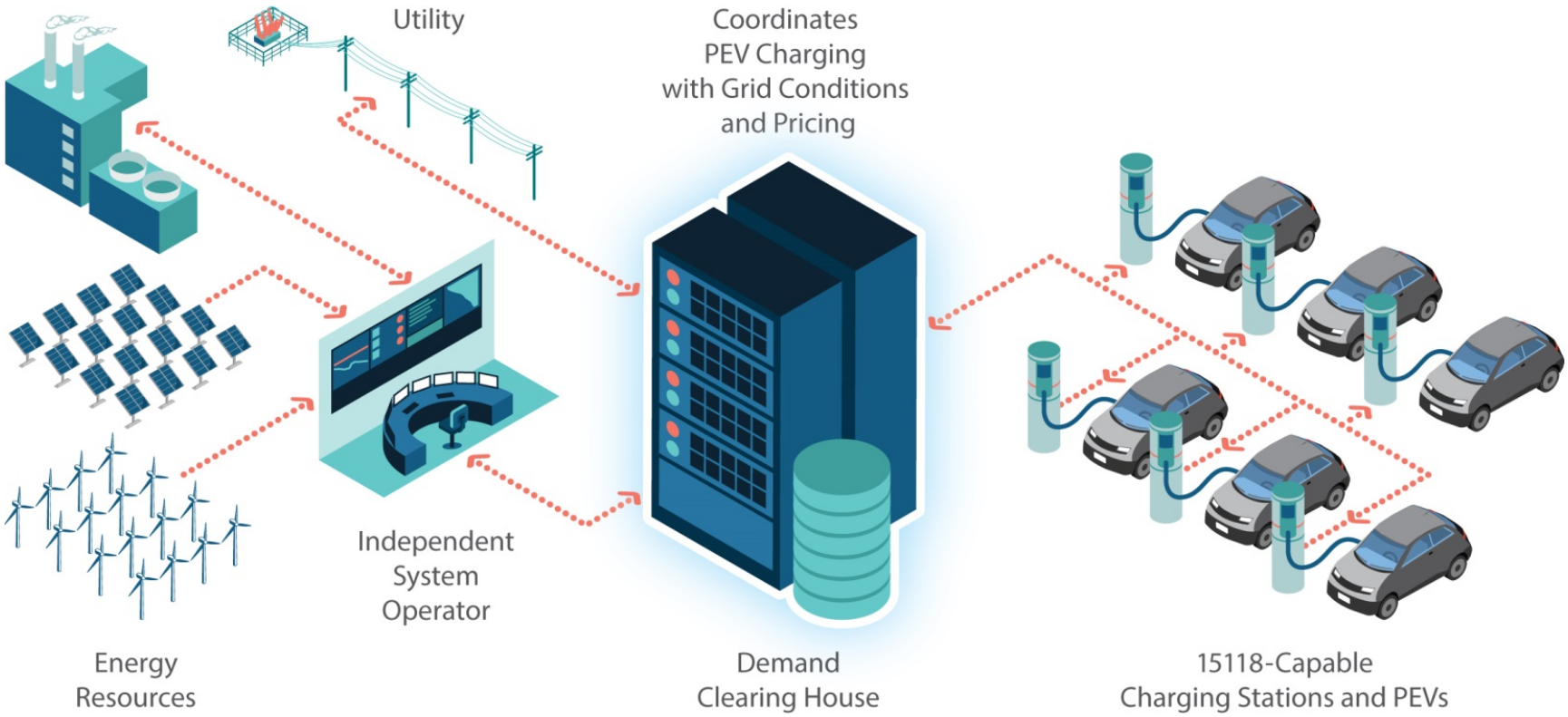
TariffTableType

Currency	REL
Tariff	T1
EPriceUnit	1 (one percent)
EPriceMuliplier	1



Source: According to Committee Draft ISO/IEC 15118-2

World's First Demand Clearinghouse



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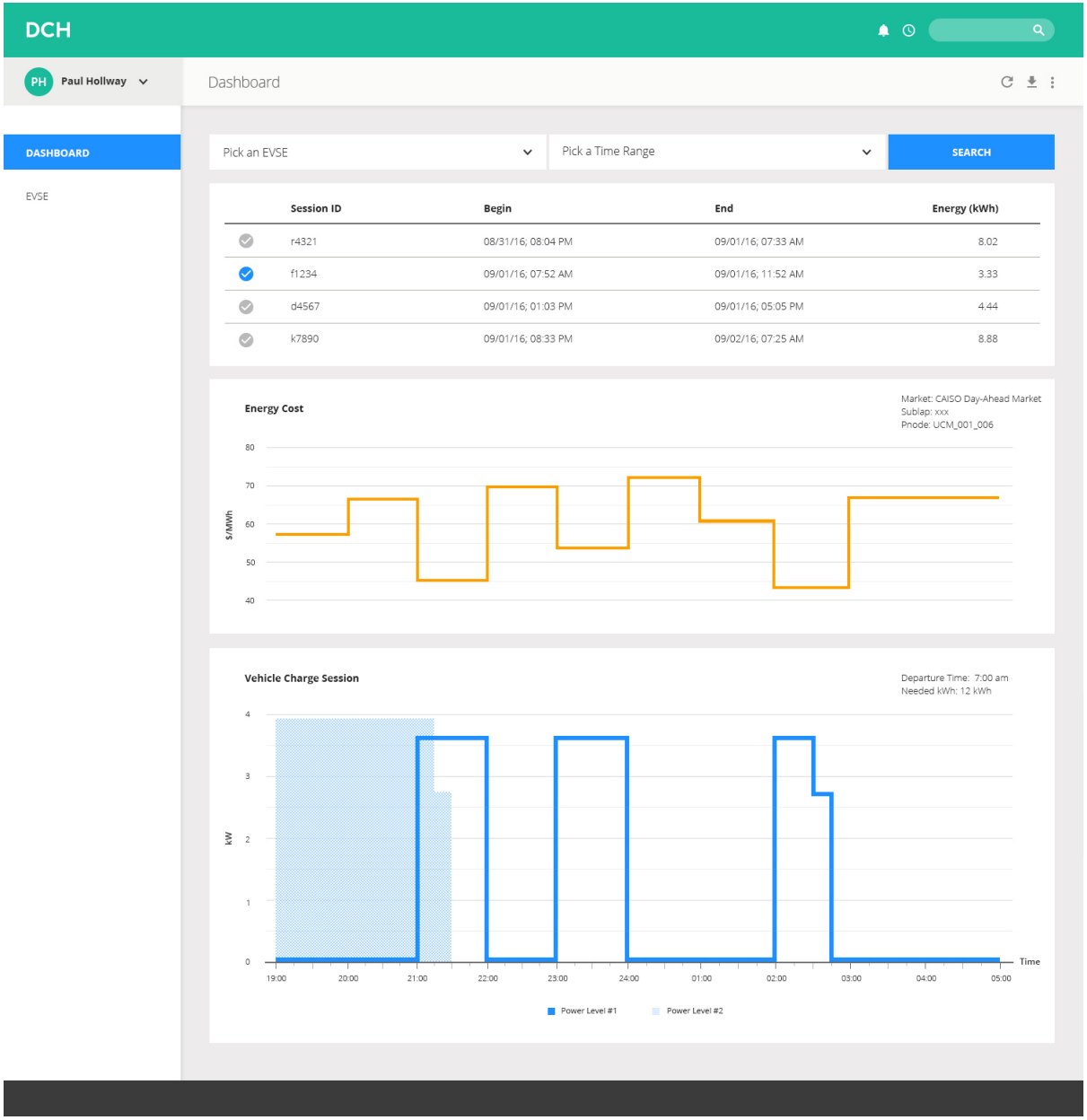

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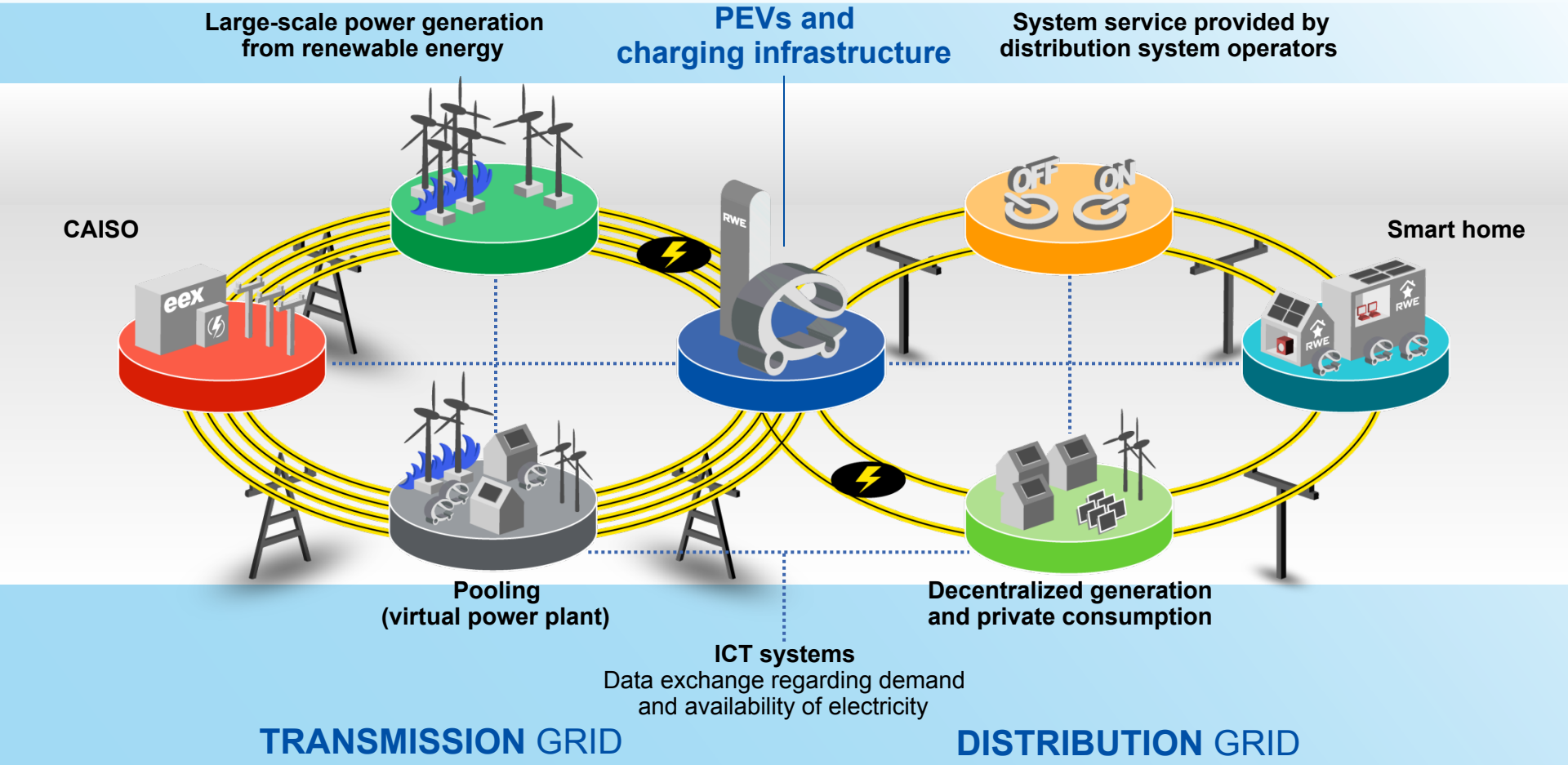
IEC 61850 DER Model created to withstand changes over time

Simplicity at the edge of the network (1) - AC Level 2



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

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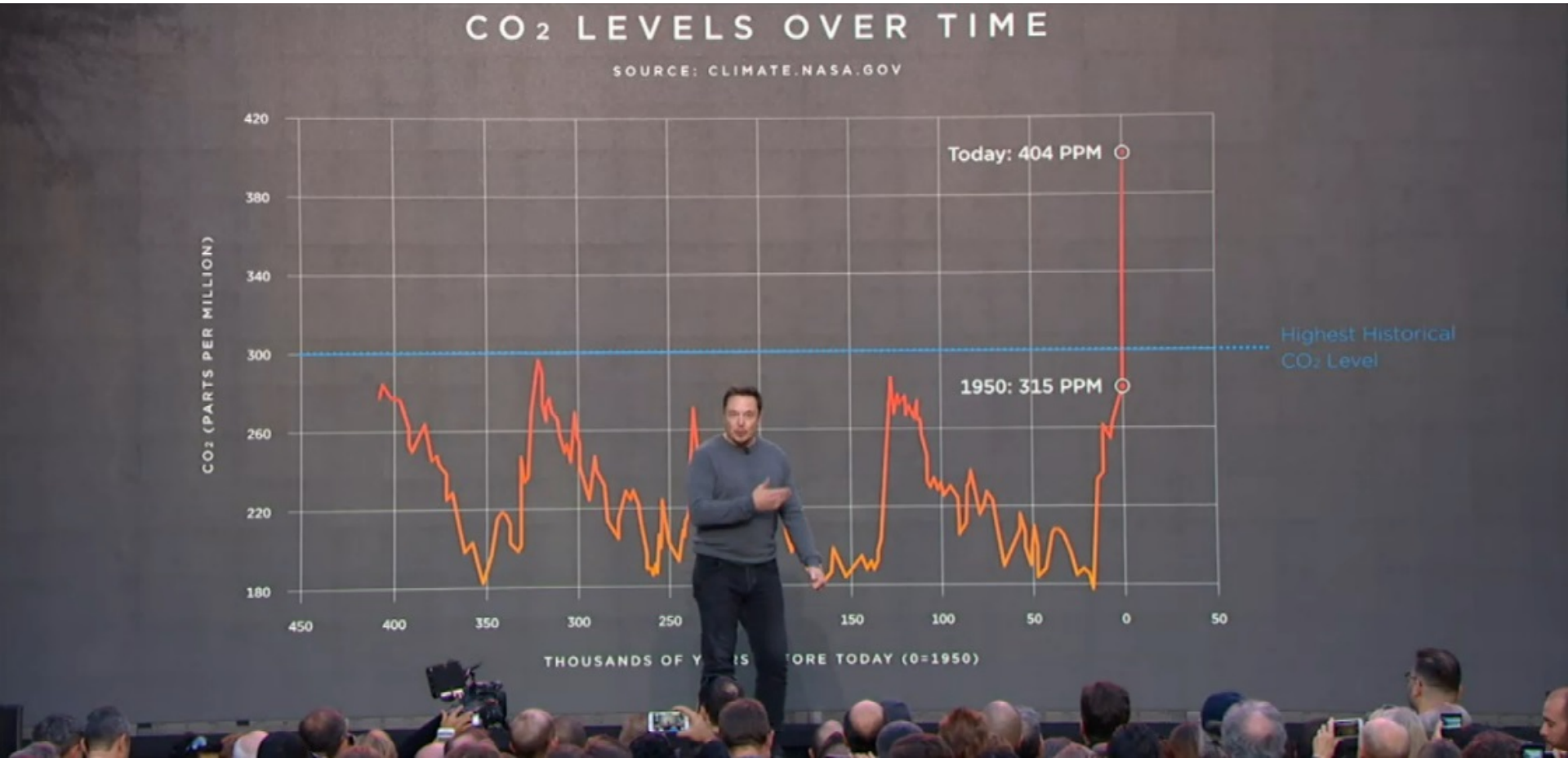
Successful Movements and Companies start with why…



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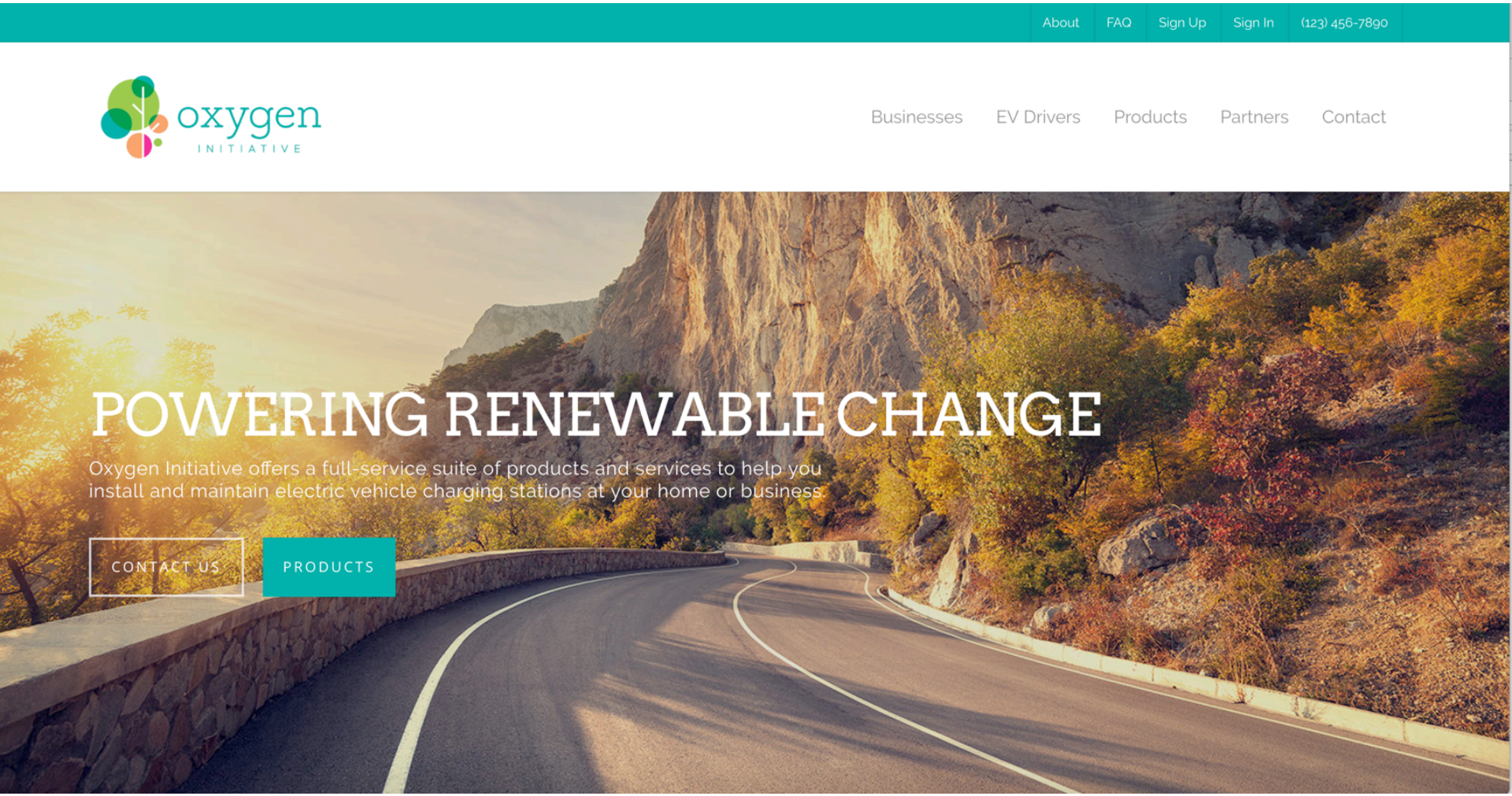
A final note….



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Stephen Davis - CEO
sdavis@oxygeninitiative.com

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