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Document Title:	Presentation - CALeVIP Future Equipment Technology Workshop
Description:	N/A
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Docketed Date:	11/19/2019

Future Equipment Requirements for CALeVIP

Fuels & Transportation Division

California Energy Commission

Sacramento, CA

November 18, 2019

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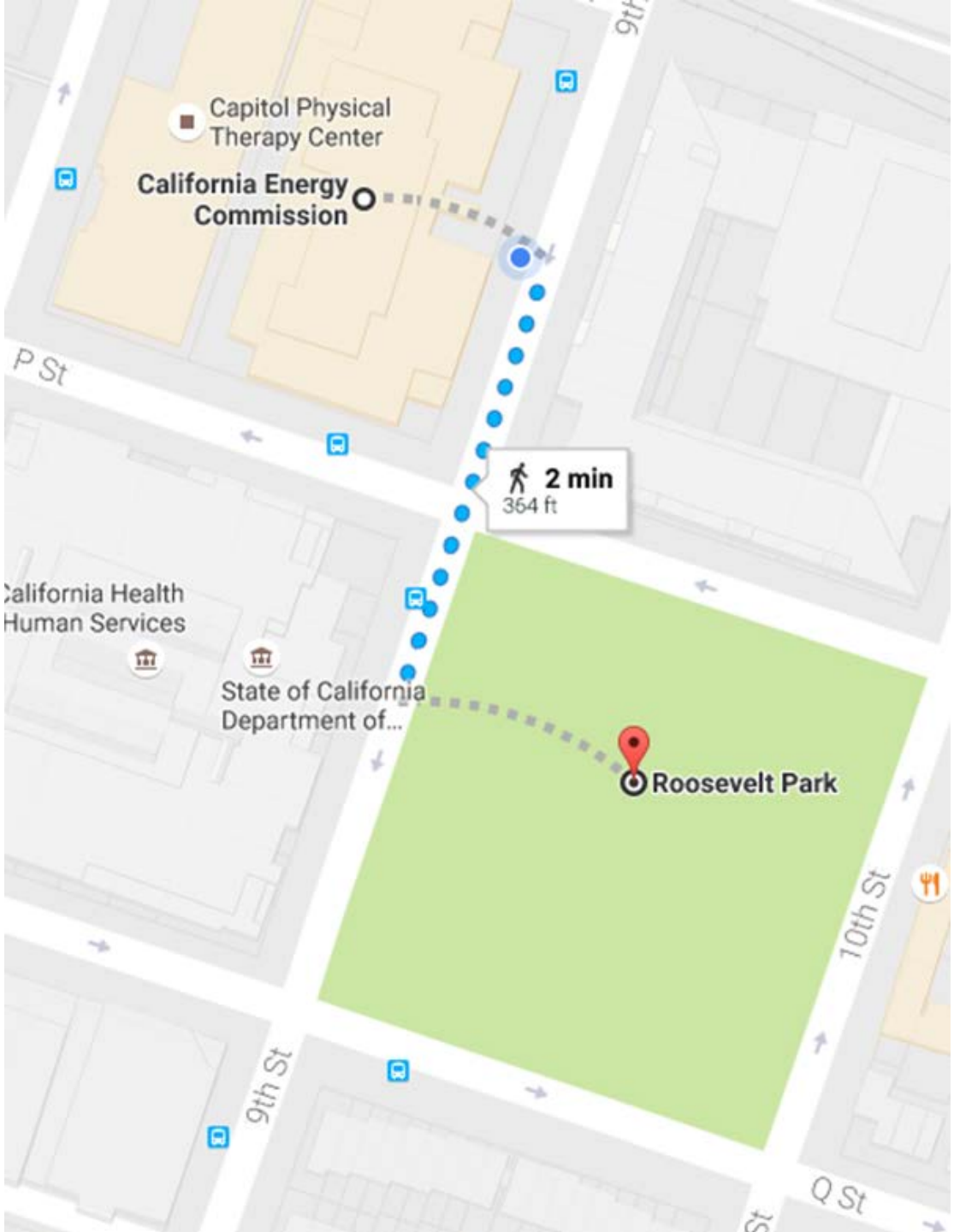
In Case of Emergency



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Agenda

CAL eVIP
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- CALeVIP Background and Current Equipment Requirements
- Updated Proposal for Future Equipment Requirements
- Analysis of Equipment Hardware and Software Technology
- Public Roundtable Discussion
  - Features Demanded and Product Supply Chain
- Proposed Timelines for Implementation
- Questions & Wrap Up

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Block Grant ARV-16-017

Goal: Rapid deployment of public L2 and DCFC stations across California

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Clean Transportation Program

Fund[s] programs and projects that ***accelerate the commercialization of vehicles and alternative and renewable fuels including buy-down programs through near-market and market-path deployments***, advanced technology warranty or replacement insurance, ***development of market niches, supply-chain development***, and research related to the pedestrian safety impacts of vehicle technologies and alternative and renewable fuels.

– Assembly Bill 118 (2007) and AB 8 (2013),
CA Health and Safety Code §44272(e)(7)

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Charging Infrastructure Assessment

The [Energy] Commission…shall prepare a statewide assessment of electric vehicle charging infrastructure needed to support the levels of electric vehicle adoption required for the state to meet its goals of putting at least five million zero-emission vehicles on California roads by 2030…

The assessment shall…consider all necessary charging infrastructure, including, but not limited to, the chargers, make-ready electrical equipment, and ***supporting hardware and software***, all vehicle categories, road, highway, and offroad electrification, port and airport electrification, and other programs to accelerate the adoption of electric vehicles…

– Assembly Bill 2127 (2018), CA Public Resources Code §25229

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Innovations in Charging Technology

Electric vehicle charging with demand-side management can reduce electricity use during peak times and shift use to periods of excess electricity supply…The Energy Commission is seeking ways to ***advance innovative and transformative technologies and transportation trends that increase the efficiency and effectiveness of zero-emission charging infrastructure***. Newer recharging technologies such as robotic charging, pantograph charging, and wireless charging have shown great potential to improve upon the speed and cost-effectiveness of charging infrastructure. Such ***advancements could greatly increase use of existing equipment and enable new private investments***.

– Clean Transportation Program Investment Plan Update (2019)

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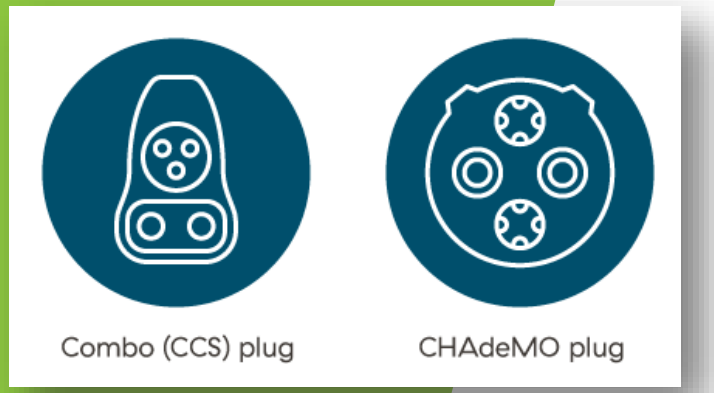
CALeVIP Pillar Requirements

- **Technology: Level 2 Chargers**
  - J-1772 connector
  - 6.2kW+ power rating
  - Networked
  - Minimum 2-year networking agreement
  - New (not refurbished, not previously installed and removed)
  - Open standard protocol
  - Energy Star Certified
  - Approved by a Nationally Recognized Testing Laboratory
  - Accept at least two payment methods (if payment is required)
    - Acceptable payment methods may include (but are not limited to) mobile app-based payment, a toll-free phone number, near-field communications (NFC) or onsite card reader

CALeVIP Pillar Requirements



- **Technology: Direct-Current Fast Charger (DCFC)**
  - Both CHAdeMO and Combined Charging System (CCS) connector
  - 50kW+ power rating
  - Networked
  - Minimum 5-year networking agreement
  - New (not refurbished, not previously installed and removed)
  - Open standard protocol
  - Approved by a Nationally Recognized Testing Laboratory
  - Accept at least two payment methods (if payment is required)
    - Acceptable payment methods may include (but are not limited to) mobile app-based payment, a toll-free phone number, near-field communications (NFC) or onsite card reader

Needs for Refinement

- **“Networked” not sufficiently-defined**
  Inconsistent application and customer confusion

- **“Open standard protocol” not sufficiently defined**
  Not implementable and unable to achieve specific functions

- **Nationally Recognized Testing Laboratory Certification**
  Processes are costly and untimely for EVSE manufacturers

- **Need to harmonize with impending or new EVSE regulations**
  Division of Measurement Standards adopting sections of the National Institute of Standards and Technology (NIST) Handbook 44, §3.40.

  Air Resources Board specifying payment methods and other requirements for publicly accessible EVSE per SB 454.

  New ENERGY STAR proposed specifications for DC Fast Charging.

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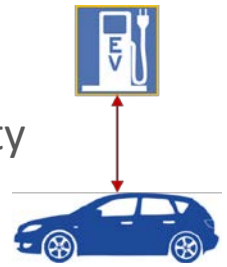
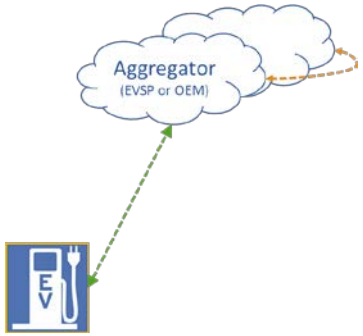
EVSE Proposal for Future Projects from June 28, 2018

EV/EVSE Interoperability



Network Interoperability



- Level 2 conductive or inductive, AC and DC chargers shall have the capability of communication with the PEV, based on ISO/IEC 15118 communication
- Require for equipment installed after January 1, 2020*, implementation of:
  - ISO/IEC 15118
  - Open Charge Point Interface (OCPI)

    *Consistent with proposed SB 454 compliance timeframe for OCPI
- Validate proof of implementation

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https://efiling.energy.ca.gov/GetDocument.aspx?tn=224015&DocumentContentId=54242

Increasing urgency for grid reliability (*integration*) ***and*** resiliency (*independence*)

LA's Heat Wave Left More Than 75,000 Without Power — And Broke An Electricity Use Record

BY RYAN FONSECA IN NEWS ON JULY 9, 2018 1:45 AM

Line crews with the Los Angeles Department of Water and Power, seen here atop a pole replacing a transformer on Sunday, July 8, 2018, work to restore power to thousands during the weekend's heat wave in the region. (Photo courtesy LADWP via Twitter)

https://laist.com/2018/07/09/las_heat_wave_left_more_than_50000_without_power_and_broke_an_electricity_use_record.php

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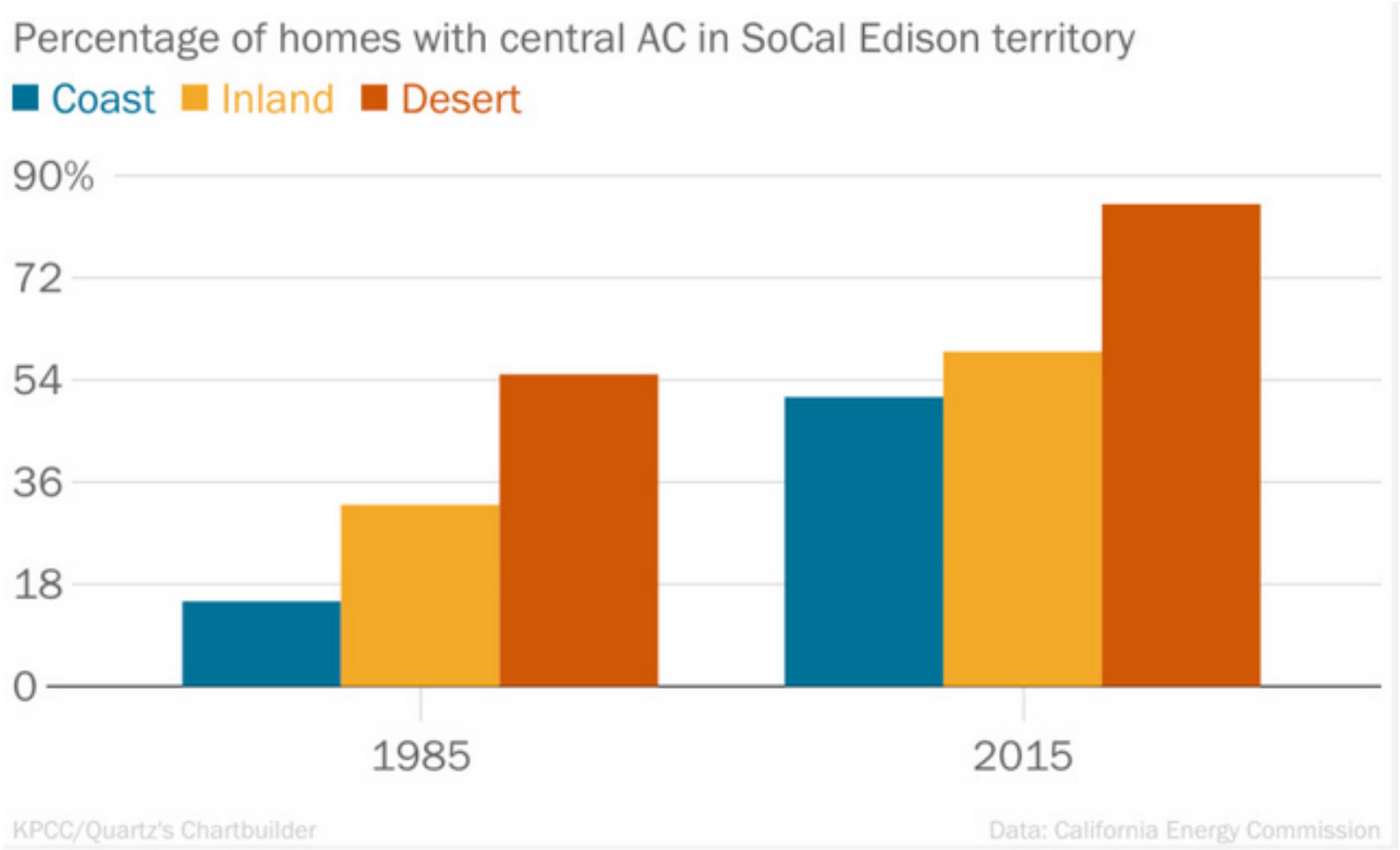
Increasing urgency for grid reliability (*integration*) ***and*** resiliency (*independence*)

In the coastal territory of Southern California Edison, AC usage jumped 36 percentage points between 1985 and 2015. That's 9 percentage points higher than SoCal Edison's desert territory.



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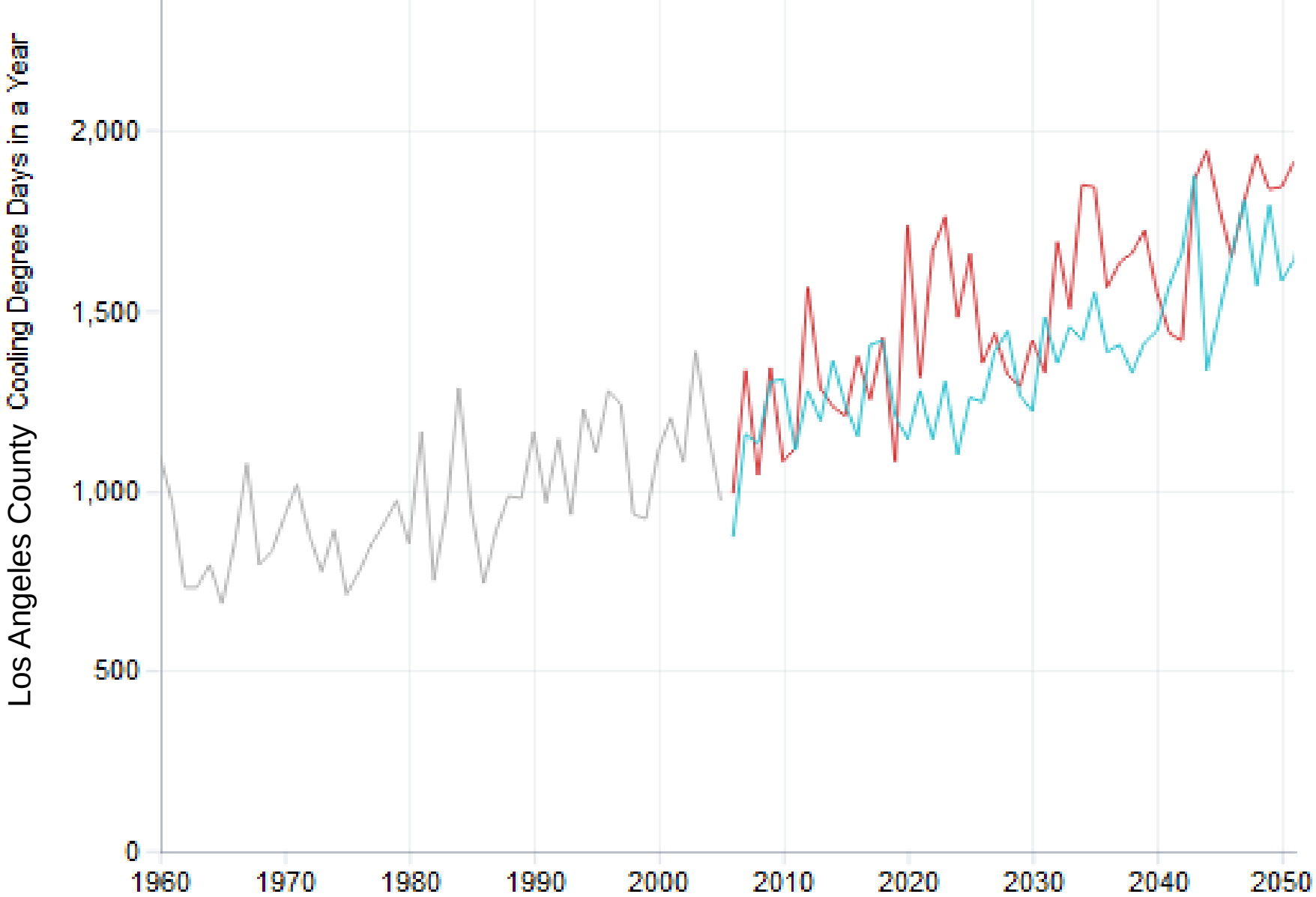
https://laist.com/2018/07/25/living_at_the_beach_no_longer_means_no_ac_needed.php

Increasing urgency for grid reliability (*integration*) ***and*** resiliency (*independence*)



CalAdapt, https://cal-adapt.org/tools/degree-days

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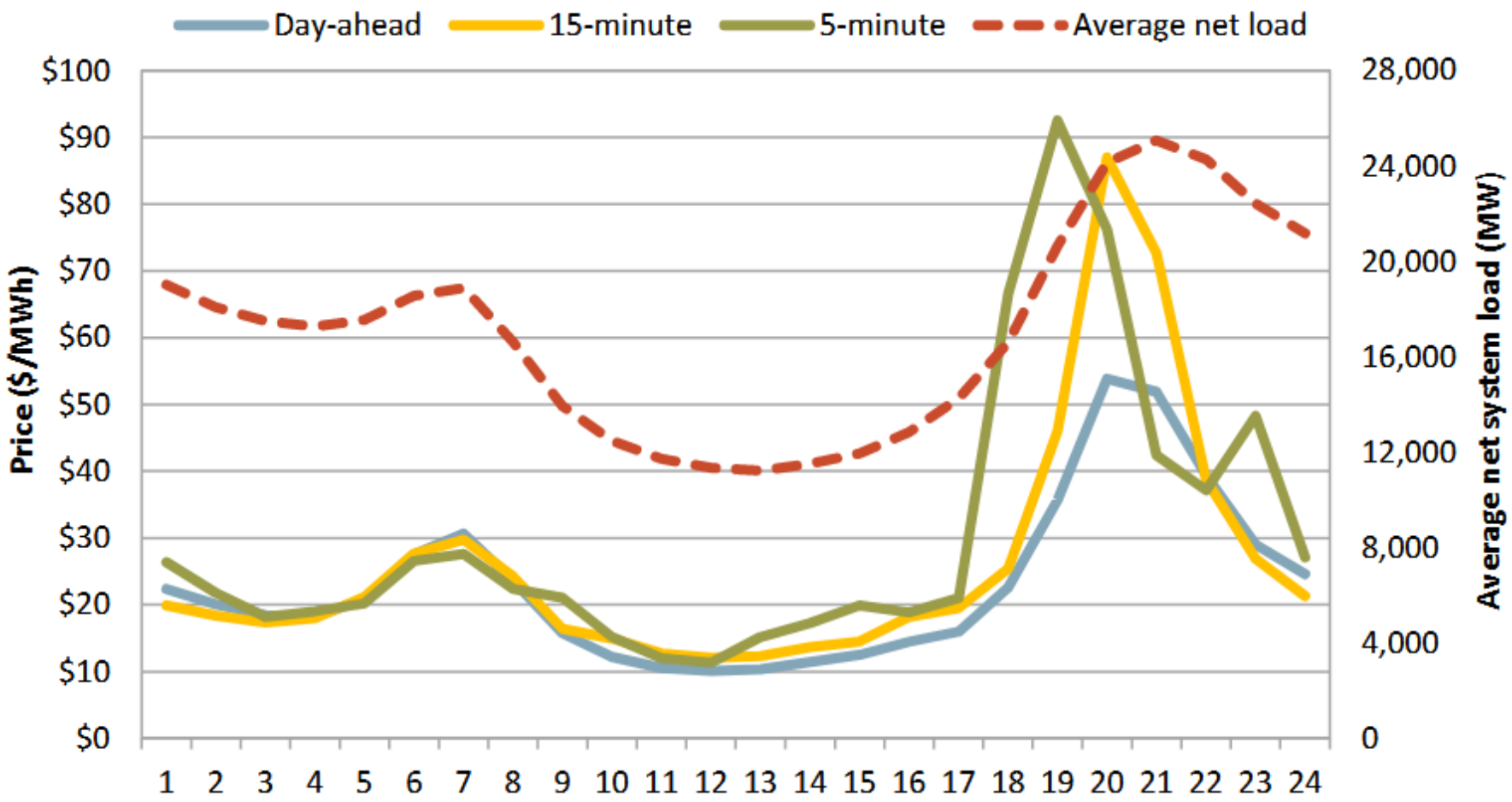
Increasing urgency for grid reliability (*integration*) ***and*** resiliency (*independence*)

Figure 1.7 **Hourly load-weighted average marginal energy prices**



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http://www.caiso.com/Documents/2019SecondQuarterReportonMarketIssuesandPerformance.pdf

Increasing urgency for grid reliability (*integration*) ***and*** resiliency (*independence*)

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Increasing urgency for grid reliability (*integration*) ***and*** resiliency (*independence*)

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BUSINESS

With Blackouts, California's Electric Car Owners Are Finding New Ways To Charge Up

November 8, 2019 · 6:03 PM ET
Heard on All Things Considered

VANESSA ROMO

Forbes

61,756 views | Nov 12, 2019, 12:00am

All The Energy Storage The Grid Needs Will Soon Be Under Our Noses

Jeff McMahon Contributor
Green Tech
From Chicago, I write about climate change, green technology, energy.

GreenBiz

Analysis Events Videos

Vehicle-to-grid technology is revving up

Elsa Wenzel
Tuesday, November 12, 2019 - 1:00am

Enel X's JuiceBox Pro 40 residential EV charging station.

gtm:

GRID EDGE

Will Your EV Keep the Lights On When the Grid Goes Down?

Home battery systems can help during power outages. So can the battery packs rolling around in electric vehicles.

JUSTIN GERDES

NOVEMBER 08, 2019

EV battery packs are functionally similar to stationary systems but much larger.

WSJ

SUBSCRIBE SIGN IN

RUMBLE SEAT

Could Electric Vehicles Really Help Prevent Forest Fires?

If you think the increased risk of power outages due to disasters argues against the purchase of an electric vehicle, you'd be wrong, says Dan Neil. Here's why EVs might actually be your best option during emergencies

CHARGED UP California added 150,000 plug-in electrics in 2018, and the state has a goal of putting 1.5 million EVs on its roads by 2025. ILLUSTRATION: DAVID MOORE

Refined Goals

- **Interoperability** "will provide standardized devices that are capable of functioning as intended with each other, without special effort by the user."[1]
- **Competition and Customer Choice.** "Standardized, open charging systems that ensure easy access by all in a competitive, and highly innovative market." [2]
- **Cost Control.** EVs should assist in grid and renewables management, and reduce fuel costs for drivers who charge in a manner consistent with grid conditions. [3]
- **Convenience.** "Ensure that technologies employed in plug-in hybrid and electric vehicles work in a harmonious manner and across service territories." [4]

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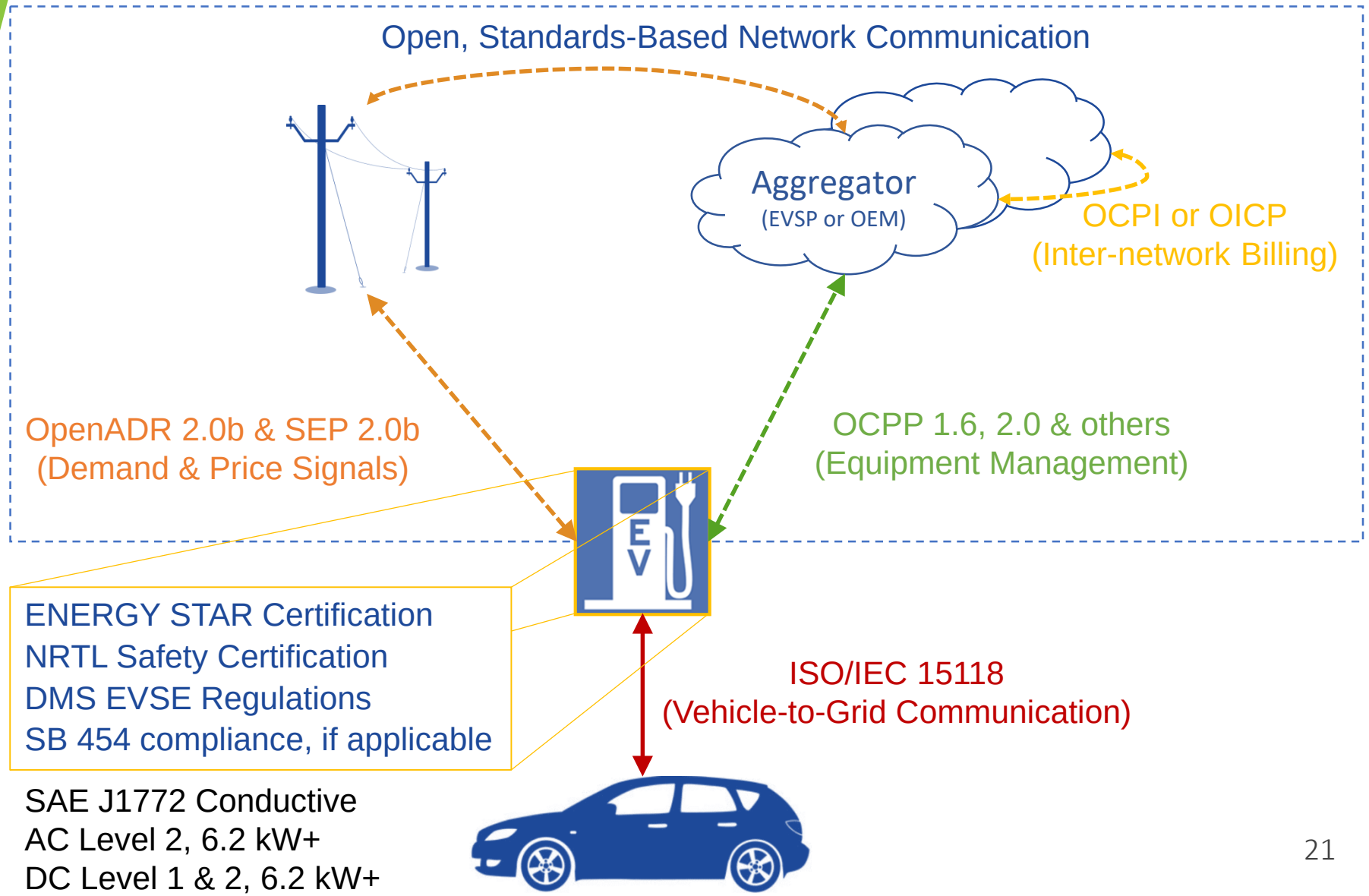
1. US DOE/EU JRC EV-Smart Grid Interoperability Center
2. U.S. DOE EERE Public Plug-In Electric Vehicle Charging Infrastructure Guiding Principles
3. Public Utilities Code 740.12(g)
4. Public Utilities Code 740.2 (e)

SAE J1772
Conductive

New Proposal for 2021+ Projects



SAE J1772 Conductive
AC Level 2, 6.2 kW+
DC Level 1 & 2, 6.2 kW+

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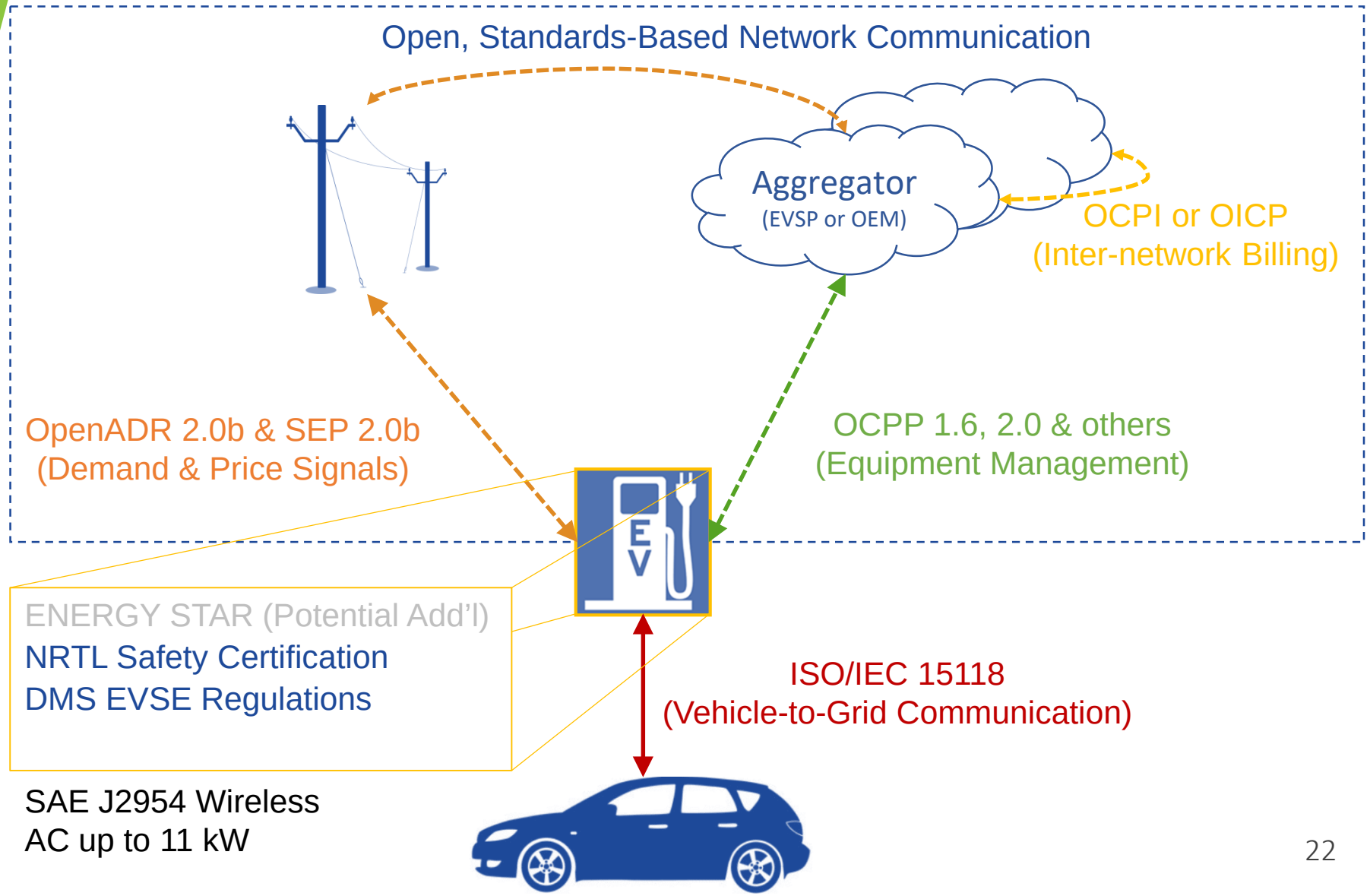
SAE J2954
Wireless

New Proposal for 2021+ Projects



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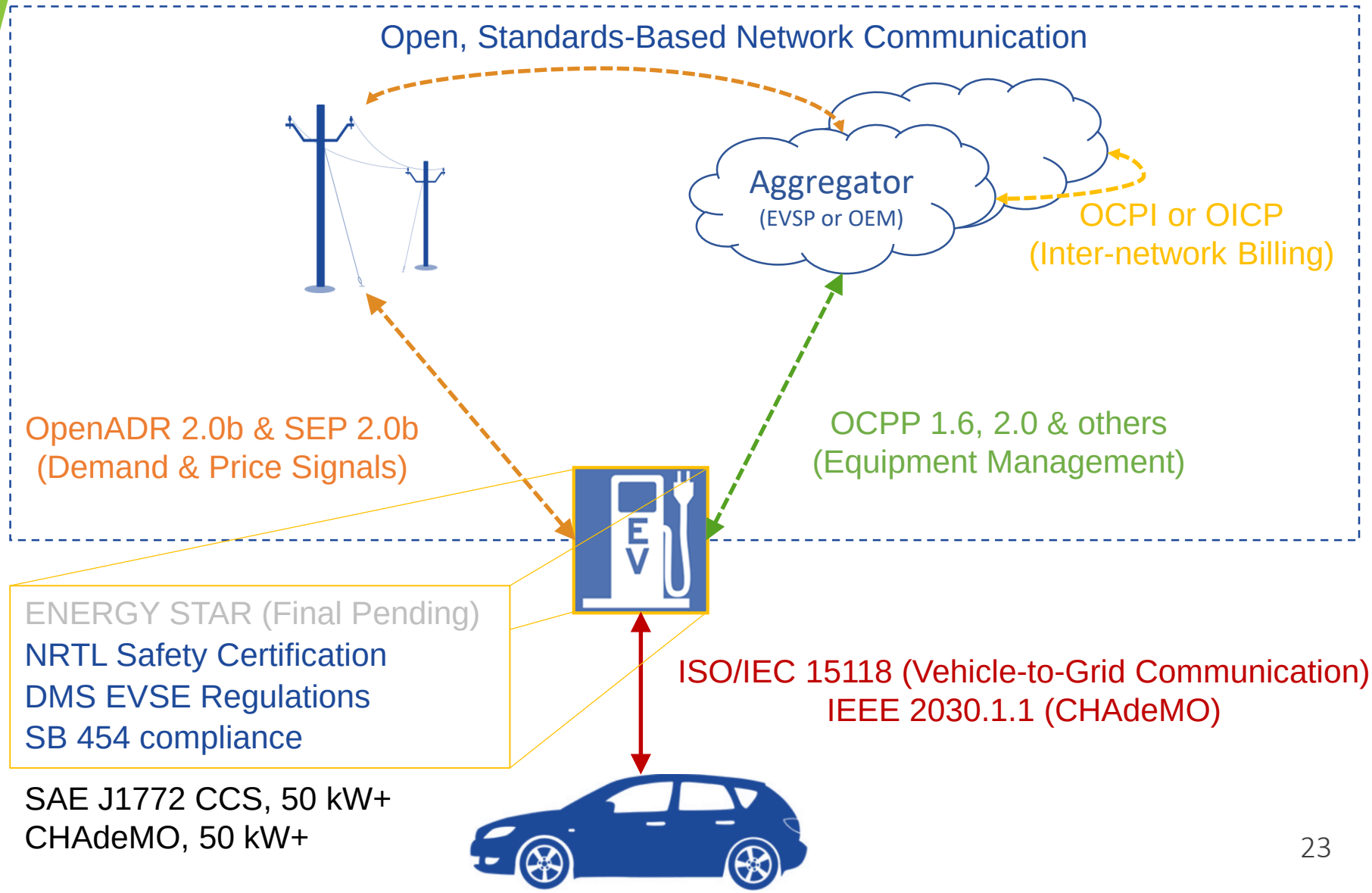
Direct Current Fast Charging

New Proposal for 2021+ Projects



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Equipment Eligibility Criteria
NRTL Safety Certification
ENERGY STAR Certification
CARB SB 454 Compliance
CDFA DMS EVSE Regulations
Open Standards-Based Network Communication
ISO/IEC 15118 Compliance

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Nationally-Recognized Testing Laboratory Approval

Competition and Customer Choice. Equipment must meet applicable product safety standards, and be tested by an accredited Nationally-Recognized Testing Laboratory and certified to meet such standards.

SAE J1772 Conductive	SAE J2954 Wireless	CCS & CHAdeMO
Currently Required for Equipment Eligibility in CALeVIP	CEC will require NRTL approval for wireless EVSE.	Currently Required for Equipment Eligibility in CALeVIP

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ENERGY STAR Certification

- **Cost Control.** ENERGY STAR certified EV chargers on average use 40% less energy than a standard EV charger when the charger is in standby mode.
- **Competition and Customer Choice.** ENERGY STAR chargers provide a well-recognized label to encourage customers to maximize their energy savings.

SAE J1772 Conductive	SAE J2954 Wireless	CCS & CHAdeMO
Final Version 1.0	Test Method not yet developed.	Version 1.1 DC EVSE Final Draft Test Method
Currently Required for Equipment Eligibility in CALeVIP	CEC will consider a Requirement in CALeVIP if or when a Specification is developed.	CEC will require DCFC certification in CALeVIP pending EPA's specified effective date of the specification in 2020.

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ENERGY STAR®
Electric Vehicle Supply Equipment

November 18, 2019

ENERGY STAR Version 1.0 Specification Today

Scope:

- ✓ AC Level 1
- ✓ AC Level 2
- ✓ AC Dual Input L1/L2

Key Features:

1. Energy Savings, 40% in Standby Modes
2. Safety
3. Open Communications

Communications Details:

- Grid Communications
- Open Access
- Consumer Override

Photo by Dennis Schroeder, NREL 39251

ENERGY STAR Version 1.0 Charging Partners

solaredge

blink

chargepoint

eMotorWerks

EVBOX

LiquidSky Technologies

ClipperCreek, Inc.

Webasto

SemaConnect

LITEON

ENERGY STAR Certification

Join ENERGY STAR

- Confirm you are eligible by reviewing the 'ENERGY STAR Partner commitments and product specifications'
- Complete a Partnership Application and Participation Form and send the forms to join@energystar.gov
- Partners will be notified when the application is processed and receive information on next steps

Certify Products

- Products must be tested by an EPA-recognized Laboratory and then certified by an EPA-recognized Certification Body (CB). A list of currently recognized Labs and CBs, and their contact information, can be found:
  - On the EPA Recognized Bodies webpage. For Product Type, select "Other" and for Program, select "Electric Vehicle Supply Equipment."

Become an ENERGY STAR Partner

- Once the CB certifies a product, it will automatically be uploaded to the ENERGY STAR Qualified Product List
  - Please allow 24 hours from time of certification for your products to appear on the Qualified Product List.

EPA-Recognized Labs and Certification Bodies

Organization Name	Type of Recognized Body	Direct Contact Information	City	State
Bay Area Compliance Laboratories Corp. (BACL) Website	Certification Body	Wayne Chu Wayne.Chu@baclcorp.com	Sunnyvale	CA
Bay Area Compliance Laboratories Corp. (BACL) Website	Accredited Laboratory	Wayne Chu Wayne.Chu@baclcorp.com	Sunnyvale	CA
Curtis-Straus LLC, a Bureau Veritas Company Website	Certification Body	Scott Lambert scott.lambert@us.bureauveritas.com 978-486-8880	Littleton	MA
Intertek Testing Services NA, Inc. Plymouth Township Website	Accredited Laboratory	Craig Davenport craig.davenport@intertek.com 607-758-6296	Plymouth Township	MI
Intertek Testing Services NA Website	Certification Body	Craig Davenport craig.davenport@intertek.com 607-758-6296	Arlington Heights	IL
MET Laboratories, Inc. Website	Certification Body	Jim Reed Jim.Reed@metlabs.com	Baltimore	MD
TUV SUD America, Inc. Website	Certification Body	Bryan Cubitt bcubitt@tuvam.com 678-341-5902	Peabody	MA
UL LLC. Website	Accredited Laboratory	David Piecuch david.piecuch@ul.com 847-664-3760	Fremont	CA
UL Verification Services Inc. Website	Certification Body	David Piecuch david.piecuch@ul.com 847-664-3760	Northbrook	IL

Rebranding

- If the partner can document a product is a privately labeled version of another model that is certified as ENERGY STAR, only one test report is required.
- Rebranded products may make use of laboratory reports that do not include the rebranded model information for purposes of certification, so long as the partner can demonstrate to the certification body through separate documentation that the products are identical other than model number.

Version 1.1 DC EVSE Test Method Activities

- **Goal of Version 1.1 is to include DC EVSE in scope**
  - Develop test method to measure energy efficiency
  - Collect data based on test method
  - Draft specification criteria to recognize most efficient products
- **Activities from launch until today:**
  - Released a Discussion Guide in May 2018, a Draft 1 Test Method in November 2018, a Draft 2 Test Method in June 2019, and a Final Draft in September 2019
  - Held 5 stakeholder webinars and numerous stakeholder discussions regarding proposals between May 2018 and now
  - EPA is now assembling data based on this Final Draft Test Method to inform a forthcoming specification

Photo by Kendall Septon, NREL 45635

ENERGY STAR Version 1.1 Specification

- Key topics that will be addressed in the specification:
  - **Criteria to recognize energy efficiency in DC chargers:**
    - ✓ Active charging % efficiency
    - ✓ Minimizing heating and cooling
    - ✓ Standby losses – display, lighting, network
  - **Allowances for features:** Will develop appropriate allowances for features based on data produced from the ENERGY STAR Test Method


Source: Cnet

Key Aspects of Final Draft Test Method - Scope

- EPA is proposing the following scope of what DC EVSE would be included in the Version 1.1:

DC EVSE Output Power	≤ 65 kW	65 kW < Output Power ≤ 350 kW	> 350 kW
Standby Mode Criteria	✓	✓	Out of scope, no criteria
Operation Mode Criteria	✓	Report efficiency, but no criteria	
Network Connection Required	✓	✓	

- The relevant criteria will be determined in the specification development process based on data available and data produced.

Key Aspects of Final Draft Test Method – Temperature Conditions

- EPA is proposing to require testing in the following **temperature** climate conditions:
  - Cold, temperate, and hot conditions for Operation Mode
  - Temperate condition only for Standby Modes

Table 4: Ambient Test Temperatures for All DC EVSE

Type of Climate	Representative Temperature	Applicable Test
Cold	20° F or –7° C (± 5° F, ± 2.5° C)	Operation Mode
Temperate	68° F or 20° C (± 5° F, ± 2.5° C)	No Vehicle Mode, Partial On Mode, Idle Mode, and Operation Mode
Hot	104° F or 40° C (± 5° F, ± 2.5° C)	Operation Mode

Key Aspects of Final Draft Test Method – Test Procedures

Test in the following modes:

- Standby Modes (No Vehicle Mode, Partial On Mode, and Idle Mode)
- Operation Mode at the following loading conditions:

Table 3: Loading Conditions for UUT

	Test Condition	Example for 150 kW capable UUT	Example for 50 kW capable UUT
Loading Condition 1	25% of Maximum Available Output Power ± 2% and 350 V ± 7 V	37.5 kW	12.5 kW
Loading Condition 2	50% of Maximum Available Output Power ± 2% and 350 V ± 7 V	75 kW	25 kW
Loading Condition 3	75% of Maximum Available Output Power ± 2% and 350 V ± 7 V	112.5 kW	37.5 kW
Loading Condition 4	50 kW ± 1 kW and 350 V ± 7 V	50 kW	50 kW
Loading Condition 5	150 kW ± 3 kW and 350 V ± 7 V	150 kW	N/A
Loading Condition 6	100% Maximum Available Output Power (determined in Section 7.4.B), above) ± 2% and Voltage= mid-point of available output voltage range	N/A	N/A

Updated Connected Functionality Criteria in V1.1

- Goal: more useful to utilities and grid operators
- Connected criteria will continue to be optional
- Aiming for more specific in order to be more useful
- Useful for **long dwell time applications**, (AC only? Small DC as well? Or only under a given kW limit? Or just advise on application?)
- Primary use case: schedule charging (through vehicle, charger, or cloud control of charger)
- Protocols: OCPP, SEP 2.0, OpenADR and CTA-2045 all relevant for DR messaging and requests

- Reporting for ISO 15118 capability, vehicle-to-grid capability, other capabilities?
- EPA will continue to require provision for consumer override of a DR event


Source: PlugShare

Version 1.1 Next Steps

Event	Date
Discussion Guide Published and Webinar	*May/June 2018*
Test Method Working Session #1 and #2	*August and September 2018*
Draft 1 Test Method Published and Webinar	*November 2018*
Draft 2 Test Method Published	*June 6, 2019*
Draft 2 Test Method Webinar	*June 25, 2019*
Draft 2 Test Method Written Comments Due	*July 8, 2019*
Final Draft Test Method and Call for Data	September 12, 2019
Data Assembly	**September 2019 - Present**
Release Version 1.1 Draft 1 Specification and Final Test Method	Early 2020
Version 1.1 Effective Date	Summer 2020

How to Participate

- If you wish to be added to EPA's stakeholder distribution list to receive test method/specification development updates, please email us at:
  - Emmy.Feldman@icf.com, or
  - EVSE@energystar.gov
- All information related to the Version 1.1 DC EVSE Test Method and Specification development process can be found at:

https://www.energystar.gov/products/spec/electric_vehicle_supply_equipment_version_1_1_pd

SB 454 Open Access Act Compliance

- **Convenience.** Choice of payment with credit card or mobile payment or both; Station location reported to Alternative Fuels Data Center; Enable Roaming.
- **Cost Control.** Disclose fees associated with charging session and display cost of electricity (i.e. $/kWh or $/MJ) at the point of sale.

SAE J1772 Conductive	SAE J2954 Wireless	CCS & CHAdeMO
EVSE Standards (Sept 4, 2019)	Regulation designed for connector-based EVSEs	EVSE Standards (Sept 4, 2019)
Payment Method requirements for Publicly Accessible EVSE* For new: July 1, 2023.		Payment Method requirements for Publicly Accessible EVSE* For new: January 1, 2022.

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*For full requirements see CARB Regulation, https://ww2.arb.ca.gov/rulemaking/2019/evse2019.

CDFA Division of Measurement Standards EVSE Regulations

- **Competition and Customer Choice.** Accurate, EVSE-based measurement of electricity maintains integrity in the sale of *commercial* services for charging.

- **Cost Control.** EVSEs with the ability to indicate energy and unit price of electricity delivered (or recorded) enables transparent site management.

SAE J1772 Conductive	SAE J2954 Wireless	CCS & CHAdeMO
Proposed EV Fueling Systems Regulations (October 9, 2019)	NIST HB 44 §3.40 defines EVSE to include wireless charge transfer Is this appropriate?	Proposed EV Fueling Systems Regulations (October 9, 2019)
CALeVIP requires access to 2 years of utilization data. Requirements for new AC EVSE: January 1, 2021 DC EVSE: January 1, 2023	CEC will consider requiring access to 2 years of utilization data.	CALeVIP requires access to 5 years of utilization data. Requirements for new DC EVSE: January 1, 2023

*For full requirements see CDFA/DMS EV Fueling Systems Regulation, https://www.cdfa.ca.gov/dms/regulations.html.

NIST

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metrology/sub-metering

DMS Load Test Tolerances and NIST "Trial" Terms to advance VGI

- **Load Test Tolerances**

Table T.2.
Accuracy Classes and Tolerances for EVSE

	Accuracy Class	Application or Commodity Being Measured	Acceptance Tolerance	Maintenance Tolerance
	2.0	AC electricity as a vehicle fuel	1.0 %	2.0 %
For installs prior to 1/1/33	5.0[1]	DC electricity as a vehicle fuel	2.5 %	5.0 %
For installs on/after 1/1/33	2.0[2]	DC electricity as a vehicle fuel	1.0 %	2.0 %

Which "experimental" or "trial" terms in §3.40 should be considered or adopted?

- **Exceptions** A.2.(a) Utility AHJ-jurisdictional, A.2.(b) Wholesale electricity
- **S.2.4.3. Selection of Unit Price** for variable unit prices prior to delivery via a purchaser's deliberate action (Note: 3 options) and approval prior to sale
- **S.3.1. Metrological Components** adequately protected from conditions detrimental to accuracy, by providing for a physical seal or audit trail

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Open, Standards-Based Network Communication

- **Convenience.** Network communications allow service providers and site hosts to monitor the status of and upgrade the EVSEs, authenticate users, reserve charging sessions, dispatch energy delivery, and transfer payments in real time.
- **Competition and Customer Choice.** Open, non-proprietary communication protocols, which are often formally created by industry via standards-development organizations, allow for site host customers to minimize the risk of stranding assets or remaining "locked-in" with an individual EV service provider.
- **Cost Control.** EVSEs with network communications enable price-based usage control, site or utility tariff load management, and recovery of installation costs.

(Independent of Charging Interface)
Currently equipment requirements for network interoperability are based on the ability to revert to an "open standard protocol"
Network protocols and architectures are designed fit for specific purposes.

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Open, Standards-Based Network Communication

Open Standards, defined per EPA ENERGY STAR, include those

- within the Smart Grid Interoperability Panel (SGIP) Catalog of Standards
- within the NIST Smart Grid Framework
- adopted within American National Standards Institute (ANSI) or other well-established international standards organizations such as the International Organization for Standardization (ISO), International Electrotechnical Commission (IEC), International Telecommunication Union (ITU), Institute for Electrical and Electronics Engineers (IEEE), or Internet Engineering Task Force (IETF).

Consideration of de facto or formal standards development organizations (SDO)

Example	Industry Specification	Formal SDO
OpenADR Alliance	OpenADR (2009)	IEC 62746-10-1 (2019)
ZigBee Alliance	Smart Energy Profile	IEEE 2030.5 (2013)
Open Charge Alliance	Open Charge Point Protocol	?

Adapted from VGI Communication Protocol Working Group Energy Division Staff Report, Table 4.

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"A modernized grid would likely have to accommodate new types of communications interfaces including new interfaces…

- For new entities
- Between subsystems
- For Legacy Systems"

NIST New Smart Grid Interfaces Categories Assessment, Discussion Draft (2018)

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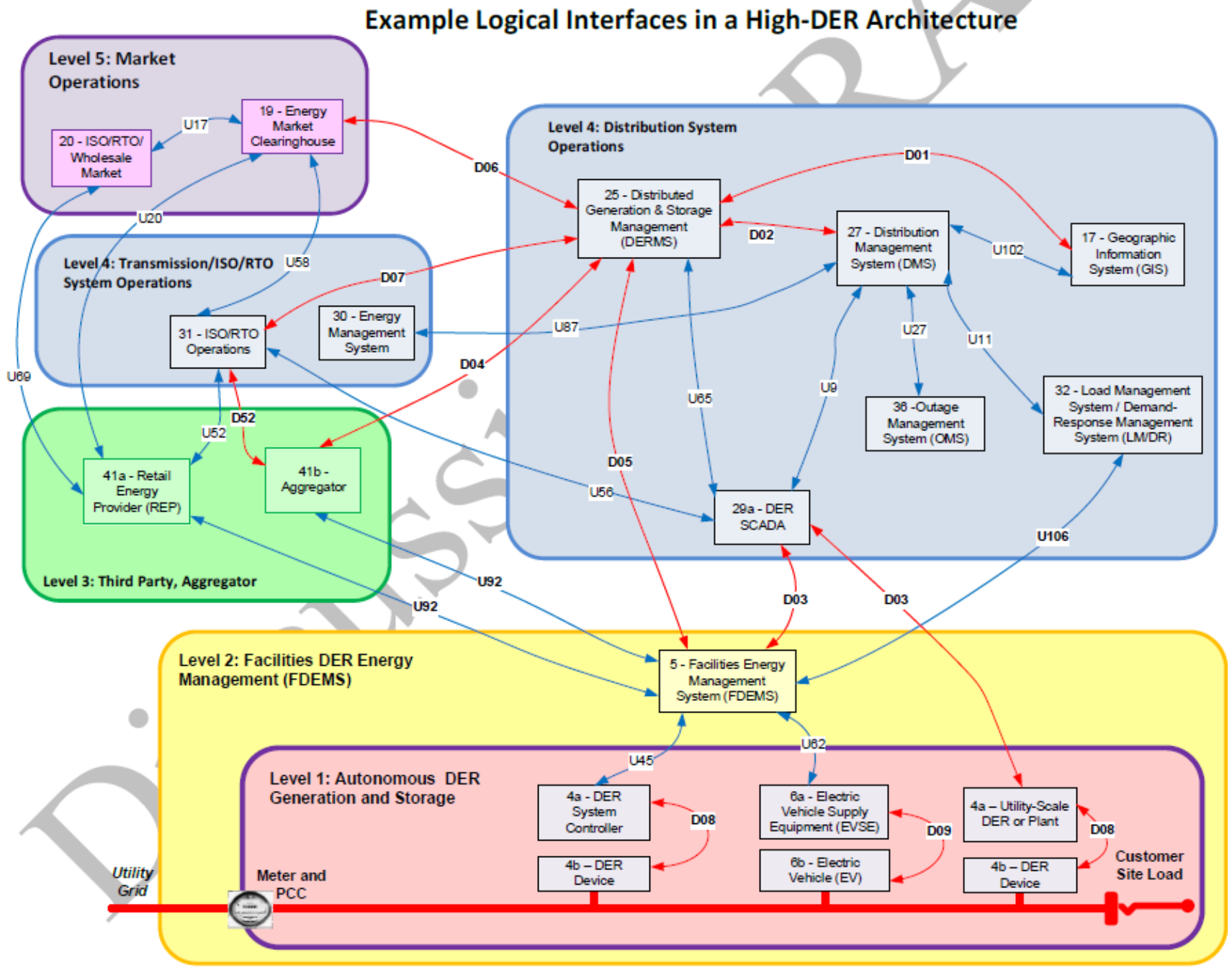
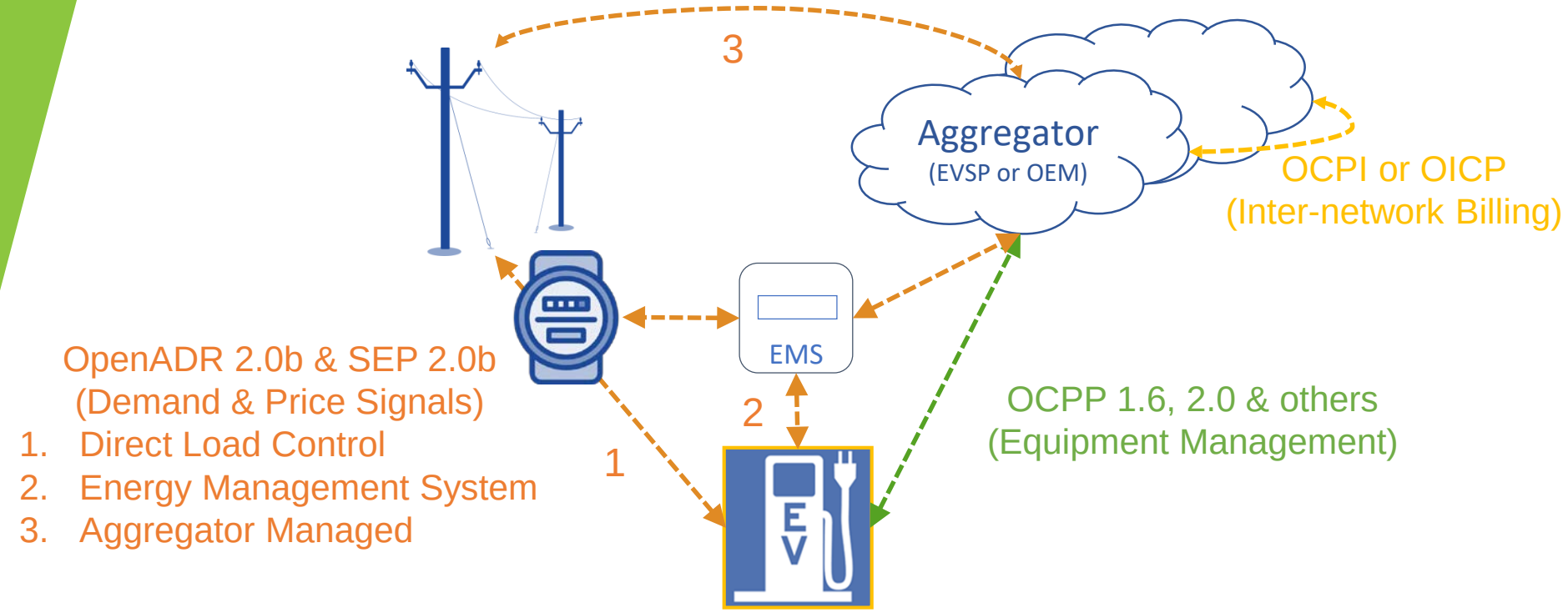


Figure 2 - Example Logical Interfaces in a High-DER Architecture. Note that to ease examination, this figure includes only those entities requiring new logical interfaces for this high-DER example.

Open, Standards-Based Network Communication



Multiple viable uses of protocols, dependent on purpose and situation

- Utility Direct or Aggregator –managed load controls
- Presence of other EVSEs, non-EV loads, and/or an Energy Management System
- Transfer information across networks (direct btw. EVSPs or via clearing houses)

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Open, Standards-Based Network Communication

Communication Functionality and Physical Layer

- Network Connectivity (one of the following)
  - IEEE 802.11n for high-bandwidth wireless networking
  - IEEE 802.3 for Ethernet for Local- or Wide- Area Network Applications
- Capable of remote software updates
- Real-time protocol translation, encryption, and decryption
  - Internet Protocol (IP)-based processor must support multiple protocols
  - Compliant with Transmission Control Protocol (TCP)/IP and IPv6

Adapted from VGI Communication Protocol Working Group Energy Division Staff Report, Table 4.

Each individual EVSE is required to be capable of open, standards-based network communication.

Should a specific protocol be required for purposes of minimizing the risk of stranding EVSE hardware?

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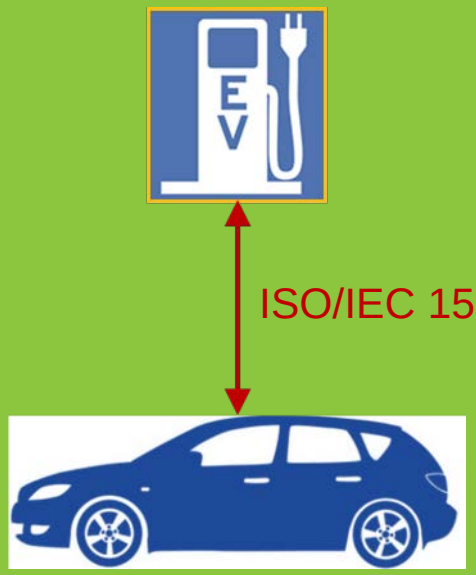

ISO/IEC 15118 High-Level Communications

- **Convenience.** ISO 15118 enables a PEV controller to "associate" with the EVSE controller. This allows for Signal-Level Attenuation Characterization, to avoid signal noise possible in arrays where multiple EVs and EVSEs can charge. The EV and EVSE pairing assists with automating transactions.

- **Competition and Customer Choice.** Many automakers and EVSE manufacturers are currently deploying, or planning to deploy EV and EVSEs with these features, providing drivers additional options and services.

- **Cost Control.** Automating the exchange of smart charging control data maximizes site demand reduction potential, while respecting driver needs.

SAE J1772 Conductive	SAE J2954 Wireless	Combined Charging Standard
VGIWG Recommendation		
Requirements for AC EVSE: TBD 2021.	CEC will consider requiring implementation	Requirements for CCS DCFC: TBD 2021.

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ISO/IEC 15118 High-Level Communications

- **High-Level Communications** (HLC) allow for driver authentication, automated transfer and renegotiation of transaction details, and information to coordinate smart charging between site hosts, EVSE networks, and drivers. Actuating the two-way controls requires a networked EVSE with an added HomePlug Green PHY transceiver chip. Most OEMs plan to use ISO 15118 or a variant for their upcoming products within the next 10 years.

  Adapted from VGI Communication Protocol Working Group Energy Division Staff Report, Table 5.

- **Implementing a common, unique EV/EVSE communications protocol** based on ISO 15118 for SAE J1772 is crucial for seamless charging interoperability to reduce EVSP network software costs and site hosts' utility operational costs.

- **Innovative use cases will build upon improvements to ISO 15118** as it is planned to enable wireless charging (J2954) and EVs to be used DER (J3072).

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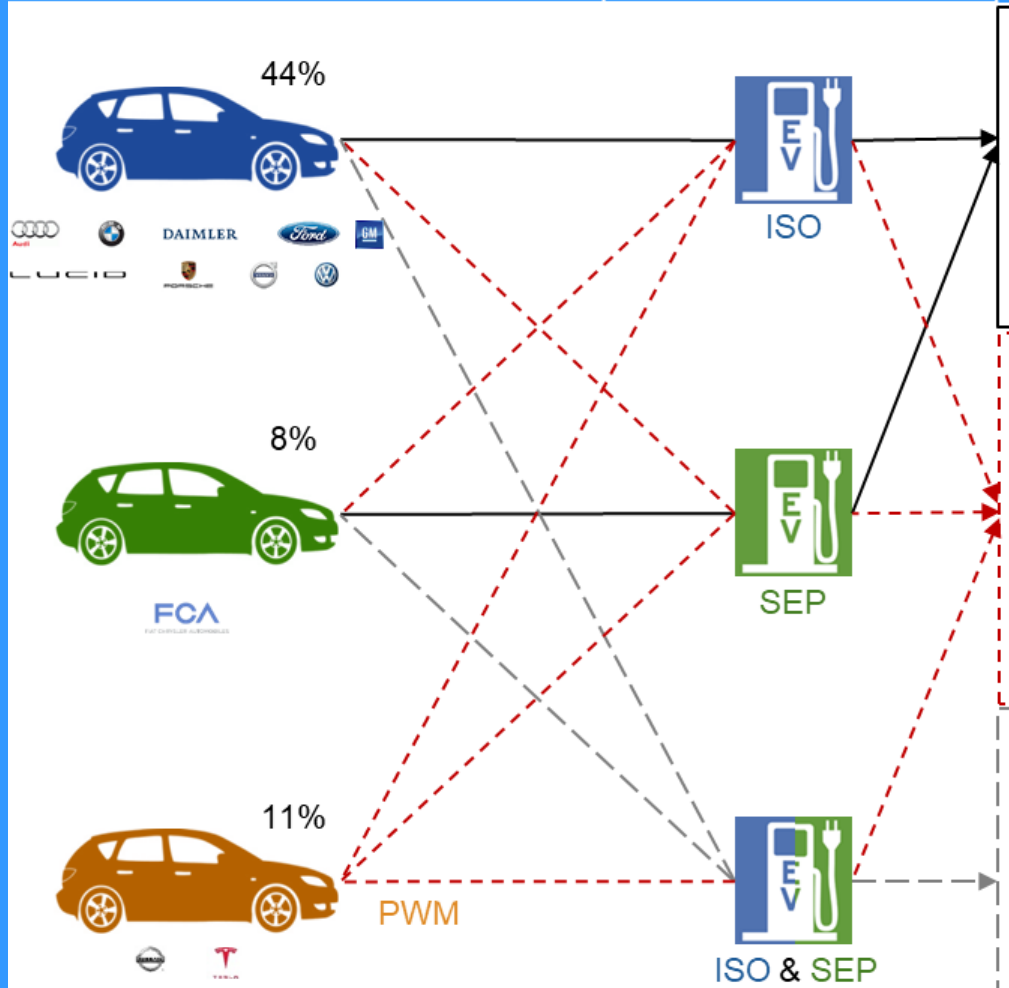
Interoperability, equipment, network, and operational implications from permutations of EVs, designed with High-Level Communications (HLC) or Pulse Width Modulation (PWM) controls, using Electric Vehicle Supply Equipment (EVSE) that communicate either ISO/IEC 15118, SEP 2.0b, or both, for charging.

Select EV OEMs (potential penetration per % of total CA sales as of Q2 2019)	EVSE Design: "one or a combination"	Interoperability Impact	Additional EVSE Cost (1)	Networking Cost (1)	Electricity Cost
		HLC successful – smart charging automated for ISO/ISO or SEP/SEP EV/EVSE pairings	Research Development Software Manufacturing $5-25/EVSE (at scale)	Monitoring & maintenance of EVSE Update one HLC software (ISO *or* SEP)	Low, for successful pairings of EV and EVSEs (2)
		HLC unsuccessful – revert to basic PWM charging for incompatible EV/EVSE pairs	No additional cost for an EVSE capable of HLC to charge a EV communicating via PWM. (Software is backward compatible.)		Medium, for a low rate of reversion to PWM charging High, for a high rate of reversion to PWM charging
		HLC successful – but implementing ISO & SEP between the EV and EVSE requires that EVSPs develop and maintain two device softwares and install additional equipment external to the EVSE	Research x2 Development x2 Software x2 Manufacturing x2 $5-25/EVSE (at scale) External converter for 2 EVSE protocols	Monitoring & maintenance of EVSE and external protocol converter Update two HLC softwares implemented (ISO *and* SEP)	Low (if the EVSE is able to convert between protocols to accept both types of EV messages)

Varied EV/EVSE HLC Protocols stifle the vision for interoperability and increase manufacturer and user costs.

Potential penetration includes new car and light truck registrations per the California New Car Dealers Association California Auto Outlook

(1) EVSE costs are approximations submitted by IoTecha to the 2017 VGI Working Group and are corroborated by CEC's transceiver marginal cost analysis.

(2) 37% of automakers not pictured have either made confidential statements about or have not discussed their HLC communications protocol designs.

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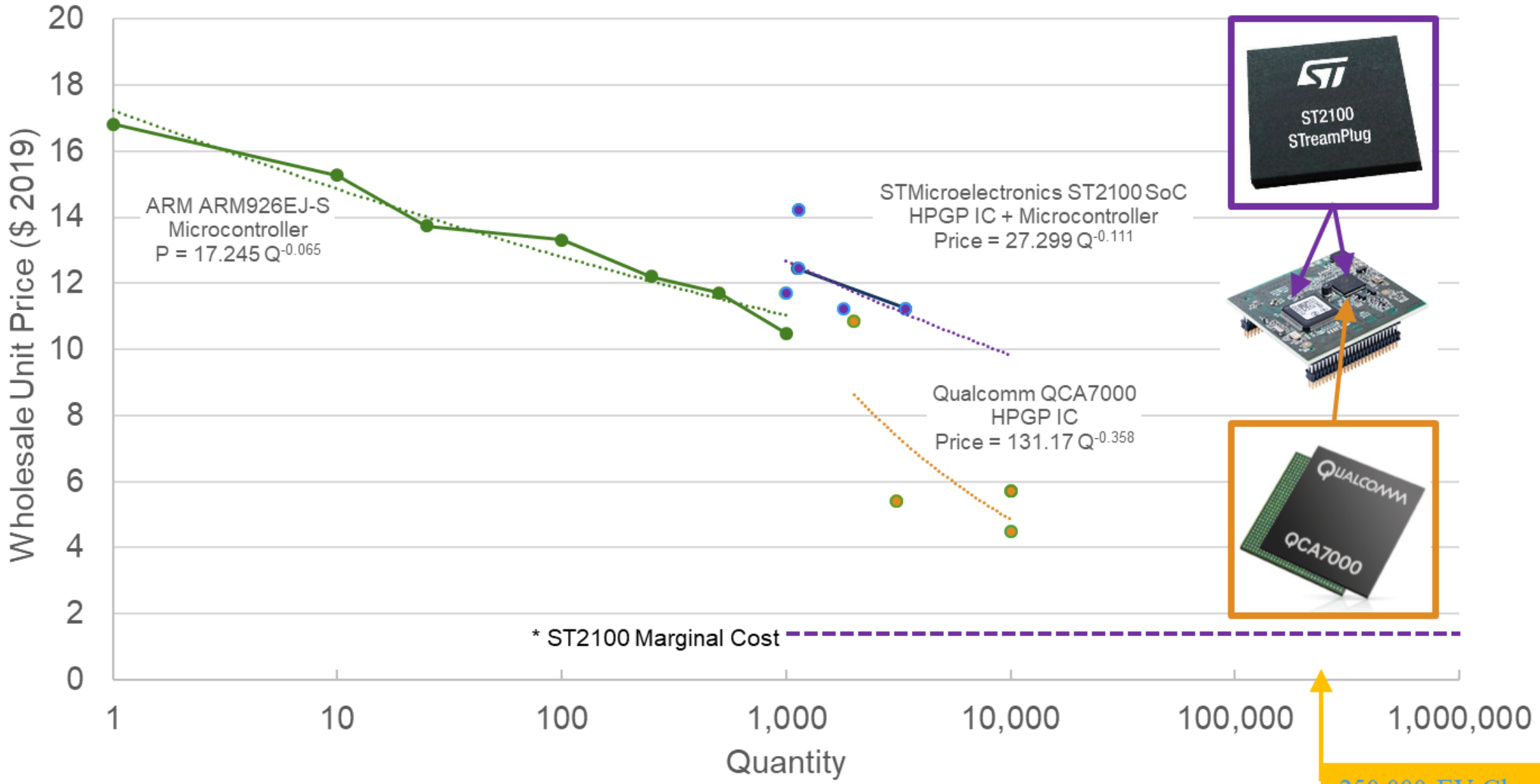
Cost of HomePlug Green PHY Transceiver Configurations



Conservatively, ISO 15118 enabling circuits cost <$10/unit at scale. Assuming that the Level 2 EVSE is networked, the transceiver marginal cost is about $1.5/unit.

Source: Energy Commission March 2019 analysis of supply equipment charge controllers and wholesale electronics suppliers.

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With economies of scale production, including a transceiver ***adds de minimis upfront costs*** to a L2 EVSE (albeit excluding design, engineering, and software integration).

Using conservative assumptions for driver willingness to pay and higher-end component costs demonstrates ***net value for OEMs at volumes <1k units.***

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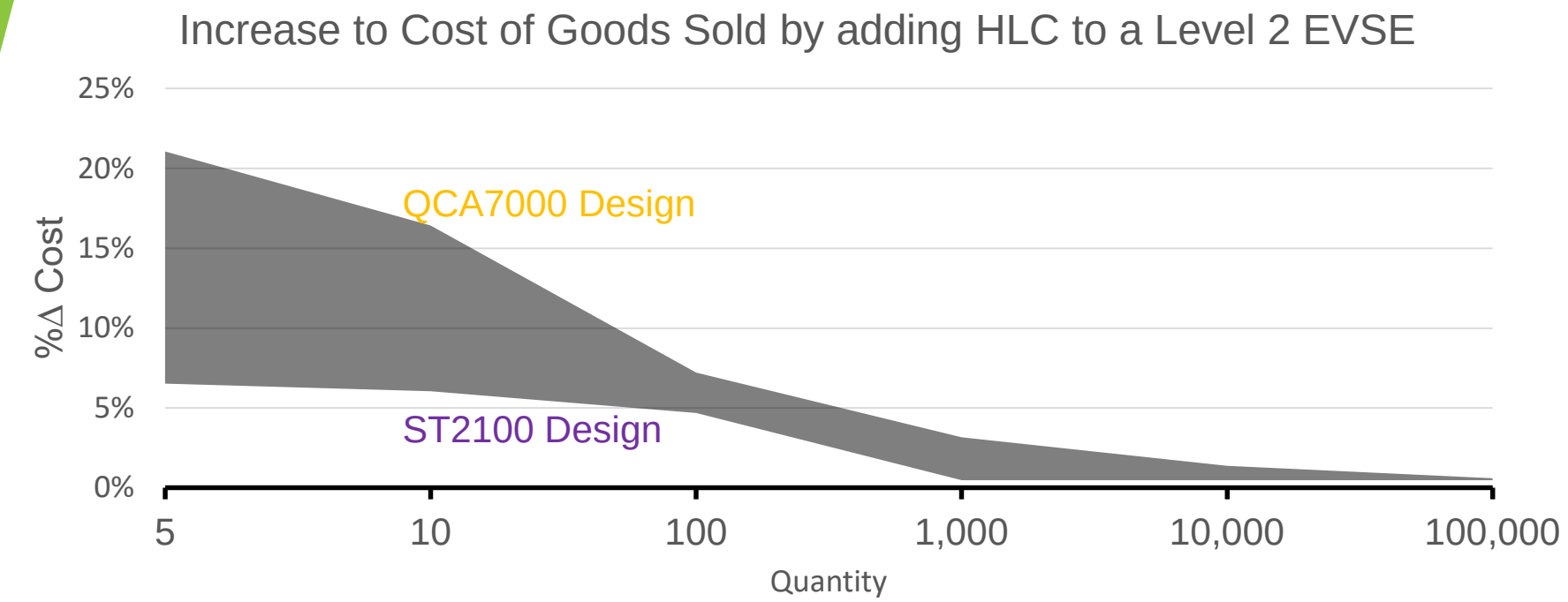

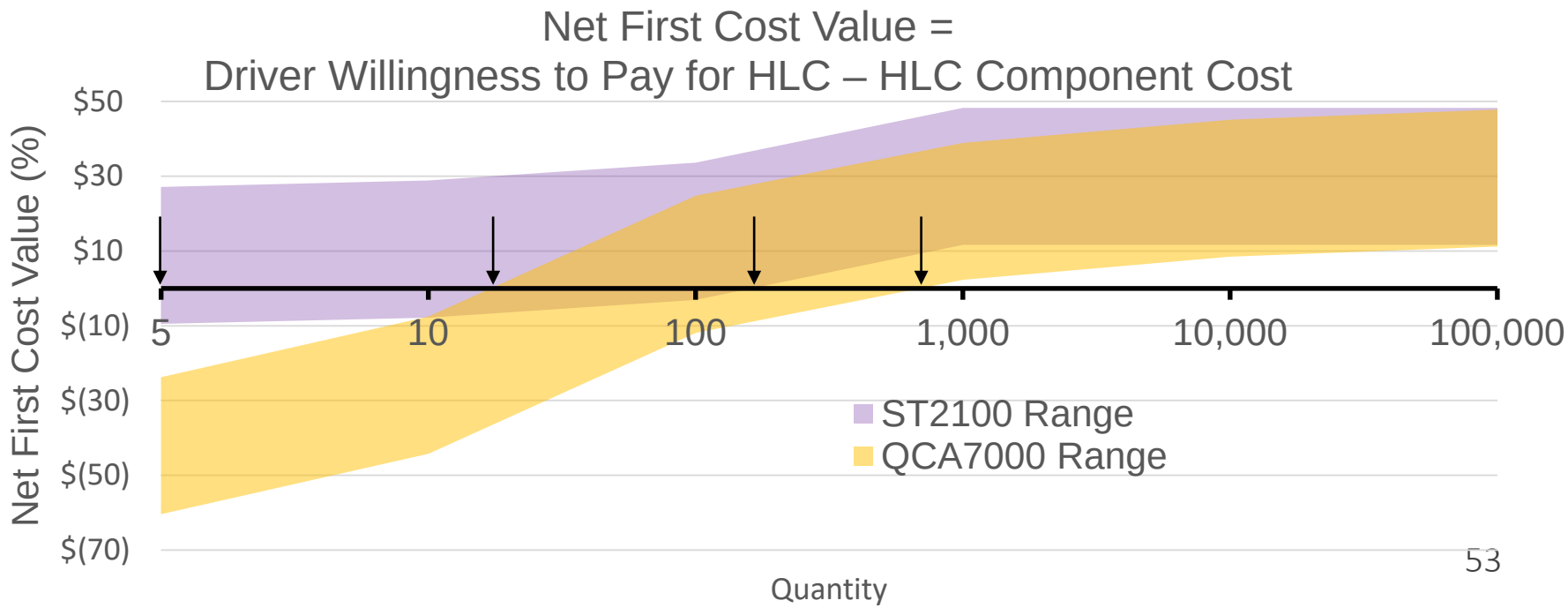

Source: Energy Commission analysis of OEM interviews; Geske and Schumann, Energy Policy (2018). "First Cost" excludes incremental HLC operational savings.

ISO/IEC 15118 High-Level Communications

- **With any networked technology, cybersecurity should be ensured upon installation and addressed continuously to establish trusted charging systems.** NIST states that most communications between EVSEs and EVs use the ISO/IEC 15118 standard, noting that cybersecurity for the standard is ongoing in development. NIST describes that:
  - The use of Intrusion Detection Systems and Simple Network Management Protocol Management Information Base (IEC 62351-7) would be used to notify of possible attacks.
  - Responses to attacks would likely require aborting communications. The EVSE may not continue to charge EVs, using local default charging conditions.
  - EVSE and communication modules would be tested for malware and additional measures for preventing attacks would be added during recovery.
- **ISO/IEC 15118-2:2014** defines messages and use of V2GTP, TLS, TCP, and IPv6.
- **ISO/IEC 15118-20** defines 2nd generation network & application protocols

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NIST Smart Grid and Cyber-Physical Systems Program Office, Draft Evaluation of Testing & Certification Landscape for Smart Grid Standards (2018)
NIST New Smart Grid Interfaces Categories Assessment, Discussion Draft (2018)

Lunch Break
Begin at 1 PM

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CALeVIP Background and Current Equipment Requirements

Updated Proposal for Future Equipment Requirements

Analysis of Equipment Hardware and Software Technology

Public Roundtable Discussion
Features Demanded and Product Supply Chain

Proposed Timelines for Implementation

Questions & Wrap Up

Customer Charging Needs

- What are customers' needs in the EV charging experience? What do customers like or want more of?
- What are drivers' and site hosts' biggest challenges or frustrations in charging?
- How are the issues common or different across locations (residential, workplace, public, and other charging)?
- How are drivers and site hosts managing the gaps between needs and frustrations? What solutions do they currently use to address their concerns?

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Manufacturer Charging Products

- What are the solutions for customers' needs? What features are manufacturers planning for in their product roadmaps (detail: what, where, when)?
- What are manufacturers doing to build chargers that accommodate future needs? What strategic investments are being made to lay the foundation necessary for long term value?
- Do standards assist in manufacturers' development and production of interoperable charging solutions? What solutions are being used for the following use cases: Level 2, conductive or wireless charging, AC or DC, fast charging (or others)?
- How are vehicle manufacturers' product commitments for California considered as part of broader marketing efforts, including on the scale of the international automotive market?

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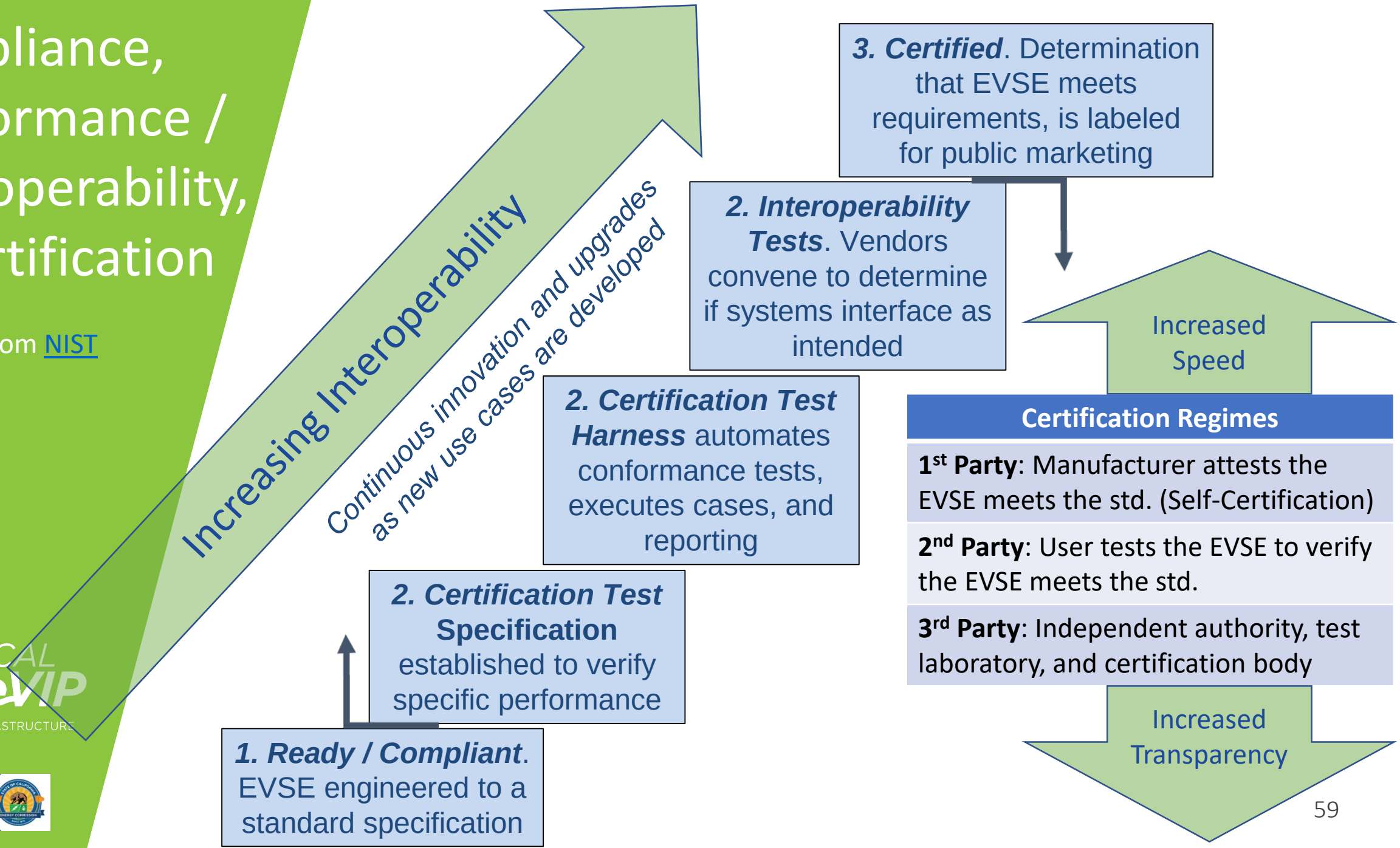
Compliance, Conformance / Interoperability, & Certification

Adapted from NIST



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EVSE Supply Chain Considerations

- To what level of requirements should the Energy Commission hold EVSE manufacturers applying to qualify their equipment as eligible for CALeVIP?
- What are EVSE manufacturers' responses to the open items (?) posed?
- What supply chain constraints should the CEC help manufacturers alleviate and how? (Amended terms, funds for R&D, testing, or manufacturing)?

Requirement Terminology	NRTL Safety Certification	EPA ENERGYSTAR	ARB Open Access (SB 454)	DMS EVSE Metering	O,S-B Network Communication	ISO/IEC 15118
1. "Ready" or "Compliant"			Compliance, as applicable	Compliance, as applicable	Individual Specification(s) Needed?	Term Needed? Version # Needed?
2. "Conformed" or "Interoperable"		Testing Laboratory Facilities?	As reported to ARB	Per the DMS Type Testing Procedures	Certification Procedures? Facilities?	Certification Procedures? Facilities?
3. "Certified"	Approval by NRTL	Certification Body	As reported to ARB	Per Local AHJ Sealing Procedures	Labeling Procedure(s) ?	Labeling Procedure?
EVSE and EVSP Critical Path Items		Updated Testing Procedures for DCFCs?	Potential updates per ARB regulation	Alignment with CEC's proposed "Trial" terms for submetering?	OpenADR 2.0b SEP 2.0b OCPP 1.6, 2.0 Others?	AC DC Wireless? …V2V/V2H/V2G?

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Proposed Timelines for Implementation

Does your product roadmap currently have or plan to have the following features?

Level 2 Manufacturers	ENERGY STAR	ISO 15118	OCPP 1.6
Yes or In Progress	14/14 (100%)	8/14 (57%)	14/14 (100%)
No	0/14 (0%)	6/14 (43%)	0/14 (100%)

DCFC Manufacturers	ENERGY STAR	ISO 15118	OCPP 1.6
Yes or In Progress	7/8 (%)	5/8 (63%)	8/8 (100%)
No	1/8 (%)	3/8 (37%)	0/8 (0%)

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EVSE Manufacturer Responses to CEC Survey, November 2019

Proposed Timelines for Implementation

	2020 Q1	Q2	Q3	Q4	2021 Q1	Q2	Q3	Q4	2022 Q1	Q2
ENERGY STAR for DCFC		Draft 1 Specification & Final Test Method	V1.1 Effective			3rd PC Certification				
OCPP 1.6	Certification by OCA avail. Fall 2019	1st PC				3st PC Certification				
ISO 15118	6/28/18 Proposal	ISO 15118-20 Enquiry & Approval?	3rd PC Testing Procedures?			1st PC Compliance				
CDFA DMS EVSE Regulations					AC EVSE 1/1/21					
CARB SB 454 Compliance									DCFC 1/1/22	

PC = Party Certification
(see page 59)

- Only EVSEs that meet the minimum requirements of CALeVIP will be eligible for funding.
- EVSEs that are currently listed within the CALeVIP Eligible Equipment List will be removed if they do not meet the requirements by the proposed effective dates.

CALeVIP Background and Current Equipment Requirements

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Questions & Wrap Up

Questions & Public Comment

Please state your name and affiliation.

Conclusion

- Written comments must be submitted to the Docket Unit by **5:00 p.m.** on **December 13, 2019**
- The CEC encourages use of its electronic commenting system. Visit https://efiling.energy.ca.gov/Ecomment/Ecomment.aspx?docketnumber=17-EVI-01, which links to the comment page for this docket. Select or enter a proceeding to be taken to the "Add Comment" page. Comments may be included in the "Comment Text" box or attached in a downloadable, searchable Microsoft® Word (.doc, .docx) or Adobe® Acrobat® (.pdf) file. Maximum file size is 10 MB.
- Written comments may also be submitted by email. Include the docket number 17-EVI-01 and Future Equipment Requirements for CALeVIP in the subject line and send to docket@energy.ca.gov.
- If preferred, a paper copy may be submitted to:

California Energy Commission
Docket Unit, MS-4
Re: Docket No. 17-EVI-01
1516 Ninth Street
Sacramento, CA 95814-5512

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Thank you

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