DOCKETED	
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Project Title:	Zero Emission Vehicle Infrastructure Barriers and Opportunities
TN #:	242337
Document Title:	Presentation - Electric Vehicle Charging Infrastructure Reliability Workshop
Description:	*** This document supersedes TN 242220 ***
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California Energy Commission

Electric Vehicle Charging Infrastructure Reliability Workshop

March 11, 2022

Workshop Agenda

- Introduction
  - Housekeeping
  - Commitment to Diversity
  - Workshop Goals
- Background
  - Definitions
  - Clean Transportation
  - Reliability Standards
- Measuring Reliability
  - Potential Metrics
  - Data Collection Methods
  - Tiered Standards
- Presentations
  - Tesla
  - Cool the Earth
  - Ford Motor Company
  - Flo
  - ChargePoint
- Q&A and Public Comment

Introduction

Introduction - Housekeeping

- Workshop is being recorded
- Workshop Event Webpage: https://www.energy.ca.gov/events
- Virtual Participation through Zoom
  - Q&A period after the main presentation
  - Raise Hand or Q&A feature
- Written Comments to Docket # 21-TRAN-03: https://efiling.energy.ca.gov/Ecomment/Ecomment.aspx?docketnumber=21-TRAN-03
  Deadline: Friday, April 1, 2022

Introduction - Commitment to Diversity

The CEC adopted a resolution strengthening its commitment to diversity in our funding programs. The CEC continues to encourage disadvantaged and underrepresented businesses and communities to engage in and benefit from our many programs.

To meet this commitment, CEC staff conducts outreach efforts and activities to:

- Engage with disadvantaged and underrepresented groups throughout the state;
- Notify potential new applicants about the CEC's funding opportunities;
- Assist applicants to understand how to apply for funding from CEC's programs;
- Survey participants to measure progress in diversity outreach efforts.

Introduction - Diversity Survey

Scan the code on a phone or tablet with a QR reader to access the survey.

One Minute Survey

The information supplied will be used for public reporting purposes to display anonymous overall attendance of diverse groups.

Zoom Participants, please use the link in the chat to access the survey or scan the QR code on the left of the screen with a phone or table to access the survey.

Survey will be closed at the end of the day.

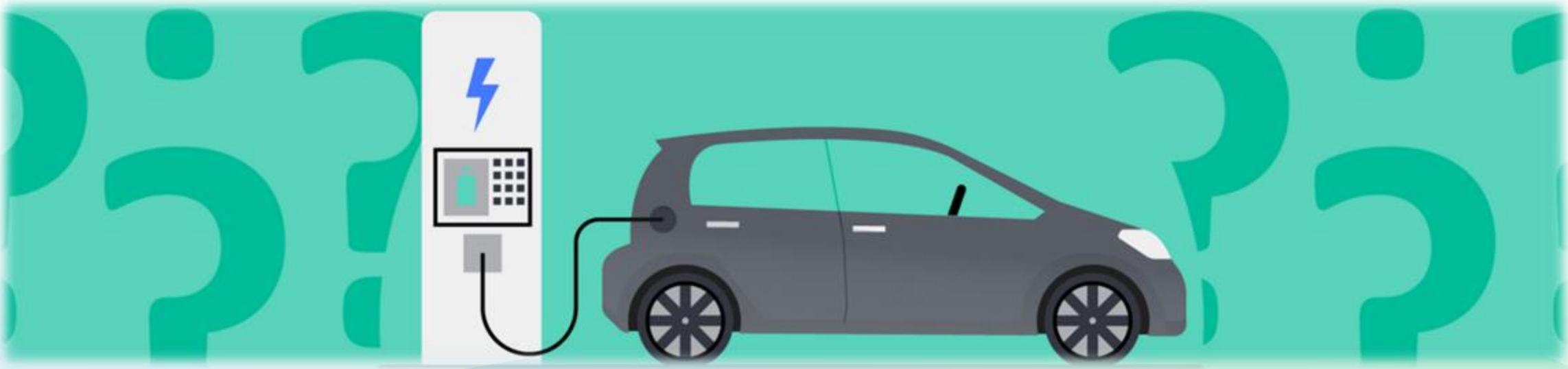
Survey Link:
https://forms.office.com/Pages/ResponsePage.aspx?id=RBI6rPQT9k6NG7qicUgZTmWqlGAqr0JNux5TMCEdoEBURTJFUVI5UVhTQUgwQldGQlo4SUxGTjdDWi4u

Introduction - Workshop Goals

This workshop seeks to gather stakeholder feedback on how to answer two questions related to reliability.

1. How to define and measure reliability, and whether/how to publish reliability metrics?

2. How to set reliability standards for EV charging infrastructure funded by the CEC?



Background

Definitions

1. User Experience is the overall experience of drivers that use public charging infrastructure to charge their electric vehicle (EV).
2. EV charging infrastructure reliability (charger reliability) refers to any element that must be operational to successfully charge an EV at a publicly available EV charging station. This includes hardware and software.

Clean Transportation Program

- Established in 2007 by Assembly Bill 118 (2007).
- Extended to January 1, 2024 by Assembly Bill 8 (2013).
- Provides approximately $95 million of funding per year through 2023.
- Investment Plan to determine funding allocations across various categories.

Reliability Standards

The Energy Commission has already begun incorporating reliability standards in recent grant solicitations. Recently, the REV and REACH solicitations included the following language on reliability:

> *"The equipment must be operational at least 97 percent of the standard operating hours of the charging facility for a period of 5 years from commissioning. It will be the recipient's responsibility to demonstrate this uptime requirement is met."*

Those solicitations also listed "extended warranty or agreement for operation, maintenance, or servicing of equipment for up to five years" as eligible costs and required an operation and maintenance plan as part of the application package.

Measuring Reliability

Impacted Chargers

Should the CEC seek to collect, aggregate, and publish reliability metrics for the full network of public chargers in California (both CEC funded and non-CEC funded)?

- If so, how can this be done?
- What are feasible metrics for evaluating reliability?

Should the CEC only focus on CEC funded chargers?

- How long should the reporting period and reliability standards be set for?
- What are feasible metrics for evaluating reliability?

Reporting

Who is responsible for reporting?

- Grant Recipient
- Site Host
- Network Provider

How is data reported?

- Periodic Reporting (e.g. Monthly or Annually)
- Application Programming Interface (API)
- Other?

Data Collection Methods

Owner / Operator Remote Monitoring	• Charger • Grid • Payment Systems
Third-Party Remote Monitoring	• OEM In-Vehicle Telematics
Manual inspection	• Crowdsourcing via App • Inspections
Suggestions?	

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Consideration of Tiered Standards

Should there be different reliability standards / metrics / reporting requirements for Level 2 and DCFC?

Level 2 Chargers

DC Fast Chargers

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Presentations

TESLA CHARGING

CEC WORKSHOP ON RELIABILITY

OUR MISSION

ACCELERATE THE WORLD'S TRANSITION TO SUSTAINABLE ENERGY

TESLA CHARGING

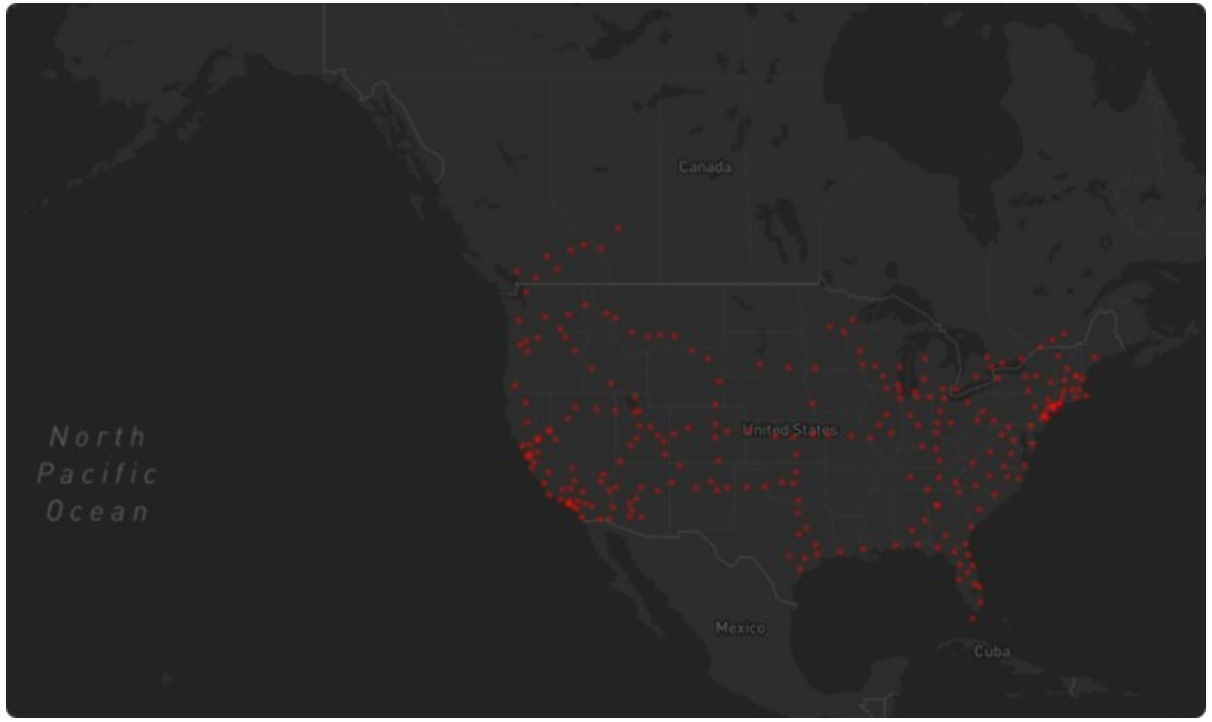
Supercharging

Destination Charging

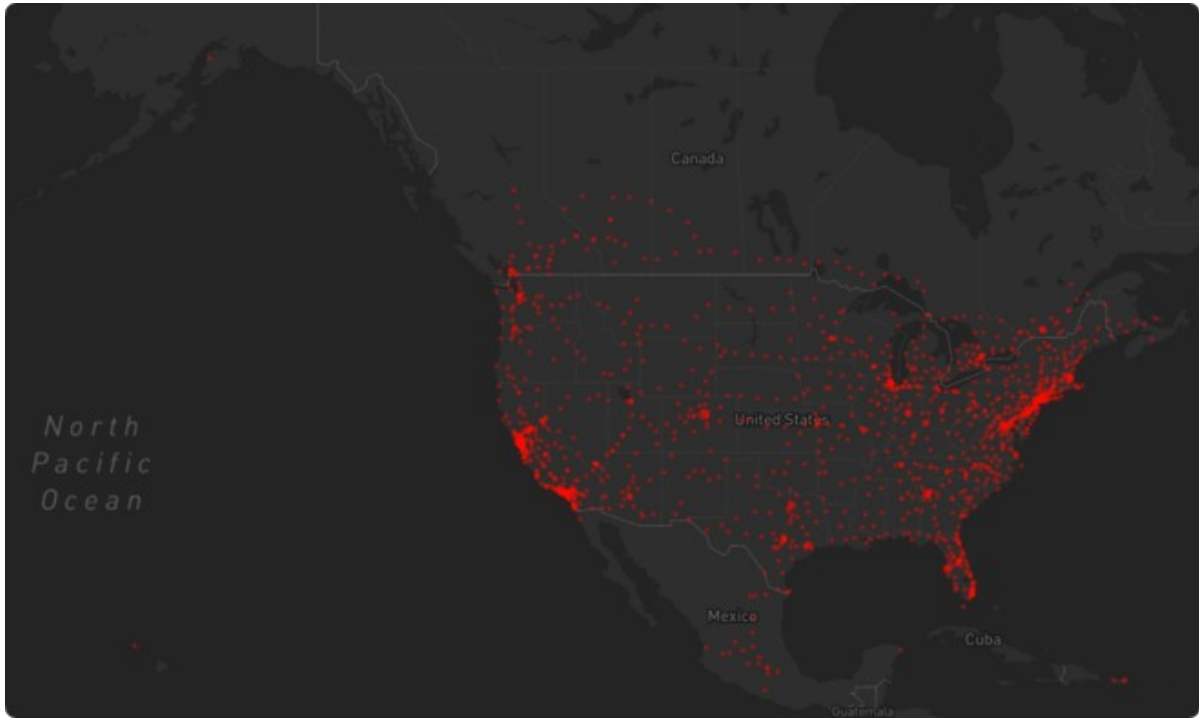
Where You Park

NETWORK GROWTH

2015



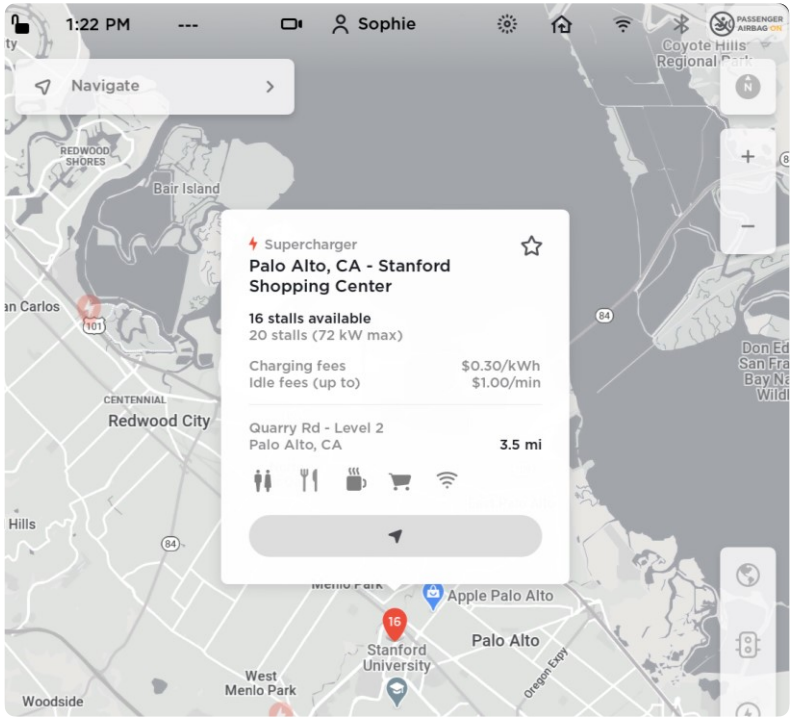
2021



SUPERCHARGER

GO ANYWHERE

RECHARGE



CONVENIENCE

STATION LAYOUT

PARKING STALL WITH SUPERCHARGER

EQUIPMENT

NEW UTILITY SERVICE

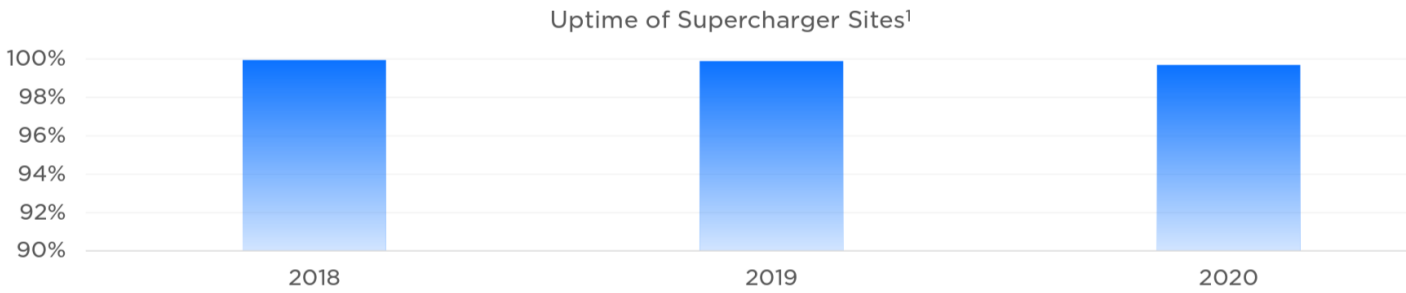
TESLA

RELIABILITY FACTORS

- ✓ Site Design
- ✓ Service and Maintenance
- ✓ Customer Communication

U P T I M E A S A M E T R I C

- ✓ Site Level
- ✓ Customer Experience
- ✓ Calculation and Key Terms



[1]Uptime of Supercharger Sites reflects the average percentage of sites globally that had at least 50% daily capacity fully functional for the year.

Source: Tesla 2020 Impact Report

cool the earth

Open-System Public Charging

Improving Reliability to Support Rapid and Large-Scale EV Adoption

Carleen Cullen

Founder and Executive Director

cool the earth

Discussion Topics

- What is reliability?
- Beyond early adopters
- Is there a reliability issue?
- New objective evaluation
- Concerns
- Defining reliability
- Next steps

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What is the Consumer Definition of Reliability?

CONFIDENCE

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Early Adopters to Early Majority

Early Adopters tolerated functionality failures and usability issues.

Early Majority demands functional and usable stations:

- One standard for DCFC plugs
- Clarity about rate of charge, including vehicle's charging profile
- A canopy to protect from the elements
- Cables and plugs that are easy to maneuver
- Directional signs to locate the stations
- A safe location, including on evenings and weekends
- Easy-to-navigate user interface

Public Charging is Unreliable

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Consumer Opinion Surveys

CARB (Feb. 2022):

- ➢ 40% of CA respondents contacted customer service
  - Top reasons: charging kiosk not working, plug was broken, or shut off during charging

Plug In America (Feb. 2022)

- ➢ 34% of those who used DC fast charging noted that broken chargers were at least a "moderate concern"

EV Service Provider Survey*

CARB (Feb. 2022):

- ➢ EVSP report a 95-98% uptime

*4 of 11 responded

Sources:
CARB: Electric Vehicle Supply Equipment Standards Technology Review
Plug in America: EV consumer survey report. February 2022

UC Berkeley Study of Open-system Public Charging Stations in the Greater Bay Area

cool the earth

- Reliability study of all 181 open, public DCFC charge stations; more than 650 connectors/plugs tested
- Study of machine functionality with a specific protocol to test if the kiosk could initiate and maintain a charge for two minutes at the time of testing
- Preliminary results indicate that approximately one-quarter of plugs tested are unreliable or have design failure.

UC Berkeley will be releasing the study in about a month.

Sign up to receive notification of the release: www.cooltheearth.org

cool the earth

Risks if Reliability is Not Improved

- Stall the growth of the EV market
- California will not reach its climate commitments
- Significant equity issue
- Consumer protection
- Concerns of misuse of public funds
- Settlement and contract compliance
- Disclosure requirements for public companies

Defining Reliability and Uptime

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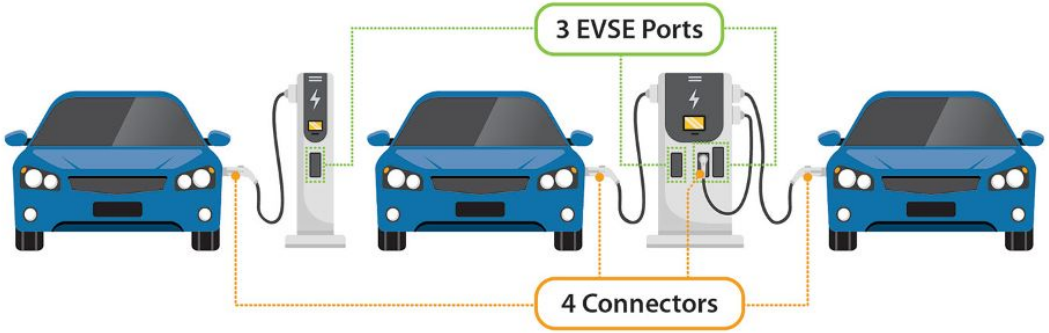

Source: DOE Alternative Fuels Data Center (AFDC) 2022

Defining Reliability and Uptime

cool the earth

Reliability is assessed based on the following functionality:

- The EV charging connector/plug is compatible with any current (2022) open-system EV
- The payment system accepts a credit card and/or debit card payment
- The kiosk successfully charges until vehicle is charged to maximum capacity or until the driver ends the session

Uptime is defined as:

- The percent of time that the components of the charging port are operational and charging in sustained
- Contracts should require 98% uptime per port/connector/plug with no more than 3.4 hours/week (average) of downtime, including maintenance. Power outages and scheduled maintenance are not included in downtime.

Next Steps

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- Funding for maintenance
- Testing protocols and metrics
- Third-party evaluation
- Funding released as key metrics are met
- Public reporting of reliability data
- National database (NREL) with real-time data on functionality

cool the earth

Thank you

Carleen Cullen
Founder and Executive Director

www.cooltheearth.org

Charger Reliability Workshop

Dave Hurst

March 11, 2022

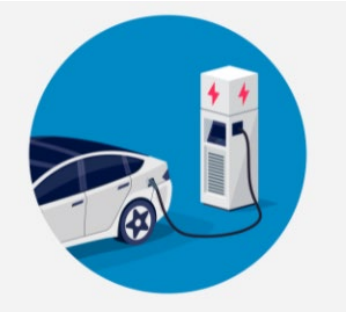
BlueOval™ Charge Network: North America's Largest Public Charging Network

Maximizing Access to Charge Points, Provide a Simple Interface, and a Common Payment Platform for Customers Using FordPass

What Issues Do We See?

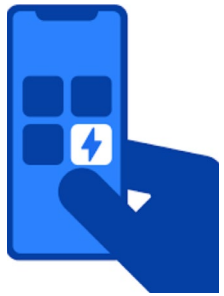
AC Charging is mostly fine – DC Charging is where we see majority of issues

Issues Can Be Binned In 3 Categories



Vehicle-2-Charger Interface

- Timeout issues
- Voltage/Amp issues
- Billing errors



Interoperability

- Remote request rejections
- Billing issues
- Lack of error explanation/data

Charger and Cable Issues

- Defective/broken cables / connectors
- Errors / power loss
- No connectivity

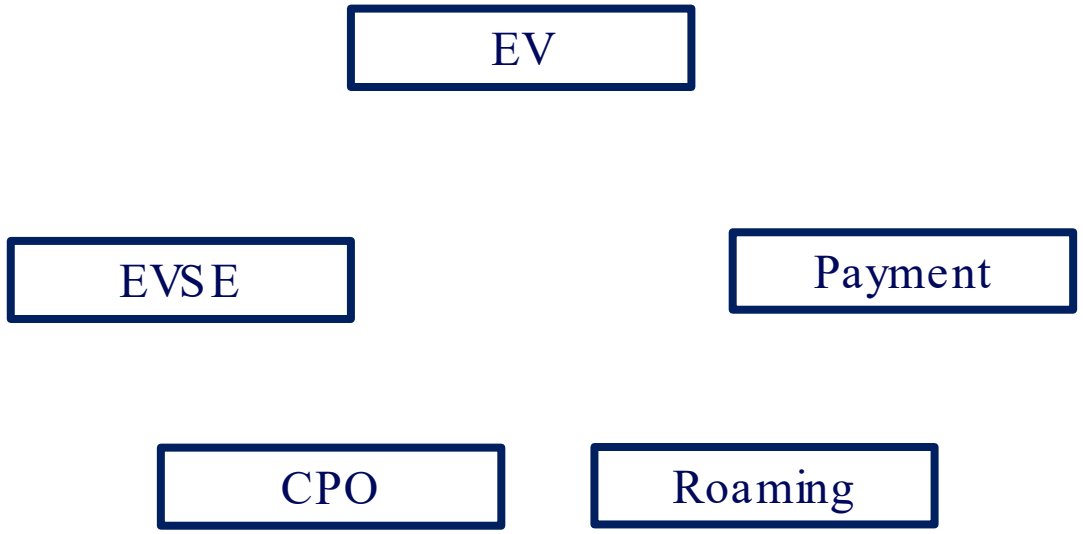
Revealed A Need for Improved Charger Data

Crux Issues: Ecosystem Complexity And Standards Maturity

Standards Are Immature and Fragmentation Is A Concern

- PLC
- ISO 15118-2
- ISO 15118-20 (lack of backward compatibility)
- SAE PKI
- OCPI 1.6/2.2
- OCPP
- Proprietary protocols
- Fragmentation of certificate issuing authorities

Ecosystem Complexity With No Change Control Protocol



Coordinating Ecosystem Is An Existential Issue For BEVs –
Current Experience Is **Unacceptable**

What Is The Charge Angels' Mission?

Test Problematic Chargers:

- Initial focus on largest networks: Electrify America, EVgo, ChargePoint, Shell Recharge/Greenlots, EV Connect
- DC charging focus

Utilize Site Score Rubric from internal Charging Data Service

Utilize insights from connected vehicle data

Tools:

- CAN-VDR
- PLC-VDR --- Wireshark
- Subjective Input Form

Thank You

Dave Hurst, Energy Services, dhurst20@ford.com

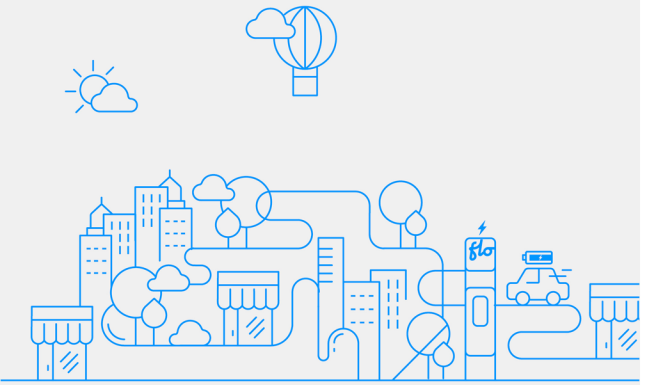
Accelerating EV Adoption

Through Improved Reliability and Customer Experience

Cory Bullis
Senior Public Affairs Specialist

We have sold and deployed over 55,000 residential, public, workplace and commercial charging stations in North America over 10+ years.

3 Gaps in EV Charging Policy



Patchwork of firm uptime requirements.

Little analysis of publicly funded station reliability.

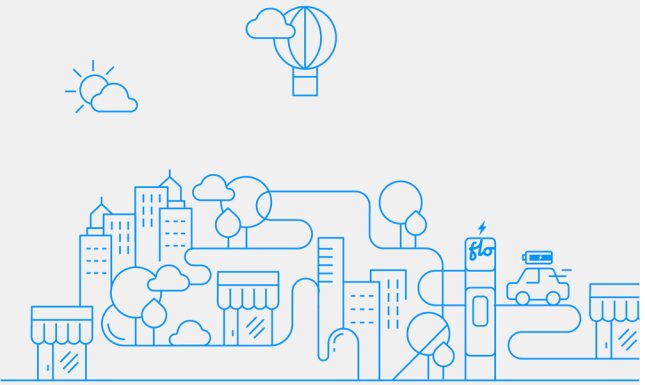
No analysis of equitable access to reliable stations.

Public or ratepayer- funded charging stations should have uptime requirements.

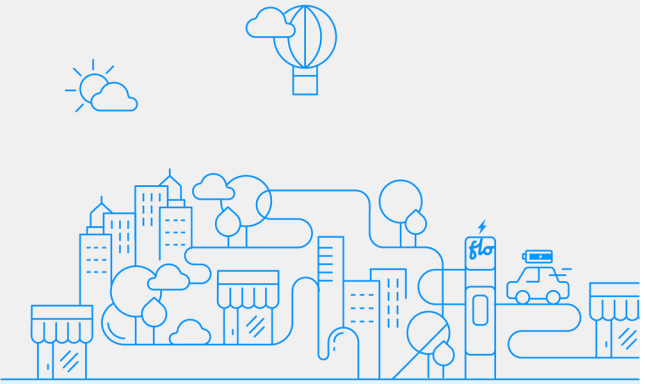
- FLO believes 97% is a reasonable uptime requirement to begin with (with a minimum of two stations per charging site).

Uptime Percentage	Days of Availability/Year
95 %	347 days (8,322 hours)
96 %	350 days (8,410 hours)
97 %	354 days (8,497 hours)
98 %	358 days (8,585 hours)
99 %	361 days (8,672 hours)

The difference between 95% and 97% is 1 week across an entire year.



Examples of uptime requirements.



conEdison, inc.

98% uptime for its DCFC program

NEW YORK STATE OF OPPORTUNITY. NYSERDA

97% uptime for its DCFC grant program

FPL

98% uptime
(Florida Power & Light)

LG&E

Requires 99% uptime for DCFCs
(Louisville Gas & Electric)

NESCAUM

Recommends 99% uptime for DCFCs

STATE OF CALIFORNIA ENERGY COMMISSION SINCE 1975

97% uptime requirement for MFH grant
97% uptime requirement for rural grant

DEPARTMENT OF TRANSPORTATION UNITED STATES OF AMERICA

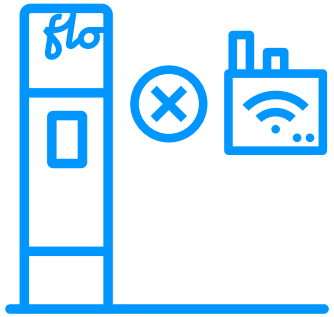
Recent federal guidance from FHWA proposed a greater than 97% uptime requirement for IIJA-funded EV infrastructure

flo lead the way

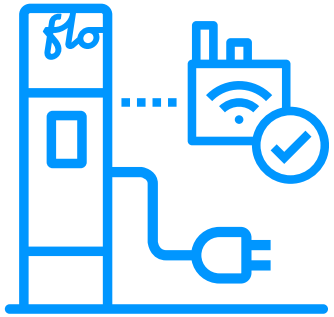
Calculating Uptime

Key Terms

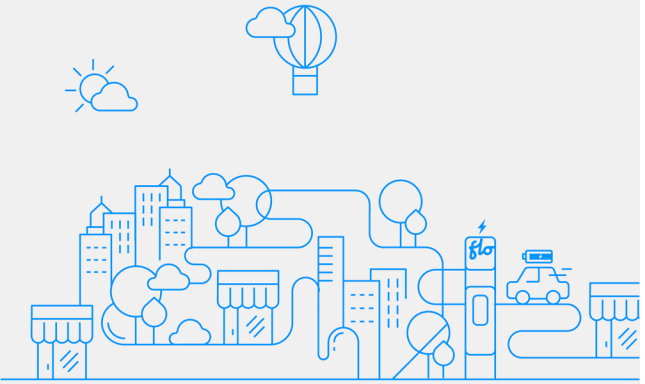
Outage Time (OT): the time required to bring the charger back online (also known as “mean time to restore service - MTTRS”).



Excluded Time (ET): the time a charger is offline due to issues outside of the EV charging network’s control.



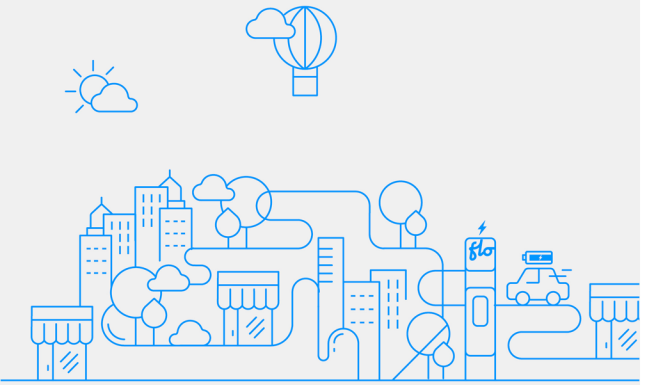
In-service Time (IT): the time a charger is online and available for use or is in use.



Calculating Uptime

Excluded Time

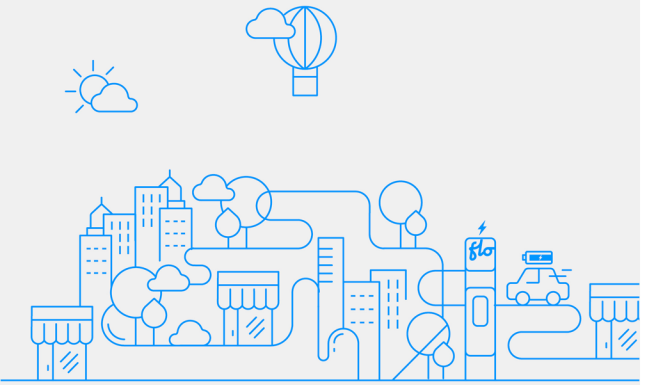
- Two key issues are outside the network provider's control:
  - Upstream power, internet, or cellular power failures
  - Abuse or vandalism
- Outage time due to abuse and vandalism should be exempted, otherwise it could disincentivize deployment in areas with higher rates of vandalism



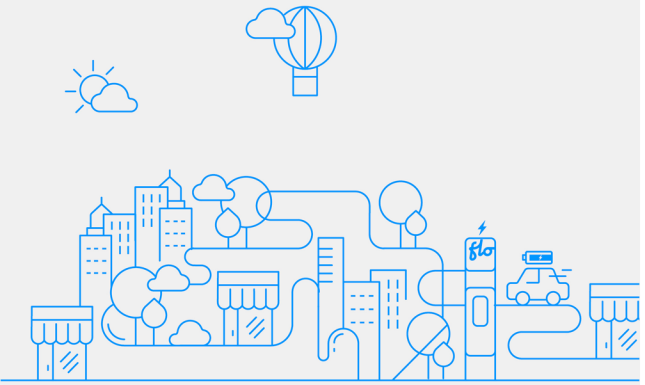
Calculating Uptime

FLO's Formula

$$\frac{[(\text{Number of hours in the period} * \text{number of available stations}) - (OT - ET)]}{(\text{Number of hours in the period} * \text{number of available stations})}$$



Questions?



Contact

Cory Bullis
Sr. Public Affairs Specialist
cbullis@flo.com

To learn more about reliability:

Reliability Blog Series #1: Can Drivers Count on EV Charging Stations to be Reliable? (flo.com)
Reliability Blog Series #2: Supporting EV Drivers with a Charging Station Reliability Standard (flo.com)
Reliability Blog Series #3: Calculating Standardized Charger Uptime (flo.com)

Charging Station Reliability Is an Equity Issue (flo.com)

CEC EVSE Reliability Workshop

Justin Wilson - Director, Public Policy

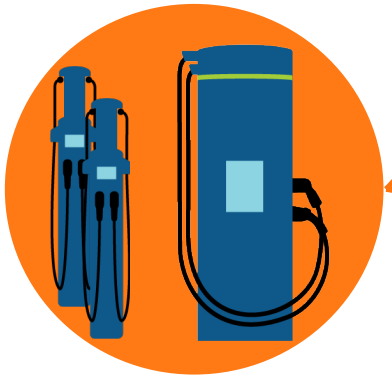
March 11, 2022

Pathway to Reliability Standards

Driver Considerations

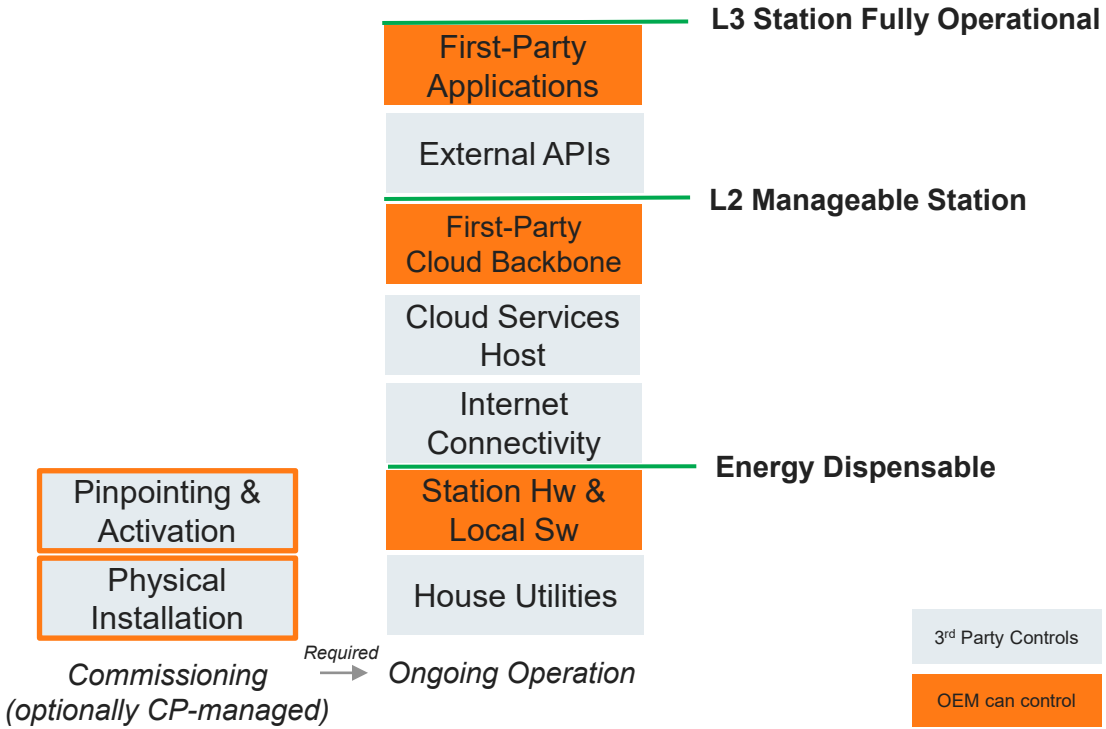
- Variety of Providers/ Solutions
- Easy To Find
- Easy to Use
- Cost Competitive
- Performs as Expected
- Reliable Experience

Provider Considerations

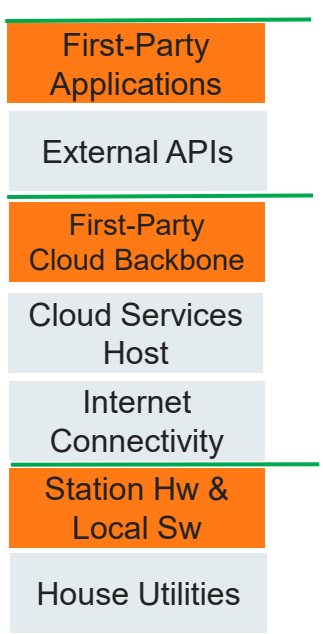


- Capital and Operating Cost
- Scalability
- Serviceability
- Diagnostics
- Anticipated Wear and Tear
- Vandalism

Uptime Hierarchy



Reliability Chain



Component Uptime

	Total Uptime %						
	90%	95%	96%	97%	98%	99%	99.90%
1st Party Apps	98.51%	99.27%	99.42%	99.57%	99.71%	99.86%	99.99%
3rd Party Partners	98.51%	99.27%	99.42%	99.57%	99.71%	99.86%	99.99%
Internal Cloud	98.51%	99.27%	99.42%	99.57%	99.71%	99.86%	99.99%
Cloud Host	98.51%	99.27%	99.42%	99.57%	99.71%	99.86%	99.99%
Cellular	98.51%	99.27%	99.42%	99.57%	99.71%	99.86%	99.99%
Station	98.51%	99.27%	99.42%	99.57%	99.71%	99.86%	99.99%
Power	98.51%	99.27%	99.42%	99.57%	99.71%	99.86%	99.99%

Thank You

For further information on this topic,
please contact Justin Wilson:

justin.wilson@chargepoint.com

+1.479.283.2995

Public Comment

Public Comment
Questions

Zoom Participants
- Use “raise hand” feature to make verbal comments
- Use the “Q&A” feature to type your question

Telephone Participants
- Dial *9 to raise your hand
- Dial *6 to mute / unmute you phone line

1. How to define and measure reliability and how to publish metrics.
2. How to set reliability standards in funding opportunities.
3. What lessons learned can help build reliable charging networks?
4. What metrics that can be feasibly collected?
5. Are there publicly available data sets that can better inform the CEC’s understanding of the reliability of existing EV charging infrastructure?
6. How can we ensure inoperable hardware is reported and information on down chargers is reported to consumers?

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Thank You!