NARUC Electric Vehicles State Working Group

UPTIME AND RELIABILITY FOR PUBLIC CHARGING/CHARGERS

MARCH 26, 2024, 3:00 - 4:30 PM ET

Welcome

EV SWG Chair

Commissioner Katherine Peretick, Michigan Public Service Commission

EV SWG Vice Chair

Commissioner Milt Doumit, Washington Utilities and Transportation Commission

EV Commission Staff Leads

Ryan Cheney, North Carolina Utilities Commission

Steve Olea, Arizona Corporate Commission

NARUC Staff

Danielle Sass Byrnett and Robert Bennett

Agenda

Time	Item
3:00 PM	**Welcome and Announcements – Commissioner Milt Doumit** • Agenda review • Announcements: resources, events
3:10 PM	**Brett Steudle, ChargerHelp**
3:25 PM	**Jacob Matthews, Joint Office of Energy and Transportation**
3:40 PM	**Jessie Lund, National Association of State Energy Officials (NASEO)**
3:50 PM	**Speaker Q&A**
4:15 PM	**Peer Sharing Discussion**
4:30 PM	**Adjourn**

EV Fact of the Week:

By 2030, the US will need 28 million EV charging ports to support 33 million EVs.

For more info and other facts, visit DOE FOTW webpage.

NEVI Brief for State Public Utility Commissions

The NARUC NEVI Brief provides:

- A concise explanation of the NEVI funding process, charger requirements, and alternative fuel corridors (AFCs).

- A description of potential PUC roles in the NEVI process in the context of other state agencies, utilities, and stakeholders.

- Key considerations for state PUCs and how Commissions enable NEVI charging infrastructure.

- A discussion of how NEVI charger buildouts could broadly influence technical requirements and standards for the EV charging industry and utilities.

- https://pubs.naruc.org/pub/2D24B6F0-D92F-38E9-589B-D07F0B44D74C

Winter Policy Summit EV Resources

▶ Winter Policy Summit presentations have been posted online.

  ▶ https://winter.naruc.org/meetings-and-events/naruc-winter-policy-summits/2024-winter-policy-summit/presentations/

  ▶ Includes: EV Medium- and Heavy-Duty Workshop and EV Hot Topics sessions.

NARUC DOE Leadership Dialogue

▶ On March 6, 2024, DOE/JOET prepared a presentation for Commissioners on EV service load requests, timelines, and the VGI accelerator

  ▶ Based on a national survey of four multi-state EVSE developers and site hosts, average timeline for EV Service Load requests to be connected is **498 days**

  ▶ DOE shared various challenges, examples of utility best practices, and potential areas of improvement for EV Service load requests.

  ▶ See PPT slides emailed on March 19, 2024

Presentations on Public Charger Reliability and Uptime

Moderator: Commissioner Milt Doumit, Washington Utilities and Transportation Commission

Guest Speaker

- Brett Steudle, ChargerHelp!
  - Public charging problems and solutions
- Jacob Matthews, Joint Office of Energy and Transportation
  - NEVI reliability/uptime requirements
- Jessie Lund, National Association of State Energy Officials (NASEO)
  - State agency perspective on federal charging opportunities and reliability

Questions

Moderator: Commissioner Milt Doumit, Washington Utilities and Transportation Commission

Guest Speaker

- Brett Steudle, ChargerHelp!
- Jacob Matthews, Joint Office of Energy and Transportation
- Jessie Lund, National Association of State Energy Officials (NASEO)

About ChargerHelp!

Our Vision

ChargerHelp, an EV Charging Infrastructure Operations & Maintenance Company, was founded in January 2020 with the vision of a future where the EV charging industry thrives on robust data-driven insights. We offers a platform-agnostic technology solution to bring transparency, efficiency, and reliability to a fragmented EV charging industry from the bottom up.
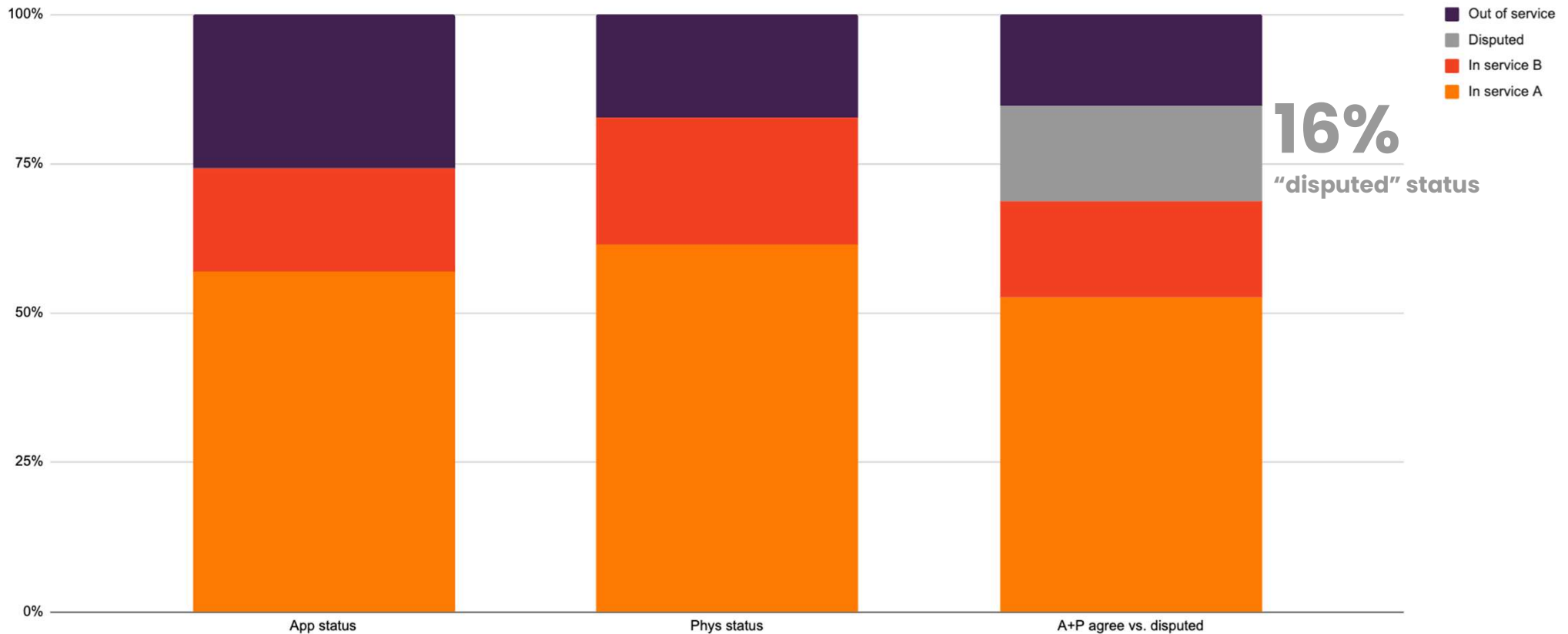
ChargerHelp's NEVI assessment

CH EVSE technicians visited and assessed nearly 5,000 charge ports across the country, with a focus on station locations where at least one port was listed in the AFDC database as unavailable — to better understand when, where, and why/how EVSE failed.

4,844
unique ports

1,261
ground truth tested

2,088
networked ports

www.chargerhelp.com
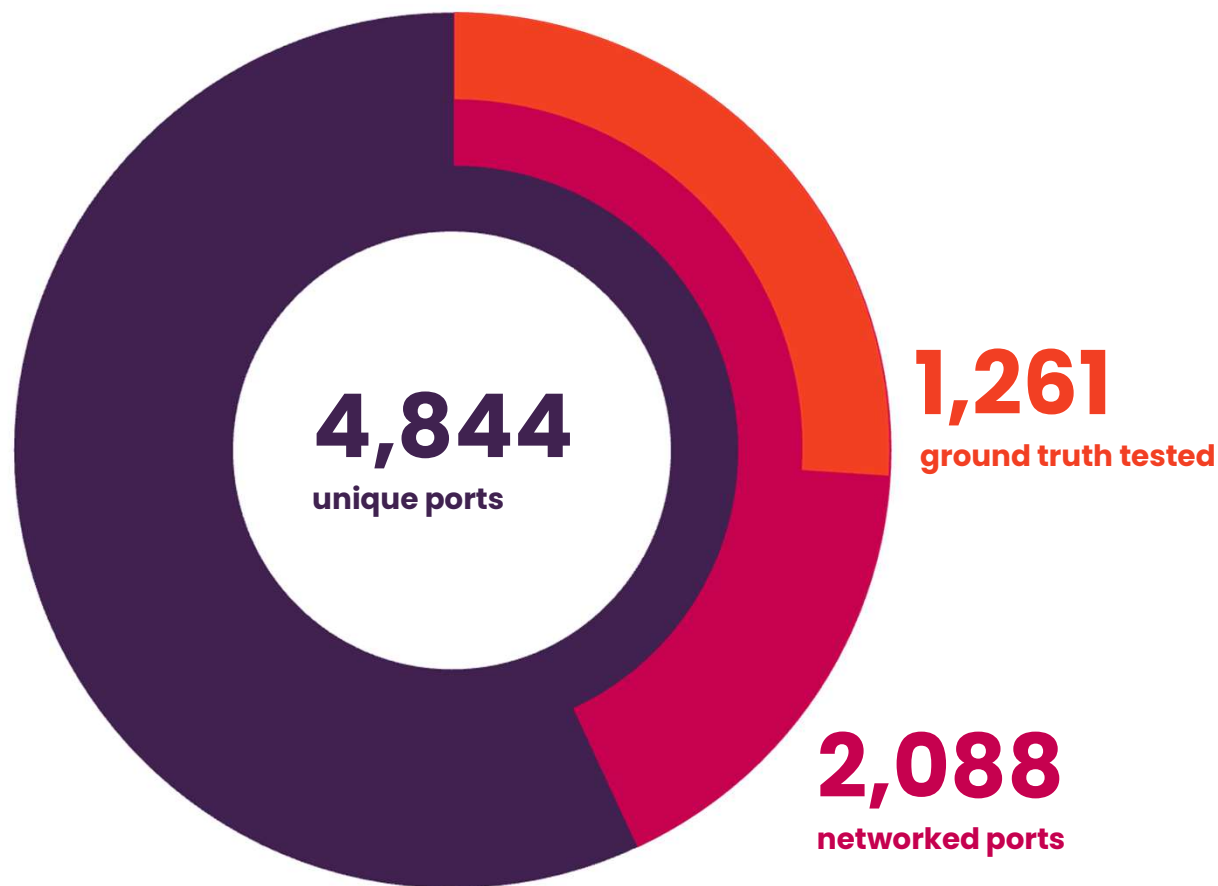
Software (app) status vs. physical station observations by CH EVSE technicians

16%
"disputed" status

Legend:
- Out of service
- Disputed
- In service B
- In service A

DISPUTED STATUS: 1 out of every 6–7 charge ports is "confused."

The software status (app-based) and the physical station status (CH EVSE technician in-person observation) disagreed 16% of the time. This "confusion" spans three major themes for EVCX.

100%

75%

50%

25%

0%

Legend:
- Out of service (dark purple)
- Disputed (gray)
- In service B (red)
- In service A (orange)

15.3%

A+P agree vs. disputed

Test charge ground truth
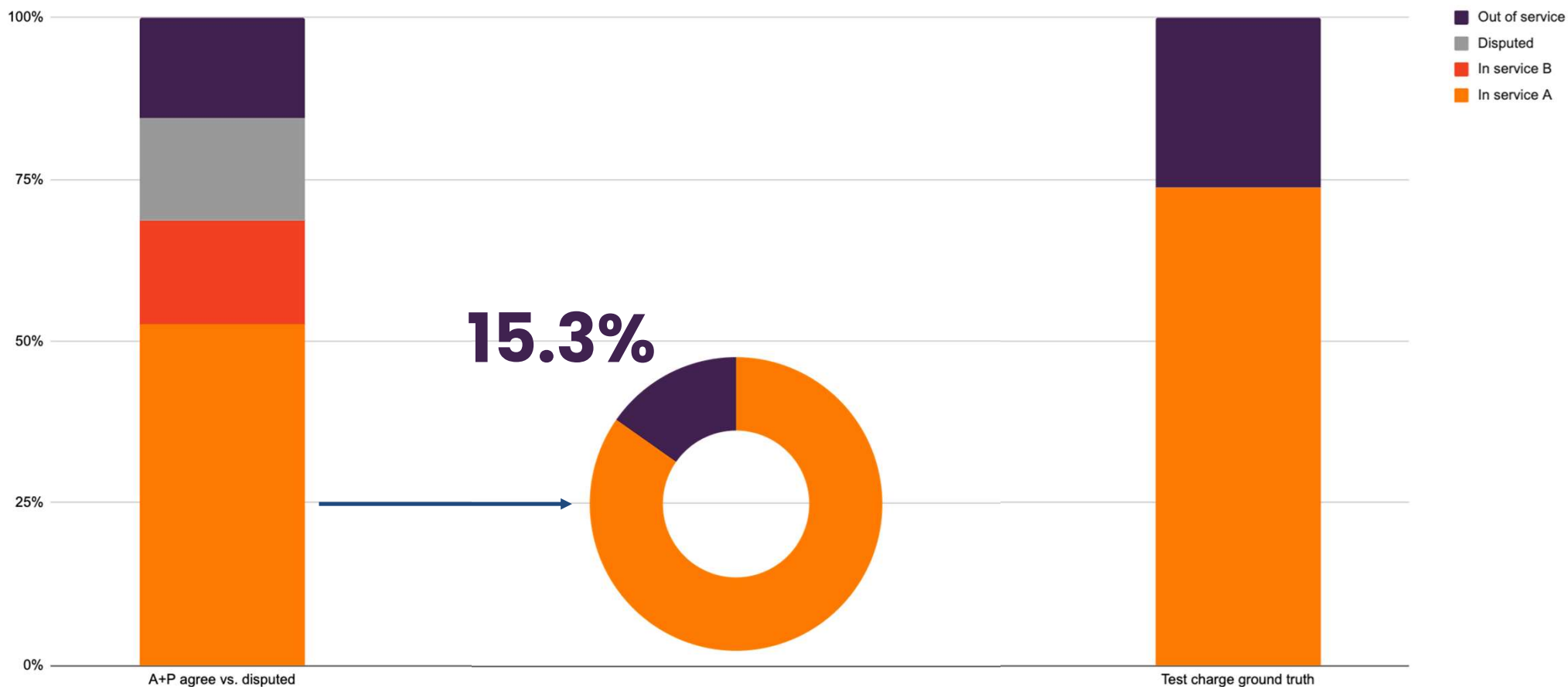
HARD TRUTH: supposedly "working" stations failed the ultimate test.

For stations where the app and the observed physical status **both agreed** the station was online and available, **1 out of every 6–7 tested charge ports STILL failed to deliver a charge.**

www.chargerhelp.com

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Problem

30% of EV Charging stations can be found inoperable at any given moment.

Misaligned Solution

More personnel on a task is thought to speed up solutions, yet it just causes frequent, unnecessary visits to reset breakers at stations that soon malfunction again.

Failed Software Interactions

Reliability depends on multiple seamless software handshakes. Today there is no single entity that ensures the process happens

Data Inaccuracy

Charging Management (Network) Software is relied upon for accuracy but is often wrong. Resulting in critical discrepancies.
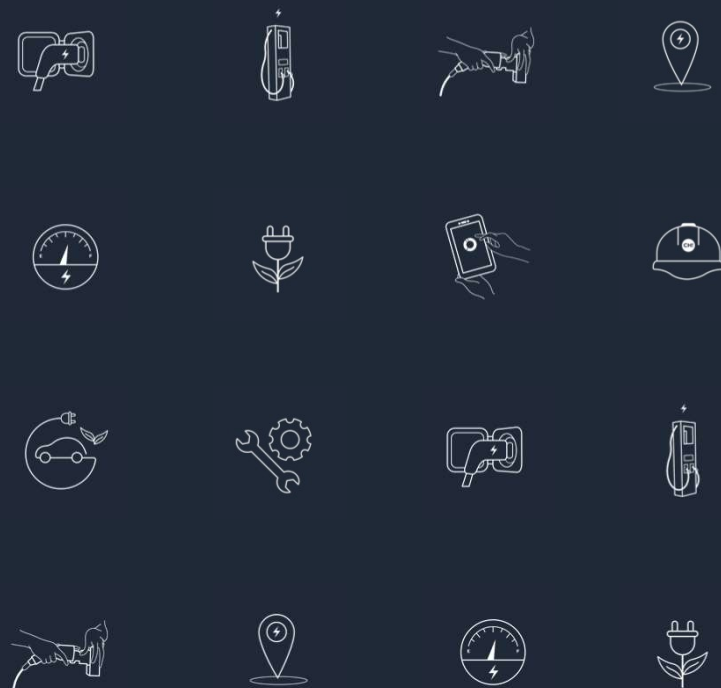
Solution

Reliability as a Service (RaaS) is an integrated solution that combines certified EVSE technicians with remote monitoring and analysis for high reliability of EV Chargers

EVSE

Certified EVSE Technician + Mobile App

Charger Health Monitor / CMS Integration

OCPP   **API**

Monitoring, management, and reporting
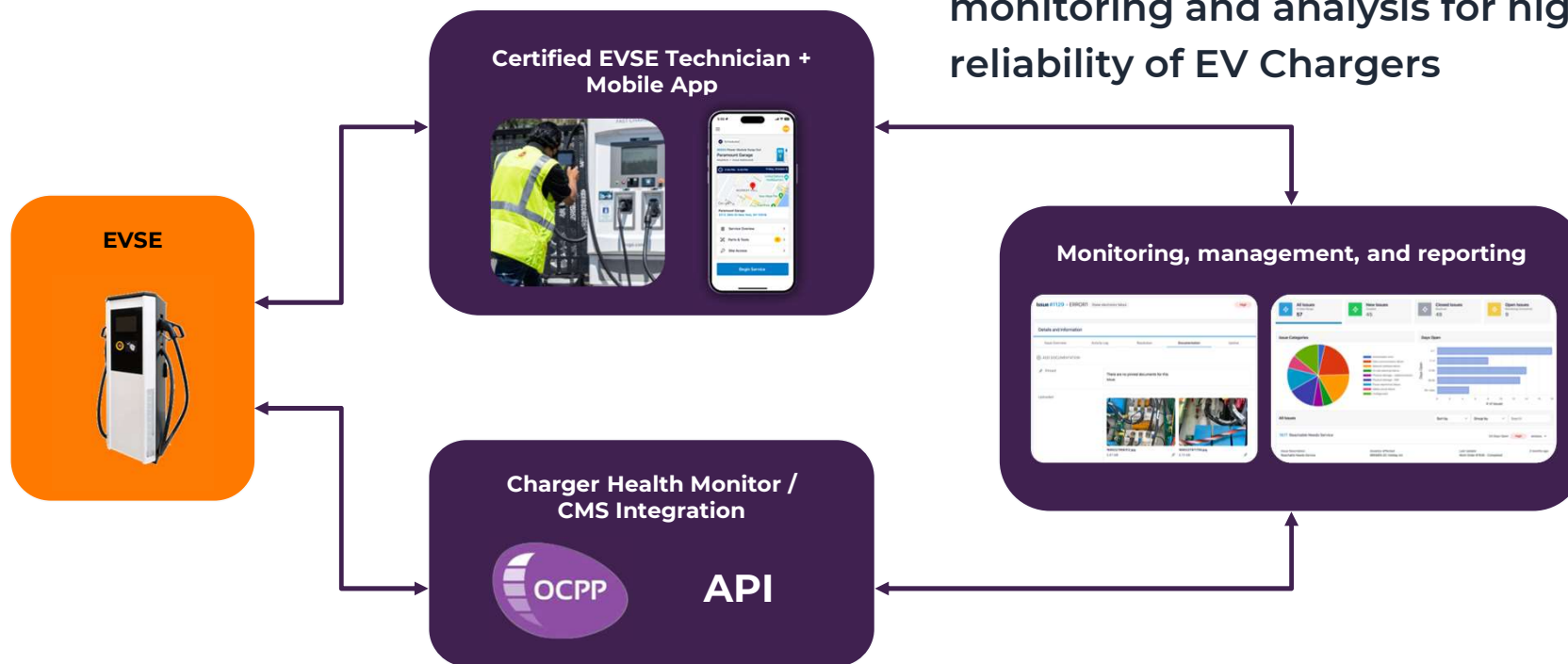
ChargerHelp Technicians

- OSHA, NFPA, high voltage, and lock out/tag out
- Level 2 & DC Fast Charging Stations
- Communications testing and resolution
- Software & Hardware Troubleshooting
- Swap Outs
- Parts Replacement
- Vandalism
- Preventative Maintenance
- Warranty Support Services
- Out of Warranty Services
- Commissioning

www.chargerhelp.com

Technician App

- Collect in-field data on technician observations and test results

- Document service interactions and ensure process adherence
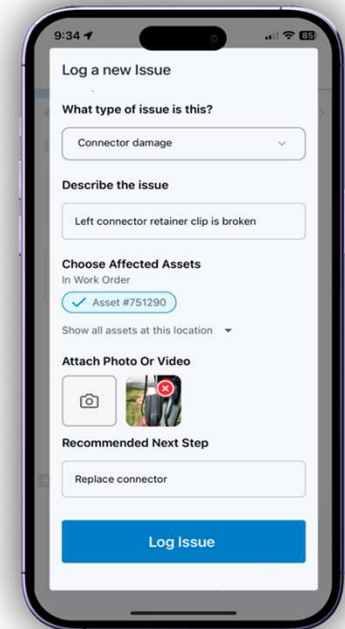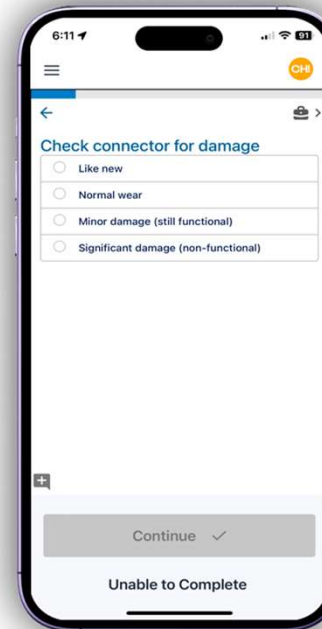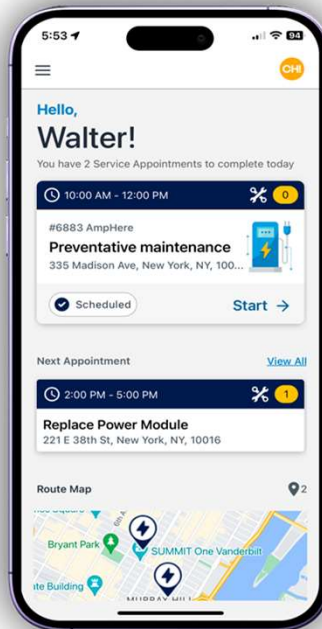
Issue Tracking

- Built for EVSE reliability management

- Track actionable, operational details driving mean time to resolution

- Track failure cause details to understand and address mean time between failure trends

www.chargerhelp.com
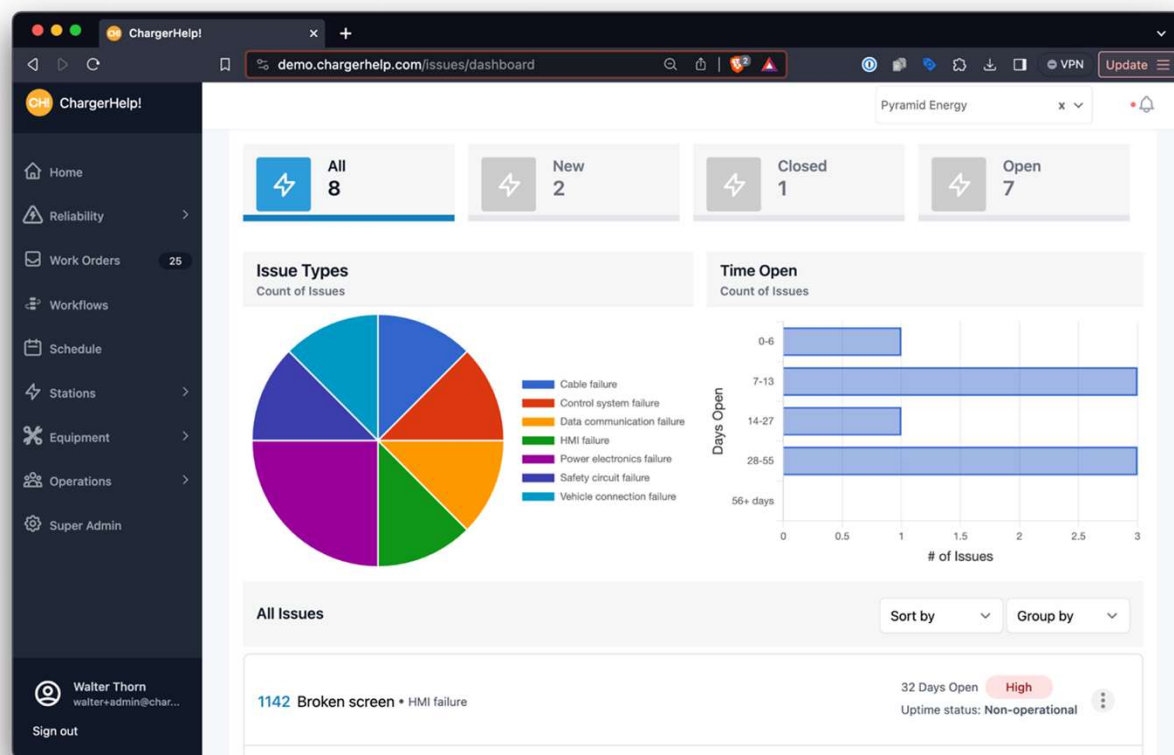
Uptime Reporting

- Represent uptime implications of reliability data

- Measure against industry uptime performance targets

- Provides operational details for specific outages
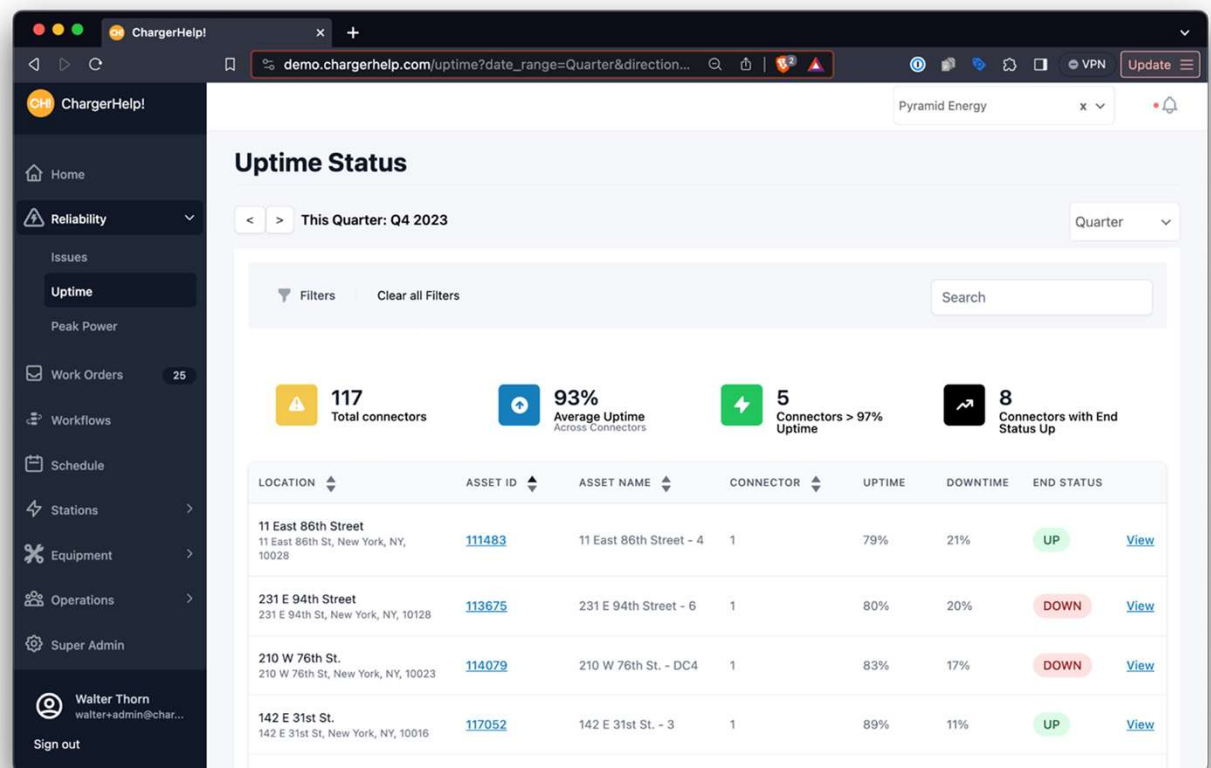
www.chargerhelp.com

Stats and Insights

ChargerHelp is rapidly increasing our in-field interactions with chargers across the country and, after nearly **19,000 touch points**, we are outperforming our commitments to our customers and providing valuable insight to them and the industry

250

Average work orders completed per month

19

Unique failure points on current work orders

97.7%

Uptime in January for customers on RaaS

50%

Average capacity available per technician

1.7

Mean days to resolution for L2s on a RaaS 3 day SLA

www.chargerhelp.com

Our Partners

INDUSTRY PARTNERS

ABB   ampUp   blink   BTC POWER

chargepoint   efacec   enel x   EVBOX

LITEON   Shell Recharge   SPARKCHARGE

CLIPPERCREEK   CHARGELAB
by Enphase

evconnect   EVOCHARGE   Juicebar

Tellus Power   TRITIUM   xeal

CLIENTS

TESLA   TRITIUM   DUKE ENERGY   RIVIAN

flo   evconnect   DUNAMIS CLEAN ENERGY PARTNERS, LLC   CHARGENET

blink   SIEMENS   Seattle City Light   Shell Recharge

INVESTORS

ENERGY IMPACT PARTNERS   BLUE BEAR CAPITAL   TRUCKS

JOBS OF THE FUTURE FUND   exelon   KAPOR CAPITAL   AUTODESK

www.chargerhelp.com

Our Team

We built an executive team that combines over 40 years of collective industry expertise, embodying a rich tapestry of knowledge and innovative thinking.

Kameale C. Terry
Co-Founder &
CEO

evconnect

Evette Ellis
Co-Founder &
Chief People Officer

DEPARTMENT OF LABOR · UNITED STATES OF AMERICA

Maricela McKenzie
SVP,
Sales

RIVIAN
TESLA

Kianna Scott
SVP, Learning &
Development

SOLA IMPACT

Walter Thorn
SVP, Product &
Strategy

McKinsey & Company

www.chargerhelp.com

CH!

Thank You

ChargerHelp! is leading the
industry to reliable EV
charging infrastructure.

Join the Charge!

brettsteudle@chargerhelp.com

NARUC /EVSWG Webinar

Standards, Reliability, & Cyber Security

Jacob Mathews

March 2024

driveelectric.gov
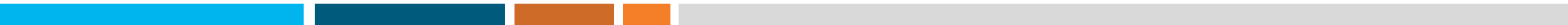
Mission and Vision
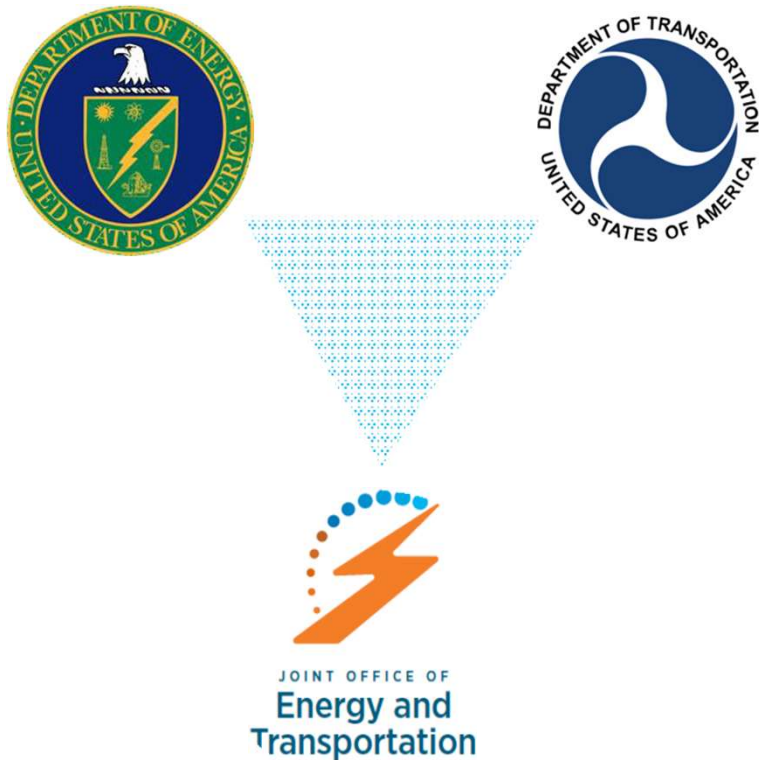
Mission

To accelerate an electrified transportation system that is affordable, convenient, equitable, reliable, and safe.

Vision

A future where everyone can ride and drive electric.

Approach to Improve EV Charging Interoperability & Reliability

We are tackling the overarching challenges to build a reliable, convenient national charging network

Reliability	Cybersecurity	Interoperability
Data Sharing	Equity	Utility Coordination

Standards & Reliability Program Activities

Simplify	Solutions and Shortcuts	Data and Certification
FHWA & JO	**National Laboratories & Industry Partners**	**Industry Partners**
Min Standards & Requirements	Open-source Deployments	Commercial Lab Capacity Building
Reliability Metrics & Standards	CHARGEX consortium	Data Collection and Sharing
Require	*Support*	*Verify*
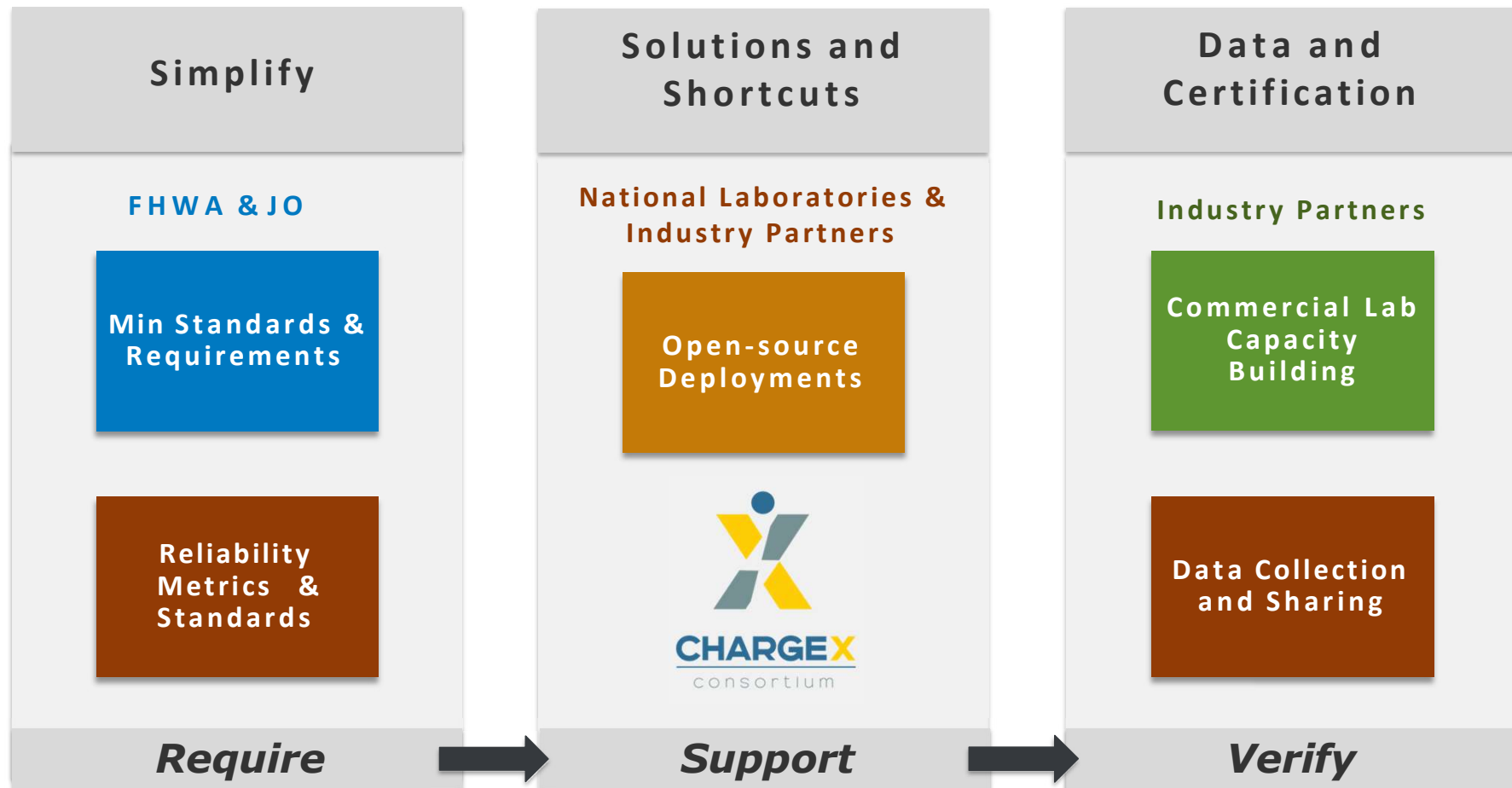
EV Charging Minimum Standards

Charging is a predictable and reliable experience, by ensuring that there are consistent plug types (at least 4 CCS), power levels, and a minimum number of chargers capable of supporting drivers' fast charging needs;

Chargers are working when drivers need them to, by requiring a 97 percent uptime reliability requirement;

Drivers can easily find a charger when they need to, by providing publicly accessible data on locations, price, availability, and accessibility through mapping applications;

Drivers do not have to use multiple apps and accounts to charge, by facilitating several payment types

Chargers will support drivers' needs well into the future, by focusing on interoperability and ensuring that chargers and vehicles work seamlessly, similarly, and together

Linux Foundation Energy
(LF Energy)

Joint Office Applied Interoperability Initiative

Create a point of industry focus through enhancement and development of a common and unique open-source reference architecture and implementation to galvanize adoption and integration of EV charging standards, communications, and processes and ultimately accelerate the EV transition.

Our Charging Ecosystem

Electric Vehicle ①

Charge Point ③

Charge Point Operators (CPOs) ④

eMobility Service Provider (eMSP)

Roaming Platform (Settlement/Contract Clearing House) ⑤

Demand Clearing House ⑥

Power Utility (Smart Grid)

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①

Electric Vehicle OEM
- Vendor lock in
- Tier 1 suppliers control code stack in EVCC
- Fragmented implementations 15118-2
- Hardware cable lengths affecting communication (SLAC)
- Testing capabilities: black box source code

②

EV to Charge Point
- Inconsistent reinitialization behavior i.e. re-authentication after session failure is not part of the standard
- Non-happy path testing capabilities
- Non-deterministic testing makes it difficult to debug errors

Opportunities
- Authorization/payment: contract communication

③

Charge Point
- Multiple operating systems
- Inconsistent reinitialization behavior i.e. re-authentication after session failure is not part of the standard
- Hardware cable lengths and noise affecting communication
- Fragmented implementation of 15118-2
- Testing capabilities: black box source code

Opportunities
- Authorization/payment: contract communication

④

Charge Point Operators
- Non-happy path testing capabilities
- OCA OCPP testing is happy path only
- Poor diagnostics capabilities
- Different CSMS/OCPP implementations

Opportunities
- Authorization/payment
  - Remote starts
  - Credit card handling
  - Plug & Charge support

⑤

Roaming
- Lack of choice between roaming

Opportunities
- PKI providers
- Roaming platform providers
- Smart/Multi-Party Contracts

⑥

Smart Charging

Opportunities
- Smart charging profile generation
- Utility protocol translation
- Vehicle-Grid Integration at scale and pace to buy time for distribution upgrades.

Priorities We Heard From Industry

01
Fully Tested ISO 15118-2 SECC Reference Implementation

02
Fully Tested OCPP 2.0.1 Reference Implementation

03
CSMS Integration

04
Dynamic Price Signals & Power Limits

Fully Tested ISO 15118-20 SECC Reference Implementation	Plug and Charge Authentication Testing in an end-to-end PKI Environment	SECC Simulator	Improved EVCC Simulation for testing SECC Stacks	Improved Developer Quality-of-Life with Implementation Guides	Virtual Test Harness for HIL Simulation

Charging Experience Consortium (ChargeX)

Vision

Any driver of any EV can charge on any charger the first time, every time

Mission

Bring together EV charging industry members, national laboratories, consumer advocates, and other stakeholders to measure and significantly improve public charging reliability and usability in North America within **24 months**

Scope

Focus on complex issues that require multi-stakeholder collaboration and national lab support to solve and simplify

Scope of Work

		Outcomes	**Participants**

Working Group 1 — **Defining the Charging Experience**

- Define KPIs
- Set and validate targets
- Track industry performance

Working Group 2 — **Reliability / Usability Triage**

Create fixes for:
- Payment and user interface
- Communication
- Hardware

Working Group 3 — **Solutions for Scaling Reliability**

Improve:
- Diagnostics
- Interoperability testing methods

Outcomes:

- Labs produce recommended practices, prototype tools, voluntary recognition program design
- Industry adopts practices and tools, improves standards

Participants:

- Charger Manufacturers and Suppliers
- Customer-Facing Charging Station Operators
- Charging Network and Software Providers
- Auto Manufacturers

- 3rd-Party Roaming Hubs and eMSPs
- Field Services and Analytics Firms
- Consumer Advocates
- Fleets
- Payment Industry Stakeholders
- Standards and Testing Organizations
- Electric Utility Representative
- Universities
- State Agencies and Policy Firms

CHARGEX consortium
Argonne NATIONAL LABORATORY
INL Idaho National Laboratory
NREL NATIONAL RENEWABLE ENERGY LABORATORY

KPIs for charging process
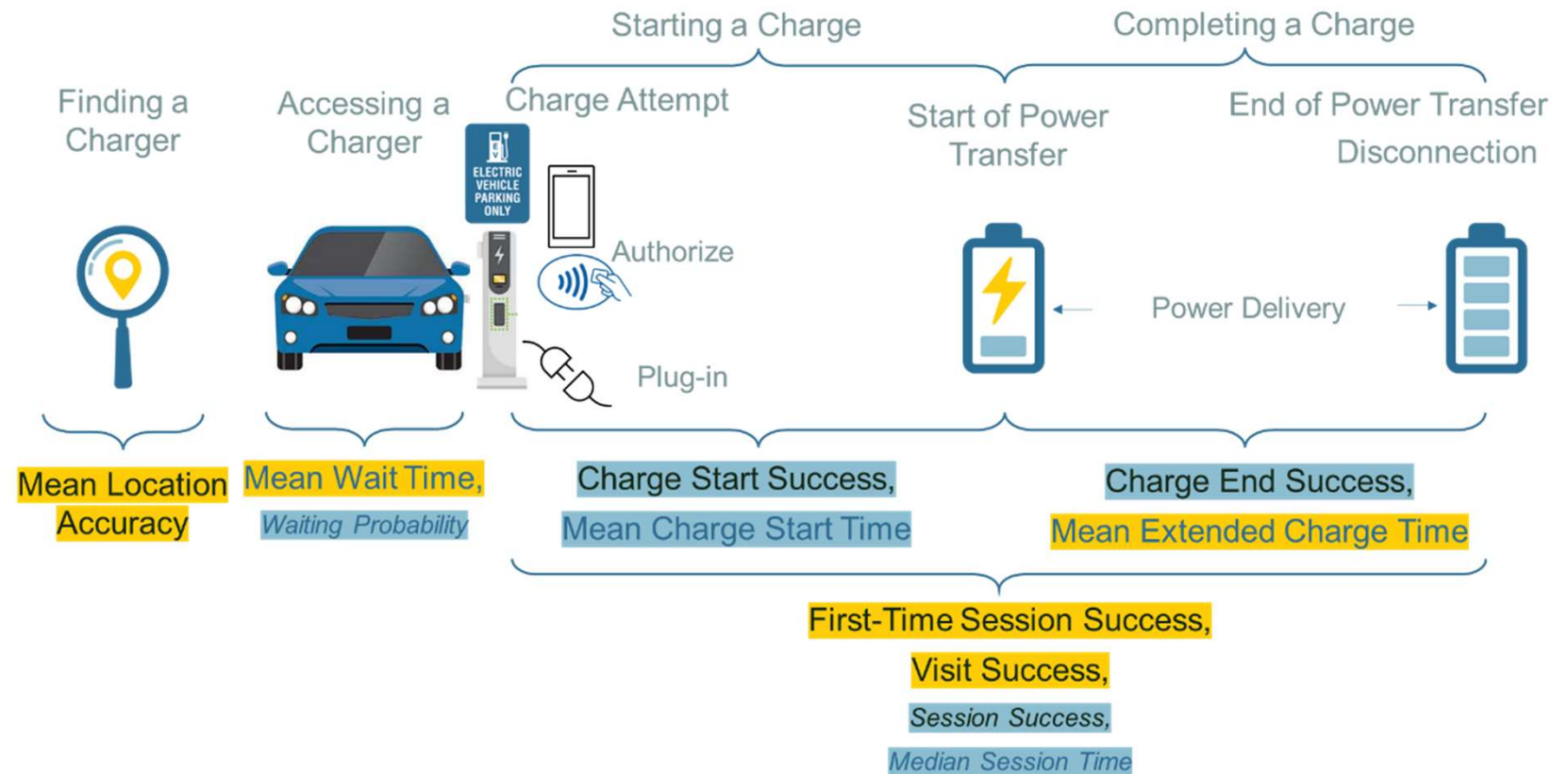
Payment System Reliability

Goal: document problems and recommend solutions for wide range of payment system issues seen in the field

Progress:

- Finished best-practice document
- Addresses payment by credit/debit card, app, RFID card, phone/SMS, PnC

Next Steps:

- JO review; publish to ChargeX website
- Identify industry champions and secure commitment to implement and demonstrate select solutions

FY23		Q1 FY24		
Define scope, form team	Develop draft	Collect data, refine, and publish	Implement and demo	Push to industry
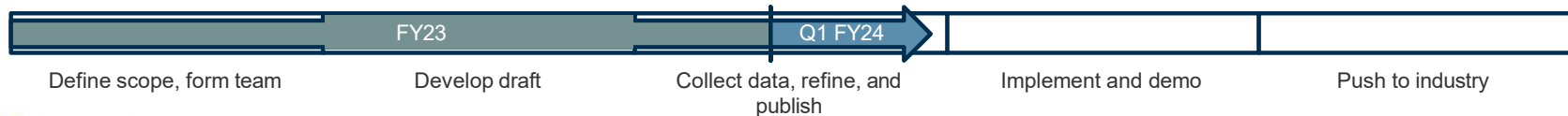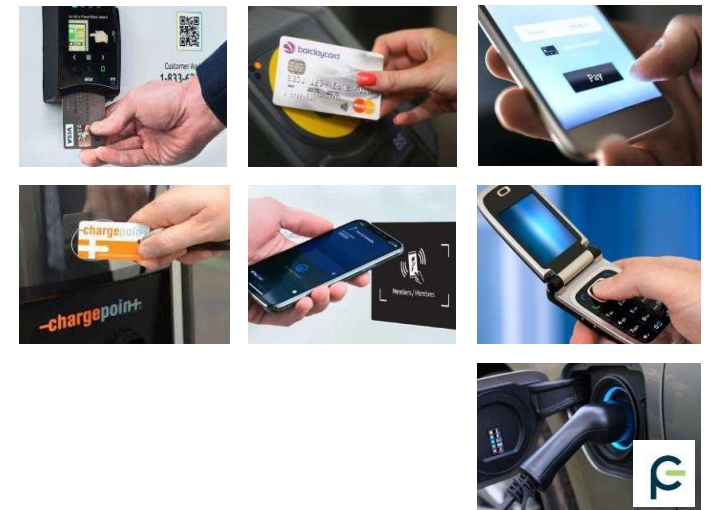
Adapter Reliability and Safety

Working Group 2,
Hardware Task Force
Lead Lab: NREL

Goal: ensure industry testing standards and practices catch all major failure modes

Progress:

- NREL completed draft FMEA with industry input
  - ➤ Held FMEA final review Feb 27 at NREL
- Hardware procurement well underway
- Design of standard reference inlet has begun

Scope expansion:

- Pin cap testing per industry request
- Broader EV and charger safety-related failure modes

FY23		Q1 FY24		
Define scope, form team	Develop draft adapter FMEA	Collect data, refine FMEA Create test plan Procure parts and test partner	Test and analyze results	Push to industry (standards committees)

CHARGEX consortium

Argonne NATIONAL LABORATORY

INL Idaho National Laboratory

NREL NATIONAL RENEWABLE ENERGY LABORATORY

Diagnostic Data Sharing

Goal: Develop solution to allow industry to efficiently share diagnostic data between charging and vehicle sides of ecosystem

Progress:

- Agreement that lack of data sharing hampers customer experience
- 3 areas of interest: co-identification, MRECs, additional data to determine where root cause resides

Next Steps:

- Develop data specification and method for sharing (cloud via API vs. EVSE to EV via pilot wire)
- Design short-term pilot
- Promote implementation and participation in pilot

Q1 FY24 →				
Define scope, form team	Develop draft	Collect data, refine, and publish	Implement and demo	Push to industry

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ChargeX Roadmap

Q4' Q1' Q2' Q3' Q4' Q1' Q2' Q3'

2023 **2024** **2025**

WG1

☆ **Understanding Customer Pain points**

KPI Development

KPI Target Setting

ChargeX Solution Pilots-Impact assessments

Reliability Market Impact

WG2

Payment & User Interface (UI) Task Force: Root cause identification, Best Practice, Publish recommendations

Comms Task Force: Seamless Retry, Timeouts,

Hardware Taskforce: FMEA on Adapters, Best Practice, Standards Thermal Reference device

WG3

☆ **Define Common Error Codes**

MREC Published

Implement MRECs in EVerest open-source code

Diagnostic Data Communication

Testing Methods Taskforce

Reliability Standard

FHWA aims to address the charger reliability issue in three ways by:

(1) Increasing the requirements for **technical skills and qualifications** specifically related to electrical components of EV chargers which require proper maintenance and prompt attention;

(2) Requiring minimum uptime (see § 680.116(b)); and

(3) Requiring **data for duration of outage and error codes** associated with an unsuccessful charging session (see § 680.112(a))

Reliability Standard

NEVI Uptime Requirement.

- High reliability at the port level is important to improve customer experience and confidence in charging infrastructure.

- This final rule also establishes that each charging port must have an average annual uptime greater than 97 percent.

- Section 680.116 was revised to clarify exclusions for the uptime calculation including additional exclusions for scheduled maintenance, vandalism, natural disasters, and limited hours of operation.

Reliability Standard

NEVI Uptime Requirement.

- CFR680.116 Minimum uptime. States or other direct recipients must ensure that each charging port has an average annual uptime of greater than 97%. In other words, the charger must be operational and deliver the minimum required power at least 97% of 'Time' in a year.

- A charging port is considered "**up**" when its hardware and software **are both online** and available for use, or in use, and the charging port successfully dispenses electricity in accordance with requirements for **minimum power level** (see § 680.106(d)).

Reliability Standard

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CHARGEX consortium · Argonne NATIONAL LABORATORY · INL Idaho National Laboratory · NREL NATIONAL RENEWABLE ENERGY LABORATORY

Uptime Calculation

$$\mu = \left(\frac{525{,}600 - \left(T_{outage} - T_{excluded} \right)}{525{,}600} \right) x100$$

$$\mu = port\ Uptime\ \%$$

$$T_{outage} = Total\ Minutes\ of\ outage$$

$$T_{excluded} = Time\ outside\ of\ Operators\ control$$

Data Submission

States and other direct recipients

Charge Point Operators

Quarterly
(1) Charging station identifier
(2) Charging port identifier.
(3) Charging session start time, end time, and any error codes associated with an unsuccessful charging session by port
(4) Energy (kWh) dispensed to EVs per charging session by port;
(5) Peak session power (kW) by port;
(6) Payment method associated with each charging session;(
(7) Charging station port uptime,
(8) Duration (minutes) of each outage.

Annually
(1) Maintenance and repair cost per charging station for the previous year.
(2) For private entities: identification of and participation in any State or local business opportunity certification programs

EV Chart

EV Consumer

CHARGEX consortium

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23 CFR 680.112 Quarterly data submittal.

- Quarterly data submittal. States and other direct recipients must ensure the following data are submitted on a quarterly basis in a manner prescribed by the FHWA. Any quarterly data made public will be aggregated and anonymized to protect confidential business information.
- (1) Charging station identifier that the following data can be associated with. This must be the same charging station name or identifier used to identify the charging station in data made available to third-parties in § 680.116(c)(1);
- (2) Charging port identifier. This must be the same charging port identifier used to identify the charging port in data made available to third-parties in § 680.116(c)(8)(ii);
- (3) Charging session start time, end time, and any error codes associated with an unsuccessful charging session by port;
- (4) Energy (kWh) dispensed to EVs per charging session by port;
- (5) Peak session power (kW) by port;
- (6) Payment method associated with each charging session;
- (7) Charging station port uptime, T_outage, and T_excluded calculated in accordance with the equation in § 680.116(b) for each of the previous 3 months;
- (8) Duration (minutes) of each outage.

25

23 CFR 680.112 Annual data submittal.

- Annual data submittal. Beginning in 2024, States and other direct recipients must ensure the following data are submitted on an annual basis, on or before March 1, in a manner prescribed by FHWA. Any annual data made public will be aggregated and anonymized to protect confidential business information.
- (1) Maintenance and repair cost per charging station for the previous year.
- (2) For private entities identified in paragraph (c)(1) of this section, identification of and participation in any State or local business opportunity certification programs including but not limited to minority-owned businesses, Veteran-owned businesses, woman-owned businesses, and businesses owned by economically disadvantaged individuals.

Joint Office of
Energy and Transportation

Thank You

driveelectric.gov

How States are Enforcing EV Charging Reliability in the NEVI Program

March 26, 2024

Photo credit: Tam Do/eExpress, NREL, 69320
Photo credit: Ed Carley, NASEO

Alaska Energy Authority (AK State Energy Office)

- NEVI Request for Application (RFA) Experience and Qualifications Narrative
  - Applicant project manager's relevant qualifications
  - Describe experience administering Title 23 programs
  - Previous experience with EVSE design and installation

  Retain a percentage of the total awarded amount to be disbursed over the five years of the program

Colorado Energy Office

- NEVI Request for Application – DCFC Plazas
  - Require applicants to submit an operation and maintenance plan
  - Address how applicant will ensure the ongoing reliability of the station
  - Detail past experience maintaining reliable EV charging stations

Colorado Energy Office will retain 5 percent of the total grant award, distributing 1 percent each year based on the grantee's timely completion of reporting and uptime requirements

Tracking California's Electric Vehicle Chargers: Regulations for Improved Inventory, Utilization, and Reliability Reporting

PUBLICATION NUMBER
CEC-600-2023-055

UPDATED
September 28, 2023

PUBLICATION YEAR
2023

PUBLICATION DIVISION
Transportation Energy (600)

PROGRAM
Clean Transportation Program

- Assembly Bill 2127 directs the California Energy Commission (CEC) to assess biennially the number of EV chargers needed to meet California's EV adoption goals

- Assembly Bill 2061 directs CEC to develop uptime recordkeeping and reporting standards for EV chargers that received either a state or ratepayer funded incentive

- Assembly Bill 2061 also directs the CEC to regularly assess the reliability of California's EV charging infrastructure starting in 2025. This includes public and privately funded charging infrastructure

Questions?

Member EV Roundtable

Please speak up and share the situation from your perspective:

1. What charger reliability or uptime problems do you hear about in your state (if any)?
2. Which state agencies have taken the lead on overseeing charger reliability in your state?
3. Has your Commission taken action, held meetings, or discussed the issue of EV charger reliability?
4. Does your state/commission have an uptime requirement for utility-operated chargers and/or third-party chargers (e.g., the same 97% requirement as NEVI or other)?

Upcoming 2024 EVSWG Topic

Date (Last Tues of the month)	Future 2024 EV SWG Topics (through June)
March 26, 2024	Utilization and uptime for public charging/charger reliability
April 30, 2024	Managed charging rate design, avoiding cross-subsidization
May 28, 2024	Distribution infrastructure needs
June 25, 2024	Equity and access to charging

The Summer Policy Summit Abstract submission process is open.

- NARUC members are welcome to submit abstracts here: https://www.naruc.org/summer-summit-2024/

Next EV SWG meeting:
April 26, 3:00-4:30 pm ET via Zoom

WWW.NARUC.ORG/CORE-SECTORS/ENERGY-RESOURCES-AND-THE-ENVIRONMENT/ELECTRIC-VEHICLES/