National Charging Experience Consortium
Virtual Kick-Off Meeting

June 1, 2023
New Effort to Improve Public Charging Reliability and Usability

Vision:
A reliable, frictionless charging experience for all

Mission:
Bring together EV charging industry members, national laboratories, consumer advocates, and other stakeholders to measure and significantly improve public charging reliability and usability within 24 months (by June 2025).
Any Driver, Any EV, Any Charger

FIRST TIME, every time
Purpose of the Consortium

Help the EV Industry achieve >97% uptime

Help EV Industry achieve first-time plug-in success every time they charge

Focus on complex issues that require multi-stakeholder collaboration to solve and simplify:

• Measuring the charging experience
• payment and user-interface issues
• communication failures
• diagnostics limitations
Committed Participants (as of 5/30)

<table>
<thead>
<tr>
<th>Category</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charger manufacturers</td>
<td>ABB, BTC Power, Tritium, Siemens, EVBox, NovaCHARGE</td>
</tr>
<tr>
<td>Charging Station Operators and Network Providers</td>
<td>EVgo, FLO, Electrify America, Blink, Francis Energy, ChargePoint, EV Connect, Switch, InCharge, ampUp, NYPA</td>
</tr>
<tr>
<td>Auto manufacturers</td>
<td>General Motors, Ford, Stellantis, Tesla, Rivian, Lucid, BMW</td>
</tr>
<tr>
<td>3rd-Party Station Locator App and Roaming Providers</td>
<td>Coming soon</td>
</tr>
<tr>
<td>Field Service Providers and Analytics Firms</td>
<td>ChargerHelp!, Uptime Charger, EVSession, Energetics</td>
</tr>
<tr>
<td>Consumer Advocates</td>
<td>JD Power, Cool the Earth, Plug In America</td>
</tr>
<tr>
<td>Payment Industry Stakeholders</td>
<td>Coming soon</td>
</tr>
<tr>
<td>Standards Organizations</td>
<td>SAE, CharIN</td>
</tr>
<tr>
<td>Electric Utility Representative</td>
<td>EPRI</td>
</tr>
<tr>
<td>Universities</td>
<td>University of California, Davis; University of Washington</td>
</tr>
<tr>
<td>State Agencies</td>
<td>California Energy Commission, California Air Resources Board</td>
</tr>
</tbody>
</table>
Lab Leadership Team
- Consortium director and two senior advisers from three national labs
- Sets direction, monitors progress, approves participation requests

Executive Advisory Board
- Senior representatives from industry participants
- Advises Lab Leadership Team on consortium strategy and impact

Working Groups
- Subject matter experts
- Each Working Group led by a national lab co-chair and industry co-chair

Task Forces
- Led by task force leader selected by Working Group co-chairs
- Specialized experts focus on key issues and tools
Leadership from National Laboratories

Consortium Lab Leadership Team

Consortium Director
John Smart
Idaho National Laboratory

Senior Adviser
Chris Gearhart
National Renewable Energy Laboratory

Senior Adviser
Thomas Wallner
Argonne National Laboratory

Working Group National Lab Co-Chairs

National Lab Co-Chair
Working Group 1
David Smith
Idaho National Lab

National Lab Co-Chair
Working Group 2
Kristi Moriarty
National Renewable Energy Lab

National Lab Co-Chair
Working Group 3
Dan Dobrzynski
Argonne National Lab

Interim National Lab Co-Chair
Working Group 3
Benny Varghese
Idaho National Lab
Working Group 1: Defining the Charging Experience

Work Plan Summary
Mission

Working Group Objectives

• Identify and prioritize the customer pain points for EV charging
• Define and publish key performance indicators (KPIs) that gauge the customer charging experience
• Set meaningful targets for each KPI and measure the performance of charging networks in the U.S.

Working Group Outcomes

• Succinct definition of the customer charging experience
• Tools and methodologies for quantifying the customer charging experience
• Insight and recommendations to inform Working Groups 2 and 3
Laboratory Co-chair: **David Smith, INL**
Industry Co-chair: **This Could Be YOU!**

Participants:

**INL:** Kaleb Houck, Casey Quinn, John Smart, Benny Varghese

**NREL:** Kristi Moriarty, Andrew Meintz, Keith Davidson

**ANL:** Dan Dobrzynski, Sam Thurston

**GM:**
Ford:
Stellantis:
Tesla: Francesca Wahl

**BMW:**
Lucid:
Electrify America: Jeff Samalot

**EVgo:** Jeffrey Dunn, Alex Beaton
ChargePoint: Mal Skowron

**InCharge:**
FLO:
EV Connect:
ampUp: Virginia Bodyfelt

**KIGT:** Paul Francis

**NYP:**
Switch: Marc Multin

**Francis Energy:** Matt Ellis

**ABB:**
Siemens:
BTC Power:

**Tritium:**

**EVBox:** Becky Knox

**NovaCHARGE:** Mark Gross

**ChargerHelp!:**

**EVSession:** Bill Ferro

**SAE:** Frank Menchaca, Mike Paras

**Cool the Earth:** Carleen Cullen

**J.D.Power:** Elizabeth Krear

**Energetics:** Bryan Roy

**Plug In America:** Ingrid Malmgren

**UC Davis:** Gil Tal, Tisura Gamage, Vaishnavi Karanam

**University of Washington:** Don MacKenzie, Daniel Malarkey
## Objectives and Timing

<table>
<thead>
<tr>
<th>Task</th>
<th>Accomplishment</th>
<th>Deadline</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Understand customer pain points</td>
<td>Identify, analyze and prioritize customer pain point data from different sources</td>
<td>9/30/2023</td>
</tr>
<tr>
<td>1.2 Define customer key performance indicators (KPIs)</td>
<td>Hold stakeholder engagement sessions to understand key customer performance attributes</td>
<td>12/31/2023</td>
</tr>
<tr>
<td>1.3 Set and validate targets for each KPI</td>
<td>Perform surveys, customer observations, and focus groups to set and validate targets for each KPI</td>
<td>6/30/2024</td>
</tr>
<tr>
<td>1.4 Track industry performance</td>
<td>Collect and analyze data from EV drivers’ experiences with public chargers and publish findings</td>
<td>6/30/2025</td>
</tr>
<tr>
<td>1.5 Assess reliability market impact</td>
<td>Determine effect of poor reliability and usability on EV adoption</td>
<td>9/30/2023</td>
</tr>
</tbody>
</table>
What We Need to Be Successful

Participant Subject Matter Expertise:

- Understanding the perspectives, preferences, and behavior of customers of public charging infrastructure
- Charging station hosting, operation, and maintenance
- Charging network operation
- Charging equipment design, manufacturing, operation, maintenance, and repair
- EV design, manufacturing, maintenance, and repair
- Standards development relevant to charging infrastructure

Participant Contributions:

- Each participant commits to engaging the necessary individuals within its organization as active participants, as appropriate, to the best of its ability, and aligned with its areas of expertise and interest.
- Participants are expected to contribute the following information to Working Group 1:
  - Consumer sentiment, consumer behavior
  - Charging performance data to support KPI development, target setting, and validation.
Meeting Cadence

Working Group 1 Meetings:
• Meeting Length: 1-hour (initially)
• Meeting Cadence: Bi-weekly (initially)
• First Meeting: TBD – Targeting mid-June

Please email chargex@inl.gov to request to participate in this group by June 8, 2023 (1 week from today)!
Working Group 2: Reliability/Usability Triage

Work Plan Summary
Mission

Working Group Objectives
• Understand the root causes of problems that prevent customers from successfully charging on public chargers, with emphasis on:
  • Payment and user interface
  • Communication between EVs, chargers, and cloud services
  • Hardware component testing
• Identify interim solutions for fast implementation and permanent corrective actions

Working Group Outcomes
• Recommended-practice documents describing root causes and recommending interim and permanent corrective actions
• Verification of corrective actions through testing and demonstration
• Hardware testing results
Team Structure

Laboratory Co-chair: Kristi Moriarty, NREL
Industry Co-chair: This Could Be YOU!

Participants:

- GM: Ford:
- Stellantis:
- Tesla:
- Rivian:
- BMW:
- Lucid:
- Electrify America: Max Zettl, Ken Tennyson
- EVgo: Jeremy Whaling, Alex Beaton
- ChargePoint: Justin Wilson
- Blink Charging:
- InCharge: Cliff Fietzek
- FLO: Matthieu Loos
- EV Connect: Riccardo Bilen
- ampUp: Josie-Dee Seagren
- KIGT: Brandon Aparicio
- NYPA: John Markowitz
- Switch: Marc Multin
- ABB:
- Siemens:
- BTC Power:
- Tritium:
- ChargerHelp!: Walter Thorn
- Uptime Charger: Bill Policastro, David Soens, Patrick Lloyd
- EPRI: Marcus Alexander, John Halliwell
- Energetics: Ewan Pritchard

Executive Advisory Board

Lab Leadership Team

Working Group 1: Defining the Charging Experience
- Payment & User Interface Task Force
- Communication Task Force

Working Group 2: Reliability/Usability Triage
- Testing Methodology Task Force
- Diagnostics Task Force

Working Group 3: Solutions for Scaling Reliability
## Objectives and Timing

<table>
<thead>
<tr>
<th>Task</th>
<th>Accomplishment</th>
<th>Deadline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Root Cause Analysis</td>
<td>Identify and prioritize top 3-5 most prevalent engineering issues that underlie customer pain points. Prepare summary report.</td>
<td>9/30/2023</td>
</tr>
<tr>
<td>Recommended Best Practices</td>
<td>Draft recommendations to improve credit card reader payment system reliability.</td>
<td>9/30/2023</td>
</tr>
<tr>
<td></td>
<td>Update credit card draft to include NFC, RFID, app payments, plug and charge</td>
<td>12/30/2023</td>
</tr>
<tr>
<td></td>
<td>Develop recommended practice for user interface.</td>
<td>3/31/2024</td>
</tr>
<tr>
<td></td>
<td>Report describing major root causes of most common vehicle-charger communication issues and recommended corrective actions</td>
<td>9/30/2024</td>
</tr>
<tr>
<td>Hardware Component Testing</td>
<td>Documented hardware evaluation approach that identifies hardware to be tested.</td>
<td>3/31/2024</td>
</tr>
<tr>
<td></td>
<td>Interim results on hardware evaluation effort.</td>
<td>9/30/2024</td>
</tr>
</tbody>
</table>
What We Need to Be Successful

Participant Subject Matter Expertise:

- User experience (UX) design, assessment, and improvement
- Charging station operation, and maintenance
- Charging network operation
- Charging equipment design, manufacturing, operation, maintenance, and repair
- EV design, manufacturing, maintenance, and repair
- Standards development relevant to charging infrastructure
- Payment device design, manufacturing, operation, maintenance, and repair
- Payment network operation
- Charging network operation
- Charging equipment design, manufacturing, operation, maintenance, and repair
- EV design, manufacturing, maintenance, and repair
- Standards development relevant to charging infrastructure

Participant Contributions:

- Charging system performance data describing the operation of EVSE, EV charging subsystems, charging network communications, and payment networks to identify issues and investigate root causes
- Data and input from engineering activities necessary to support collaborative testing to identify issues, investigate root causes, and verify corrective actions, and/or
- Data and input from engineering activities needed to identify and implement interim and permanent corrective actions
Meeting Cadence

Working Group 2 Meetings:

• Meeting Length: 1-hour (initially)
• Meeting Cadence: Bi-weekly (initially)
• First Meeting: TBD – Targeting mid-June

Please email chargex@inl.gov to request to participate in this group by June 8, 2023 (1 week from today)!
Working Group 3: Solutions for Scaling Reliability

Work Plan Summary
Mission

Working Group Objectives

• Rapidly improve charger reliability and usability by overcoming diagnostic limitations
  • Enable industry-wide sharing of error code and diagnostic definitions.

• Reduce communication failures between EVs, EVSEs and charging networks by improving scalable interop testing
  • Ensure every EV can successfully charge with every charger as the market grows.

Working Group Outcomes

• Common error code and diagnostic definitions
• Design and prototype cloud-based diagnostic exchange
• Improve interoperability testing methodologies
• Prototype remote testing tool
Team Structure

Laboratory Co-chair: Dan Dobrzynski, ANL
Interim Laboratory Co-chair: Benny Varghese, INL
Industry Co-chair: This could be YOU!

Participants:

ANL: Sam Thurston, Bryan Nystrom, Jason Harper, Akram Ali
INL: Kaleb Houck, Mayur Savargaonkar, Anudeep Medam
NREL: Andrew Meintz, Keith Davidson

GM: Ford:
Stellantis:
Tesla:
BMW:
Lucid:
Electrify America: Max Zettl, Ken Tennyson
EVgo: Jeremy Bibeau, Alex Beaton
ChargePoint: Brian Hendrickson
Blink Charging:
InCharge:
FLO: Matthieu Loos
EV Connect: Riccardo Bilen

ampUp: Virginia Bodyfelt
KIGT: Adrian Hightower
NYPA: Neal Addison
Switch: Marc Multin
ABB:
Siemens:
BTC Power:
Tritium:
ChargerHelp!: Walter Thorn
Uptime Charger: Bill Policastro, David Soens, Patrick Lloyd
SAE: Frank Menchaca, Mike Paras
EPRI: John Halliwell
CharIN: Erika Myers
Energetics: Cameron Rainey
<table>
<thead>
<tr>
<th>Task</th>
<th>Accomplishment</th>
<th>Deadline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common error code and diagnostic definitions</td>
<td>Preliminary recommended practice on error code definitions based on industry workshop.</td>
<td>6/30/2023</td>
</tr>
<tr>
<td></td>
<td>Perform a generalized charge system DFMEA and identify/prioritize common and critical failures</td>
<td>8/31/2023</td>
</tr>
<tr>
<td></td>
<td>Develop recommended practice with error and diagnostic code definitions</td>
<td>9/30/2023</td>
</tr>
<tr>
<td></td>
<td>Implementation and demonstration at CharIN Testival</td>
<td>9/30/2023</td>
</tr>
<tr>
<td>Cloud-based diagnostic data exchange</td>
<td>Industry review of cloud-based exchange functional requirements and architecture</td>
<td>12/31/2023</td>
</tr>
<tr>
<td></td>
<td>Review of performance results and prototype demonstrations</td>
<td>4/30/2024</td>
</tr>
</tbody>
</table>
# Objectives and Timing

<table>
<thead>
<tr>
<th>Task</th>
<th>Accomplishment</th>
<th>Deadline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interoperability testing methodologies</td>
<td>Outline current testing practices and deficiencies based on industry workshop.</td>
<td>9/30/2023</td>
</tr>
<tr>
<td></td>
<td>Build out a set of use-cases and testing scenarios that confront the current testing deficiencies.</td>
<td>12/31/2023</td>
</tr>
<tr>
<td></td>
<td>Provide summary report on new testing methodologies and demonstrate at interoperability test event</td>
<td>4/30/2024</td>
</tr>
<tr>
<td>Prototype remote testing tool</td>
<td>Industry review of test tool device functional requirements and architecture</td>
<td>9/30/2023</td>
</tr>
<tr>
<td></td>
<td>Review of performance results and demonstrations</td>
<td>9/30/2024</td>
</tr>
</tbody>
</table>
What We Need to Be Successful

Participant Subject Matter Expertise:

- Charging equipment architecture, operation, maintenance, and repair
- Charging network operation
- DFMEA experience
- Charge process errors
- Interoperability assurance and testing
- EV and EVSE charging communication (EVCC/SECC)
- OCPP/OCPI and device model architecture

Participant Contributions:

- Support implementation of error code and diagnostic definitions
- Information on failure modes and critical charge system components
- Support solutions and share implementation insights for scalable interoperability testing
- Review and feedback of remote test tool functions and feature-sets
Meeting Cadence

Working Group 3 Meetings:
• Meeting Length: 1-hour
• Meeting Cadence: Monthly
• First Meeting: TBD – Targeting mid-June

Common Diagnostics Task Force Meetings:
• Meeting Length: 1-hour
• Meeting Cadence: Bi-Weekly
• First Meeting: TBD – 1 week after WG3 meeting

Testing Methodologies Task Force Meetings:
• Meeting Length: 1-hour
• Meeting Cadence: Bi-Weekly
• First Meeting: TBD – 2 weeks after WG3 meeting

Please email chargex@inl.gov to request to participate in this group by June 8, 2023 (1 week from today)!
Common Error Code Meeting @ EVS36

WG3 Diagnostics Task Force *in-person meeting* to discuss common error code definitions

**When?**
Tue June 13, 2023 – 3 to 5 pm PT

**Where?**
SAFE Credit Union Convention Center, Sacramento, CA (Co-located with EVS36)

Must register for EVS36 to attend
1-day passes are available on EVS36 Registration Page on evs36.com
Q&A
Let’s Get to Work!

By Thu, June 8, email chargex@inl.gov to:

• Submit names of Working Group and EAB participants
• Nominate Working Group industry co-chairs
• RSVP to attend Common Error Code meeting at EVS36 on June 13

Working Group national lab co-chairs will be in touch to schedule first Working Group meetings