COORDINATING RESEARCH COUNCIL, INC.
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WWW.CRCAO.ORG

January 26, 2026
In reply, refer to:
CRC Project No. SM-E-2023-02

Dear Prospective Bidder:

The Coordinating Research Council (CRC) invites you to submit a written proposal to provide services for "Survey of Public EV Charger Interoperability" (CRC Project No. SM-E-2023-02). A description of the project is presented in Exhibit A, "Statement of Work."

Please indicate your intention to bid at this link on or before **February 9, 2026** if you or your organization intends to submit a written proposal for this research program. CRC will answer technical questions regarding the Request for Proposal if they are submitted in writing at least one week before the proposal submission deadline here: Q & A Link. CRC will then return written answers to all of the bidders, along with a copy of the original questions. Questions submitted within a week of the deadline may not be answered before the proposal submission deadline.

A CRC technical group composed of industry representatives will evaluate your proposal. CRC reserves the right to accept or reject any or all proposals.

The reporting requirements will be monthly progress reports and a summary technical report at the end of the contractual period. The reporting requirements are described in more detail in the attachment entitled "Reports" (Exhibit B).

The proposal must be submitted as two separate documents. Potential bidders are welcome to submit a technical proposal for only Step 3 of the SOW, or for the full proposal. The technical approach to the problem will be described in part one, and a cost breakdown that is priced by task will be described in part two. The cost proposal document should include all costs associated with conducting the proposed program. The technical proposal shall not be longer than 10 pages in length.

CRC expects to negotiate a cost-plus fixed fee or cost reimbursement contract for the research program.

Contract language for intellectual property and liability clauses is presented in Exhibit C and in Exhibit D, respectively.

Important selection factors to be taken into account are listed in Exhibit E. CRC evaluation procedures require the technical group to complete a thorough technical evaluation before considering costs. After developing a recommendation based on technical considerations, the costs are revealed and the recommendation is modified as needed.

Electronic copies of the technical and cost proposals should be submitted to:

Prem Lehr
Coordinating Research Council
1 Concourse Parkway, Suite 800
Atlanta, GA 30328

Phone: 678-795-0506
Fax: 678-795-0509
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The deadline for receipt of your proposal is **February 23, 2026.**

Yours truly,

Prem Lehr
Project Manager

EXHIBIT A

SM-E-2023-02 Statement of Work

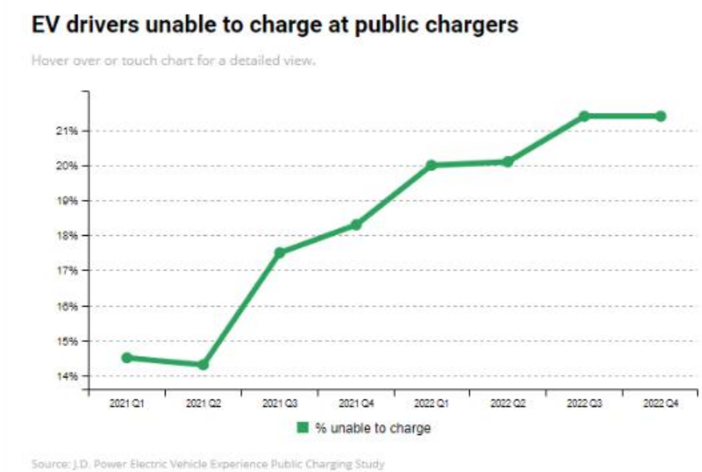
"Survey of Public EV Charger Interoperability"

Background

EV chargers are best referred to by the more general term of Electric Vehicle Supply Equipment (EVSE), given that an on-vehicle charger is used for all Level 1 and Level 2 charging. A DC fast charger can also be categorized as an EVSE; it charges the vehicle's battery directly using a DC connection.

Federal and state governments are encouraging—and in some cases mandating—increased adoption of electric vehicles. Anticipating this transition to EVs, multiple programs have been launched to increase the population of EVSEs. The federal government has allocated over $7B to the goal of installing 500,000 EVSEs across the U.S., through various programs [1,2]. Auto OEMs, fuel retailers, EVSE providers, and others have also made substantial commitments [1].

However, there is a wide variation in public EVSE performance and usability. A recent study by J.D. Power indicated that >20% of EV charger attempts failed on average, with EVSEs from one charging network failing 39% of the time [3]. Research performed by UC Berkeley, which was focused on public DC fast chargers, showed that 27.5% of the chargers were not useable [4]. In the latter study, <u>all</u> of the EVSEs with CCS connectors in the California's Greater Bay Area were evaluated; (657 connectors, representing 181 charging stations). Tesla and non-public EVSEs were excluded.



Many government requirements related to EVSE infrastructure expansion specify an EVSE uptime of 97% [5]. Although the definition of "uptime" is under debate, it's clear that the currently installed base of EVSEs does not meet that objective. Some EVSE problems are well documented and can be automatically reported back to the provider via their network. However, charging failures related to the vehicle-EVSE interface—i.e. interoperability—are not reported with sufficient detail to enable root cause analysis.

Objectives

Survey a representative number of public charging stations and compile a database of various attributes, as outlined in the *Scope of Work* section below. The primary focus should be on interoperability, evaluated using appropriate test equipment. Note that this involves real-world testing of EVSEs in the field, i.e. hardware encountered by customers. This is <u>not</u> a project to test EVSEs in a controlled laboratory environment.

Potential uses for results from this project should be considered when finalizing the test plan, e.g.:

- Inform policy for stakeholders and regulators.

- Provide background information for future EVSE reliability investigations by the California Energy Commission (CEC), U.S. Department of Energy (DOE) [5,6], and consortia such as EVs2Scale2030 and ChargeX [7,8].
- Identify gaps in current EVSE codes and standards.
- Supply technical targets for auto OEMs and EVSE manufacturers.
- Provide background information for entities planning EVSE installations.

Scope of Work

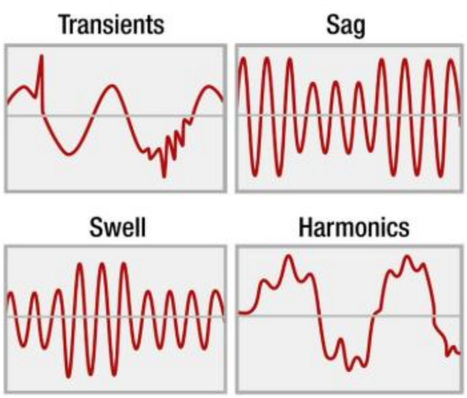
Step 1. Determine Parameters to be Investigated and Prioritize

Myriad standards and specifications related to EV charging exist, published by multiple entities [9,10]. Regarding SAE, some of the key standards are J1772 (general charging), the J2894 series (charger power quality), and the J2953 series (interoperability). Recent federal and state (CA) proposals recommend that future EVSEs should conform to the ISO 15118 series of standards [11,12]. The Tesla "North American Charging Standard" (NACS) [13] is being codified as SAE J3400. Due to this proliferation of standards, a suggested first step would be to interview EV OEMs to determine what interoperability parameters and specifications are considered most critical. An OEM could, for example, design to an existing standard but have a different specification tolerance related to that standard. It's also possible that an OEM uses some internal specification for which there is no direct analogue in published standards. (Information received through such interviews should be generalized in any reporting activity, and not associated with specific OEMs.) See **Appendix 1** for an example of OEM suggestions received thus far.

Primary Activities

In addition to measurements suggested by the OEMs, the following measurements and observations should be made:

- Confirm successful charge initiation. If charge initiation fails, identify the cause. Examples of potential failure points:
  - EVSE-vehicle handshake
  - Payment process
  - Communication with app
- Power quality during charging. Some examples of potential power-related problems are shown in the diagram below.



- kW delivered: Actual (measured) vs. EVSE display.
- Maximum kW delivered at start of charge: Actual (measured) vs. labeled. Note that the initial state of charge (SOC), rather real or simulated, must be low for an accurate measurement. Any vehicles charging at the same EVSE or nearby should be noted, given that some stations are designed to share available power between vehicles.
- Accessibility. Examples:
  - Length of cable. (Specifically, maximum distance cable will reach.) If bollards or similar features impede access, the available cable length after the impediment should be noted.
  - Position of EVSE in relation to the designated EV parking spot.
- Take photographs of unique or problematic features.

- Whenever possible, the specific EVSE model number and software revision should be recorded, in addition to the provider's name. (e.g., ChargePoint, EVgo, Electrify America, Shell/Volta, etc.) Some or all of these details will be blinded in the final project report, but might be used in private communications with individual EVSE providers.

Secondary Activities

The activities below are considered secondary, because they have been investigated in other projects. Regardless, these activities should be performed whenever conditions permit.

- General station observations; e.g., poor plug design, cables too heavy, level of usage (i.e. popularity). Total number of plugs at each station, and summary by type; e.g., Level 2 (J1772), DCFC CCS, DCFC NACS, and DCFC CHAdeMO. Labeled power (max kW available) per plug.
- Record inoperative connections and the reason they are unusable (if known). Report as a fraction of all plugs of that type at the station. Also report the total number of inoperative plugs encountered, as a fraction of the total plugs surveyed.
- Check the function and response of the EVSE mobile app. (This applies only to networked stations.) Example functions:
    - Accuracy of station locator. For example, a listed station might be inaccessible by the general public. (Private station, parking permit required, etc.)
    - Accuracy of station status
    - Price: Listed vs. actual (Including parking fees, idle fees, etc.)
    - Real-time data streaming, e.g., charge rate, price, etc.

Step 2. Prepare Test Devices

Considering the primary activities above, determine what hardware will be required to conduct the survey. The hardware must be capable of accommodating EVSEs up to 350kW. Hardware appropriate for this activity is generally available, although fabrication of a test rig is another approach. See **Appendix 2** for examples of test configurations. An example of a custom-built device for testing EVSEs in the field is shown below [14]. In this case, the focus was on commerce-related measurements, i.e., ensuring the that displayed amount of transferred power was accurate. Examples of suppliers for test equipment more appropriate for this project are listed in Appendix 2.

If one or more test vehicles are deemed necessary to perform this work, and must be purchased or leased, this should be noted in the proposal but not included in the cost estimate. The objective is to collect data that apply to a broad cross-section of EVs, not to focus on the idiosyncrasies of a particular model.

Step 3. Develop Test Plan and Conduct Survey

NOTE from CRC: Potential bidders are welcome to submit a proposal for ONLY Step 3, or for the full proposal.

The survey should be conducted in a region with a large number and variety of EVSEs. To simplify logistics, a single region or county can be selected. Orange County in Southern California is just one example. Regions with extreme weather would be of interest, but it is understood that such regions might have an insufficient population of EVSEs.

The target number of tested connections is 300. Approximately one-third of these connections should be of the DC fast charge variety, with the remaining connections being Level 2. (A "station" can contain multiple EVSEs. Each EVSE typically has one or two plugs, or "connections.") Station locations and EVSE providers should be chosen to roughly represent the geographic and hardware variety of the chosen region. PlugShare or a similar app can be used to find appropriate stations, although a provider-specific app might be required to determine the real-time availability of a charging port.

Multiple charging use-cases are possible in the market. A suggested testing priority is outlined in the figure and table below.

Use Case #	Vehicle Type	Vehicle Receptacle	Adapter	EVSE	Level
1	non-Tesla	CCS	none	J1772	2
2	non-Tesla	CCS	none	CCS	DCFC
3	non-Tesla	CCS	Yes	Tesla NACS (≥V3)	DCFC
4	non-Tesla	CCS	(built-in)	Tesla Magic Dock	DCFC
5	non-Tesla	NACS	none	Tesla NACS	DCFC
6	non-Tesla	NACS	none	non-Tesla NACS	DCFC
7	Tesla	NACS	none	non-Tesla NACS	DCFC
8	Tesla	NACS	Yes	CCS	DCFC
9	Tesla	NACS	none	Tesla NACS	DCFC

It is assumed that use-cases 1 though 4 will be the focus of this program, with cases 1 and 2 being the most prevalent. The hardware required in use-cases 5 through 7 is not yet widely available, but could be included in a future phase of this project. Consumer complaints are much less prevalent with use-cases 8 and 9; these scenarios are not included in this program. Testing of CHAdeMO connectors will also not be necessary in this program.

Reporting

Reporting requirements are detailed elsewhere in this RFP, as are schedule expectations and administrative items.

References

1. "Fact Sheet: Biden-Harris Administration Announces New Standards and Major Progress for a Made-in-America National Network of Electric Vehicle Chargers," White House press release, February 15, 2023 Link

2. "Technical Assistance and Resources for States and Communities," Joint Office of Energy and Transportation Link

3. "EV Drivers Struggle with Declining Reliability of Charging Network," *Automotive News*, February 8, 2023 Link

4. "Reliability of Open Public Electric Vehicle Direct Current Fast Chargers," D. Rempel et al., UC Berkeley, April 7, 2022 Link

5. California Energy Commission presentation at Electric Vehicle Charging Infrastructure Reliability Workshop, October 21, 2022 Link
   (Comments and presentations related to the workshop—and other information—can be found in the CEC's Electric Vehicle Charging Infrastructure Reliability docket: Link)

6. "Request for Information on Electric Vehicle No-Charge Events, including Interoperability," DE-FOA-0002797, U.S. Department of Energy. October 4, 2022 Link

7. Overview of EPRI's EVs2Scale2030 consortium: Link

8. Overview of the National Charging Experience Consortium (ChargeX): Link

9. "Standardization Roadmap for Electric Vehicles version 2.0,"American National Standards Institute (ANSI), May 2013 Link

10. "Roadmap Standards Compendium," American National Standards Institute (ANSI), November 2014 Link

11. "National Electric Vehicle Infrastructure Standards and Requirements," Section 680.108, Interoperability of Electric Vehicle Charger Infrastructure, *Federal Register*, February 28, 2023 Link

12. "CEC Recommendation for Deployment of ISO 15118-Ready Chargers," Docket Number 19-AB-2127, TN# 241955, California Energy Commission, February 24, 2022 Link

13. North American Charging Standard TS-0023666 Link

14. "Electrical Measurement Standards for Electric Vehicle Charging, Final Project Report, CEC-600-2022-045" California Department of Food and Agriculture, Division of Measurement Standards, January 2022 Link

Appendix 1

Example of OEM Feedback Regarding Properties of Interest

It is noted that some test items might be difficult or even impossible.

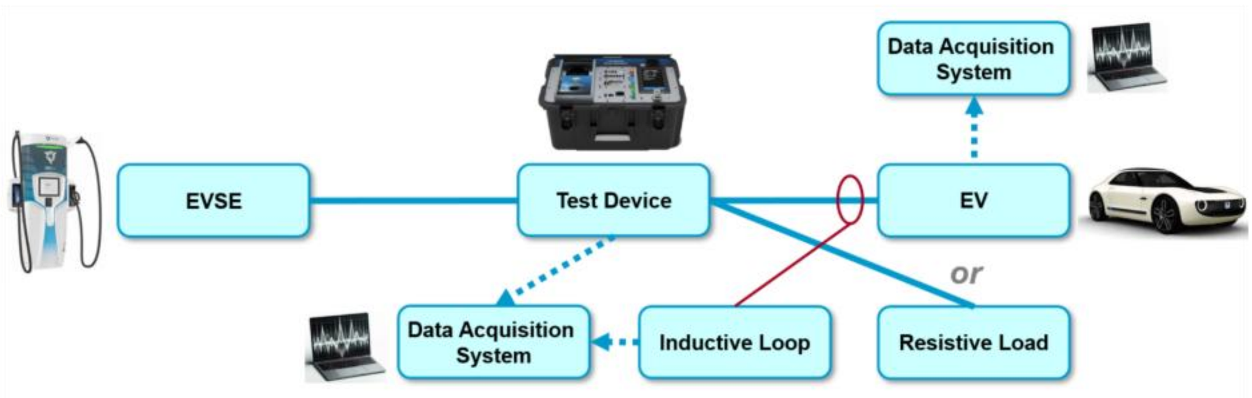
- AC voltage / current waveform, distortion
- Voltage waveform of proximity circuit
- Voltage waveform of control pilot
- Voltage and current behaviors when emergency stop button is pressed
- Mating resistance of the coupler

- AC voltage / current waveform of 277 V location (only Tesla EVSE can accommodate 277 V as of now), and locations
- Response time of DC EVSE
- Voltage output characteristics of DC EVSE
- Output current following performance of DC EVSE
- Output voltage of DC EVSE
- Power behavior between transformer (to 240 V) and EVSE (XX kVA)
- Power cable specification (wire diameter, etc.) between transformer (to 240 V) and EVSE
- Presence of leakage current detection and its detection logic

Appendix 2

Examples of EVSE Testing Configurations

General hardware configuration image. Not all components will be needed.



Notes:

- The EVSE test device *might* not be required if sufficient data can be acquired directly from the vehicle during charging. OEM support will be needed under that scenario, however.
- Conversely, a test vehicle *might* not be required if sufficient data can be acquired from a test device. Under such a scenario, a load-shedding method will be required, such as a resistive load or a low-SOC EV. See below:

Links to potential test device suppliers (examples):

- Comemso https://comemso.com/charging-analysis/
- Tesco https://www.tescometering.com/product-list/
- MDL https://www.mdltechnologies.co.uk/ev-power-components-evse/

EXHIBIT B

REPORTS

MONTHLY TECHNICAL PROGRESS REPORTS

The contractor shall submit a monthly technical progress report covering work accomplished during each calendar month of the contract performance. An electronic Microsoft® Word compatible file (<1 MB) of the monthly technical progress report shall be distributed by the contractor within ten (10) calendar days after the end of each reporting period. The report shall contain a description of overall progress, plus a separate description for each task or other logical segment of work on which effort was expended during the reporting period.

FINAL REPORT

The contractor shall submit to or distribute for CRC an electronic (Microsoft Word) copy transmittable via email) of a rough draft of a final report within thirty (30) days after completion of the technical effort specified in the contract. The report shall document, in detail, the test program and all of the work performed under the contract. The report shall include tables, graphs, diagrams, curves, sketches, photographs and drawings in sufficient detail to comprehensively explain the test program and results achieved under the contract. The report shall be complete in itself and contain no reference, directly or indirectly, to the monthly report(s).

The draft report must have appropriate editorial review corrections made by the contractor prior to submission to CRC to avoid obvious formatting, grammar, and spelling errors. The report should be written in a formal technical style employing a format that best communicates the work conducted, results observed, and conclusions derived. Standard practice typically calls for a CRC Title Page, Disclaimer Statement, Foreword/Preface, Table of Contents, List of Figures, List of Tables, List of Acronyms and Abbreviations, Executive Summary, Background, Approach (including a full description of all experimental materials and methods), Results, Conclusions, List of References, and Appendices as appropriate for the scope of the study. Reports submitted to CRC shall be written with a degree of skill and care customarily required by professionals engaged in the same trade and /or profession.

Within thirty (30) days after receipt of the approved draft copy of the final report, the contractor shall make the requested changes and deliver to CRC ten (10) hardcopies including a reproducible master copy of the final report. The final report shall also be submitted as electronic copies in a pdf and Microsoft Word file format. The final report may be prepared using the contractor's standard format, acknowledging author and sponsors. An outside CRC cover page will be provided by CRC. The electronic copy will be made available for posting on the CRC website.

EXHIBIT C

INTELLECTUAL PROPERTY RIGHTS

Title to all inventions, improvements, and data, hereinafter, collectively referred to as ("Inventions"), whether or not patentable, resulting from the performance of work under this Agreement shall be assigned to CRC. Contractor X shall promptly disclose to CRC any Invention which is made or conceived by Contractor X, its employees, agents, or representatives, either alone or jointly with others, during the term of this agreement, which result from the performance of work under this agreement, or are a result of confidential information provided to Contractor X by CRC or its Participants. Contractor X agrees to assign to CRC the entire right, title, and interest in and to any and all such Inventions, and to execute and cause its employees or representatives to execute such documents as may be required to file applications and to obtain patents covering such Inventions in CRC's name or in the name of CRC's Participants or nominees. At CRC's expense, Contractor X shall provide reasonable assistance to CRC or its designee in obtaining patents on such Inventions.

To the extent that a CRC member makes available any of its intellectual property (including but not limited to patents, patent applications, copyrighted material, trade secrets, or trademarks) to Contractor X, Contractor X shall have only a limited license to such intellectual property for the sole purpose of performing work pursuant to this Agreement and shall have no other right or license, express or implied, or by estoppel. To the extent a CRC member contributes materials, tangible items, or information for use in the project, Contractor X acknowledges that it obtains only the right to use the materials, items, or information supplied for the purposes of performing the work provided for in this Agreement, and obtains no rights to copy, distribute, disclose, make, use, sell or offer to sell such materials or items outside of the performance of this Agreement.

EXHIBIT D

LIABILITY

It is agreed and understood that ____________ is acting as an independent contractor in the performance of any and all work hereunder and, as such, has control over the performance of such work. ______________ agrees to indemnify and defend CRC from and against any and all liabilities, claims, and expenses incident thereto (including, for example, reasonable attorneys' fees) which CRC may hereafter incur, become responsible for or pay out as a result of death or bodily injury to any person or destruction or damage to any property, caused, in whole or in part, by _________'s performance of, or failure to perform, the work hereunder or any other act of omission in connection therewith.

EXHIBIT E

PROPOSAL EVALUATION CRITERIA

1) Merits of proposed technical approach.
2) Previous performance on related research studies.
3) Personnel available for proposed study – related experience.
4) Timeliness of study completion.
5) Cost.