

May 27, 2022

Chair Randolph and Members of the Board
California Air Resources Board
1001 I St.
Sacramento, CA 95814

*Submitted to the Clerk of the Board via online comment log portal
<https://ww2.arb.ca.gov/applications/public-comments> “Notice of Public Hearing to Consider Proposed Advanced Clean Cars II Regulations (accii2022)”*

Subject: CHAdEMO Association stakeholder comments regarding the Proposed Advanced Clean Cars II (ACC II) Regulations, Staff Report: Initial Statement of Reasons

Dear Chair Randolph:

Thank you for California’s continued leadership to accelerate the transition to zero-emission vehicles. The CHAdEMO Association (CHAdEMO) appreciates the opportunity to provide stakeholder comments regarding the Proposed Advanced Clean Cars II (ACC II) Regulations, Staff Report: Initial Statement of Reasons (ISOR) Dated April 12, 2022.

We are writing to urge you to modify Staff’s Proposal for Standardization of Fast Charge Electric Vehicle Supply Connectors.¹ As the pioneer for light duty electric vehicle direct current fast charging (DCFC), CHAdEMO generally supports Staff’s proposal to require all battery electric vehicles to be DCFC capable.

However, CHAdEMO strongly opposes Staff’s proposal to require all 2026 and subsequent model year vehicles use Combined Charging System (CCS) 1 Standard (also known as SAE1772 standard).

CHAdEMO agrees as Staff notes:

*“Even as staff’s proposal is under consideration, technology is rapidly developing, battery costs are coming down, and charging behavior is being studied —**and is changing**—as the BEV market grows.” (ISOR p.46)*

¹ California Air Resources Board Staff, “Proposed Advanced Clean Cars II Regulations.” *Staff Report: Initial Statement of Reasons*, Date of Release: April 12, 2022, p. 55. Hereafter abbreviated *ISOR*

With so many new demands placed on vehicle charging, this is not the time to choose technological winners and losers. CHAdEMO shares CARB's pioneering spirit for achieving straightforward, simple charging for all electric vehicle drivers, and achieving access to electric vehicles by disadvantaged and low-income communities. To drive global adoption of plug-in electric vehicles, we need to drastically increase the amount of publicly accessible, easy-to-use charging stations. CARB should continue to encourage technological development of fast charging technology – not restrict it with arbitrary standards. **Instead, CARB should adopt a Performance Standards (require installation of a DCFC connector on all BEVs) in place of Prescriptive Standards (requiring only the CCS-1 standard) in compliance with Government Code section 11346.2(b)(4)(A).** (ISOR p.180)

Most importantly, we are unable to find any reports of consumers confused by three different DCFC systems. In CARB's own Electric Vehicle Supply Equipment Standards Technology Review, CARB staff found inoperable stations and payment issues continue to be barriers for drivers.² The Review made no mention of *“inconsistent and complex charging experiences for consumers”* caused by DCFC standards/connectors. (ISOR p.55) In fact, the Review makes no comment about DCFC standards. Further, in the ISOR, CARB staff does not reference any known source regarding consumer confusion about DCFC standards.

Let's evaluate the deficiencies of Staff's recommended solution – the CCS-1 charging standard:

1. CCS-1 is not a globally unified standard – it is limited to the North American market. Though similarly named, “CCS” has compatibility problem between EU (CCS-2) and USA (CCS-1) – the two connectors are geometrically different and not interchangeable. If CCS is unified in the future, it is possible that CCS-1 for US will disappear causing problems with older vehicles and/or stranded vehicle charging infrastructure assets.
2. CCS-1 lacks VGI capability. The State of California and the US Department of Energy³ are expending a great deal of time and resources to evaluate and plan the implementation and utilization of VGI technologies. (ISOR pp.32-33) Currently, the CCS-1 standard has not developed bi-directional capability – it depends on updates to SAE and ISO15118 standards.

² California Air Resources Board Staff, “Electric Vehicle Supply Equipment Standards Technology Review.” Date of Release: February 2022, p. 19.

³ US Department of Energy, “Department of Energy Announces First of Its Kind Collaboration to Accelerate “Vehicle-to-Everything” Technologies.” Date of Release: April 20, 2022.

Please note, there are proprietary solutions using the CCS connector, such as marketed by Rhombus Energy Solutions, that *“require custom communication and control development.”* Therefore, Staff’s proposal to standardize to CCS-1 – without a developed and tested bi-directional VGI capability - could prevent or at least would delay the implementation of VGI.

Conversely, companies such as Fermata Energy ⁵ are currently testing and operating fleets of vehicles using CHAdeMO’s proven bi-directional capability. Over 40,000 Nissan Leafs and other CHAdeMO equipped vehicles are operating in California and able to reliably provide bi-directional VGI services. These services could easily offset the purchase price and charging of a used CHAdeMO equipped electric vehicles – a viable solution to providing electric vehicles in disadvantaged and low-income communities.

3. CCS’s power line carrier (PLC) communication signals over the J1772 AC pins of the connector are not secure and subject to denial-of-service attack. Recently, a group of academics from the University of Oxford and Armasuisse S+T investigated the effects of BROKENWIRE,⁶ an attack against the Combined Charging System (CCS) that could potentially disrupt the ability to charge electric vehicles at scale. The method interferes with the control communications between the vehicle and charger to wirelessly stop the charging sessions from as far as 151ft. After testing in a controlled laboratory environment, they conducted extensive real-world evaluation, including seven EVs and 18 charging stations. This demonstration, using only off-the-shelf equipment and with little knowledge, suggest that the use of PLC for charging communication is a serious design flaw that leaves millions of vehicles vulnerable.
4. CCS-1 lack independent certification and verification of compliance with the standard causes significant consumer dissatisfaction. Staff notes consumer frustration with infrastructure and charging is number one reason for ZEV discontinuance. They suggest, among other things, a measure that increase consistency. (ISOR p.55) CHAdeMO, the only DCFC standard with an impartial third-party certification system, believes certification can guarantee the safety and ensure interoperability across any CHAdeMO chargers and

⁴ Rhombus Energy Solutions, “RES-D2-CS20 Electric Vehicle (EV) DC Fast Charger Disenser Datasheet, Accessed May 31,, 2022, <https://rhombusenergysolutions.com/2021/03/res-d2-cs20-v2g-dc-dispenser>

⁵ Fermata Energy, “Press & Media Kit”: Accessed May 31, 2022, <https://www.fermataenergy.com/press>.

⁶ Sebastian Kohler, Richard Baker, Martin Strohmeier, Ivan Martinovic, “Brokenwire”, Accessed: May 31, 2022, <https://www.brokenwire.fail/>

vehicles. It can also facilitate any companies in various regions of the world to develop safe and interoperable CHAdeMO devices, fostering the development of locally made but globally conformed high-quality charging infrastructure.

In contrast, CharIN, the global association dedicated to promoting **the Combined Charging System (CCS)**, states:

*CharIN's next goal (after development of the Megawatt Charging System (MCS)) is to define requirements for the evolution of CCS related standards and for the certification of CCS based products.*⁷

Therefore, CCS-1 does not have an independent certification and compliance verification system.

5. CCS-1 has no capability for adapters to support CHAdeMO and Tesla equipped vehicles. CCS-1⁸ has no plans for backward compatibility or adapters for existing vehicles using CANbus communications and, therefore, cannot support legacy vehicles using the other standards.
6. These are pioneering times for medium and heavy-duty BEV trucks charging technologies in support of the ZEV Truck Mandate. New technological solutions need to be developed and new charging stations will need to be constructed to support to Ultra-high-power charging. The opportunity is ripe to co-develop a new, robust and backward compatible charging standard such as the ChaoJi standard that would service all types of vehicles. Therefore, instead mandating CCS-1 with its known limitations (CharIN is developing the separate MCS to charge trucks), the future development of a unified vehicle DCFC charging should be allowed to develop unhindered.
7. Both CHAdeMO and Tesla are supported by early adopter BEV OEMs. Mitsubishi Motors, Nissan and Tesla all introduced BEVs prior to 2010 and worked to develop fast charging stations to promote sales of BEVs. Tesla, and to a lesser extent Nissan, established their own network of fast chargers in the US and globally. In 2009, CHAdeMO partnered with Pacific Gas and Electric (PG&E) and CARB to install the first North American public Quickchargers in Vacaville California. This historic charger, donated to the City of Vacaville by

⁷ CharIN, “Cross-industry, global, non-profit and holistic”, Accessed: May 31, 2022, <https://www.charin.global/>.

⁸ CharIN, “Position Paper of Charging Interface Initiative e.V. CharIN’s view on adapters within the Combined Charging System”, Accessed: May 31, 2022, https://www.charin.global/media/pages/technology/knowledge-base/d5b6b3c40a-1615552587/charins_view_on_adapters_within_the_combined_charging_system_v08.pdf.

⁹ CHAdeMO Association, “High Power (ChaoJi)”, Accessed: May 31, 2022, <https://www.chademo.com/technology/high-power>.

CHAdeMO, demonstrated BEVs were capable of long-distance travel. Both Mitsubishi Motors and Nissan Motors utilized this charging station for early vehicle demonstrations and R&D. Most importantly, numerous early Nissan Leaf owners used this charging station and became early advocates for public fast charging systems such as the West Coast Electric Highway. Later, this station became part of the California-Japan project “DRIVEtheARC” (Advanced Recharging Corridor) Project from Monterey to Lake Tahoe “surf-to-ski emission-free”.

In contrast, the SAE standard effort to establish a DCFC standard (CCS-1) deliberately ignored the existing CHAdeMO standard resulting market confusion and delaying the construction of fast charging network essential to the sales of BEVs. **Why should CARB now create a monopoly for the CCS-1 standard which delayed the development of the early fast charging infrastructure?**

In summary, these are the deficiencies of CCS-1 Fast Charging Standard:

- Not global standard, North America only
- No support for legacy vehicles – no adaptors
- No support bi-directional (V2G) power flow
- PLC communication signals subject to denial-of-service attack
- No independent certification and compliance verification
- No development path for unification of existing or future fast charging standards

Therefore, CHAdeMO strongly opposes Staff’s proposal to require all 2026 and subsequent model year vehicles to be equipped with Combined Charging System (CCS) 1 Standard. **It is clearly not the proper time to force DCFC standardization** – instead, let the pioneering spirit of charging and vehicle manufacturers select the proper DCFC charging solution.

We respectfully ask for the Board to include in the adoption resolution a request for a DCFC technology and progress review within three years where staff provides analysis and recommendations on the following issues relevant to improving ACC II:

- Conduct a new comparative analysis DCFC Charging Technology functionality and reliability (with recommendations).
- Conduct an analysis on how CARB can advance bidirectional charging in PHEVs and BEVs in light-, medium- and heavy-duty vehicles (with recommendations for incentives or regulations).
- Conduct a detailed examination of future new technologies to ensure the **best possible solution at the lowest cost and highest benefit to the consumer**.
- Conduct other analysis as determined by CARB staff.



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Thank you for your consideration of our comments. Please do not hesitate to contact me at patterson@chademo.org.

Sincerely yours,

A handwritten signature in blue ink, appearing to read "D. Patterson".

David N. Patterson, P.E.
Executive Director
CHAdEMO Association North America

Appendix A

CHAdeMO, the pioneer for light duty vehicle fast charging, is the most popular charging standard with 49100 charging stations globally. The CHAdeMO Association is comprised of 450 members including major Automakers including General Motors, Honda, Isuzu, Jaguar Land Rover, Mazda, Mitsubishi Motors, Nissan, Subaru, Tesla, and Toyota, zero-emission trucks and buses manufacturers, 50 charging station manufacturers (with over 260 certified charger models), construction, watercraft, aircraft and other off-road vehicle manufacturers and other industry and government leaders supporting transportation electrification. Most importantly, **CHAdeMO compatible vehicles are the majority of the electric vehicle in-use fleet** – the combination of CHAdeMO equipped vehicles and Tesla brand vehicles utilize CHAdeMO chargers with a simple adaptor.