



August 26, 2022

National Conference on Weights and Measures  
Specifications and Tolerances Committee  
Jason Glass, Chair  
1135 M Street, Suite 110  
Lincoln, NE 68508

To the Specifications and Tolerances Committee:

We write regarding a new proposal, submitted for the 2023 revision cycle of Handbook 44, numbered EVF-23.1. The proposal was submitted by the Office of Weights and Measures of the National Institute of Standards and Technology (“NIST”), presenting it as being on behalf of the U.S. National Working Group on Electric Vehicle Refueling and Submetering, subgroup on electric vehicle fueling (the “Work Group”). We offer a revision to this proposal that we believe is narrowly tailored and necessary to avoid significant interference with the ordinary operation of electric vehicle chargers.

Electrify America, LLC, is the country’s largest open network of fast DC electric vehicle chargers (“EV chargers”), operating over 3,000 chargers spanning most states. We participated in the discussions of the Work Group over the past eight months, and we appreciate the Work Group as a forum for discussion of the details of weights and measures regulations for the rapidly evolving technology and market of EV charging.

We are generally supportive of EVF-23.1, except for one important point, discussed below. The proposal would eliminate or revise certain features of Handbook 44 section 3.40 (the “EV charging code”) that have proved to be unnecessary, irrelevant, or impractical. The EV charging code was drafted in 2015, before the development of the modern fast chargers that are making it conceivable to recharge an EV in a 20-minute timescale. Some features in the EV charging code are not meaningful, or are not useful, for real chargers today. For example, the requirement to verify that a charger detects a load of 0.5 A is not sensible, because the initial communication process with a vehicle often generates a load above that minimal quantity and there should be no obligation to charge the customer for such trivial amounts.

We have a serious concern about the proposed revision to paragraph S.2.5.1, “Money-Value Divisions Digital,” where the total price computation must be based on quantities not exceeding 0.01 kWh. This change would present significant difficulties. Most chargers operate by means of communication with a centralized server, maintained by the company that operates a given charger. The measurements of energy delivery are carried out locally, but the price calculation is carried out by the centralized server and reported back, repeatedly through the transaction, for display to the customer. To update the user for each additional 0.01 kWh-worth of cost would



mean communicating rapidly and frequently between the charger and the back end. For a charger operating at 350 kW (a capability that is now quite common), the energy delivered increases by 0.01 kWh in just 100 milliseconds. To ensure that the total cost is updated with each 0.01 kWh, as a matter of practical engineering it would be necessary to get an update at least twice that often, at least every 50 milliseconds—i.e., 20 times every second. These very frequent updates will impose a heavy burden on communications systems.

The 0.01 kWh standard will also create a high risk of non-compliance. A lag of just 100 milliseconds would mean the charger has failed to keep the cost updated at the 0.01-kWh level. And such lags are not at all uncommon in internet communications. One major internet service provider guarantees, for its business customers, that latency *on the backbone*, for communications regionally, will average 45 milliseconds over a month. Thus, even within the central internet there can regularly be delays over 45 milliseconds, and that does not even count latency in communication between the central internet and the actual device. In short, for fast chargers it will be not uncommon to be more than 0.01 kWh late in updating the rolling cost display, even after operators incur the heavy bandwidth penalty to even attempt these updates.

Meanwhile, there is little customer benefit for such rapid updates. The cost increase for 0.01 kWh is roughly half a cent.<sup>1</sup> Even if a customer wanted to choose to terminate a charging session on the basis of a half-cent cost difference, nobody could actually take in the cost information, make a decision, and act on it in such short time frames. In healthy 18- to 20-year-olds, the reaction time to a simple visual stimulus is between 220 and 250 milliseconds, and to an auditory stimulus 210 to 230 milliseconds.<sup>2</sup> It would be impossible for even the swiftest humans to make a choice, and stop a charging session, based on a change in information occurring in 100 milliseconds.

To be clear, the system we describe here, in which cost information is calculated and communicated by a central server, is widespread. This mode of operation is codified in the Open Charge Point Protocol (“OCPP”). OCPP is not only the emerging industry standard protocol for chargers to communicate with servers; it will be a required qualification for any EV charger funded by the federal National Electric Vehicle Infrastructure program.<sup>3</sup> Moreover, these central-server calculations are important for chargers to be able to operate flexibly with multiple pricing structures, as many operators currently do and as many governments have requested in their infrastructure programs.

In short, a requirement to update the display of cost every 0.01 kWh would be extremely burdensome; would be impractical to comply with fully; and would provide no actual benefit to customers. These are sound reasons not to adopt this proposed requirement. Against those

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<sup>1</sup> We assume a current price of 40 cents per kWh; typical prices range from 30 to 50 cents.

<sup>2</sup> Aditya Jain *et al.*, “A comparative study of visual and auditory reaction times on the basis of gender and physical activity levels of medical first year students,” 5 Int’l J. App. Basic Med. Research 124 (2015).

<sup>3</sup> 87 Fed. Reg. 37,262, 37,278 (June 22, 2022) (proposed 23 C.F.R. § 680.114(a)(5)).



concerns, we did not see anything in proposal EVF-23.1 that said why this requirement should be imposed. It appears in the proposal without any explanation or justification.

The 0.01-kWh proposal was not discussed in the Work Group. Electrify America participated in the meetings, and we were not aware that this 0.01-kWh issue was brought up and deliberated. Upon seeing the draft Form 15 that NIST intended to submit (to become EVF-23.1), we promptly alerted NIST to this concern, in writing, and explained the problems above.

All that said, we recognize that customers who are receiving information about the energy delivery at the 0.001-kWh level might want to have cost calculated in a precise way as well. It would be straightforward to do that for the cost presented at the end of a transaction; the difficulty only arises if a charger has to provide 0.01-kWh-worth updates. As we understand the code, the obligation to present a running, continually-updated cost would come from the reference to paragraph G-S.5.5. Money-Values, Mathematical Agreement. So proposal EVF-23.1 could be revised to separate the 0.01-kWh requirement, as follows:

*S.2.5.1. Money-Value Divisions Digital.* – An EVSE with digital indications shall comply with the requirements of paragraph G-S.5.5. Money-Values, Mathematical Agreement, and the total **computed price of the energy sale, presented at the completion of a transaction,** ~~computation presented~~ shall be based on quantities not exceeding ~~0.5 MJ or~~ 0.01 kWh.

In this proposed revision, we have used the term “total computed price” instead of “price computation” to remain consistent with existing paragraph S.2.6, which describes the information that must be provided at the end of the transaction. “The completion of a transaction” is also the same term that is used in paragraph S.2.6.

We ask the Committee to recommend this change. The remainder of EVF-23.1 is sensible and appropriate, but it contains this one aspect that would cause major problems, with no real justification. The change we have suggested would avoid those concerns.

Sincerely,  
David Appelbaum