Spuckler, Amanda (DLI)

From: Michael Hart <michart@tesla.com>
Sent: Tuesday, April 18, 2023 1:08 PM
To: RULES, DLI (DLI)
Subject: Comments & Request for Hearing: MN Rules 1315 for 2023 National Electric Code
Attachments: MN_ NEC 2023 702.4 _ Ammendment Proposal.pdf

Importance: High

Hi Amanda,

My name is Michael and I work for Tesla and a regulatory engineer.

I have been working on an amendment proposal for Article 702.4(A)(2) of the 2023 NEC that I would like to present to the Board of Electricity. While the article's intent is clear that it is meant to prevent overload of the source, it lacks a compliance pathway for grid-interactive battery energy storage systems that have built-in safety features to prevent overloading the source upon transfer.

I have attached the proposal with justification, impact, and how our energy storage systems prevent overload upon transfer. I would like to request that this be submitted to the Board of electricity for review before the state adopts finalized language for the 2023 National Electric Code. I would also like to request that the May 23rd public hearing be held to discuss this topic.

Please let me know if there is anything else I can provide.

Thank you and have a nice week.

Michael Hart

Sr. Regulatory Engineer - Energy

E. michart@tesla.com

TESLA

2023 NEC: Article 702.4

The intent of this letter is to communicate concerns about the proposed language in Article 702.4 of the 2023 National Electric Code (NEC). You will find an outline of its impact to energy storage deployment, the impact to residents in Minnesota, and a proposal for amended language that would clarify the intent of this article and eliminate these impacts.

Issue with Language in Article 710 and 702.4(A)(2)

Article 710: Stand-alone Systems

There is new language in Article 710 that excludes grid-connected energy storage systems from being considered "stand-alone" systems. Traditionally energy storage systems, such as the Tesla Powerwall, have qualified as both grid-interactive and stand-alone systems due to their island functionality when operating off-grid. Stand-alone systems can supply a load panel that includes any number of house electrical loads if the stand-alone system has enough output capacity to back-up the largest single load in the panel.

Stand-alone System Sizing Summary

- *Sum of stand-alone system output capacity >= Largest single load connected to the system*

Example

- *Stand-alone system output capacity = 50A*
- *Allowable loads in back-up circuit: All loads individually 50A or less*

Due to the NEC 2023 exclusion of grid-connected energy storage systems from being classified as stand-alone systems, back-up circuit sizing is now forced into the requirements of Article 702 for optional standby systems.

Article 702.4(A)(2): Optional Standby Systems – System Capacity for Automatic Load Connection

This section covers optional standby systems. In this section, there are only two means of compliance for sizing the back-up circuit when automatically connected.

a) The standby source must be capable of supplying the full load that is automatically connected

Example:

- Optional standby system capacity = 50A
- Allowable loads in back-up circuit: A total calculated (combined) load of 50A or less

Or,

b) The standby source must be able to automatically manage the connected load as an Energy Management System and be capable of supplying the maximum load that will be connected to that system

These two options for back-up circuit sizing do not cover all potential pathways that meet the intent of this Article. The "Enhanced Content" on NFPA Link clearly states that the intent of this Article is to ensure the transferred load does not overload the source.

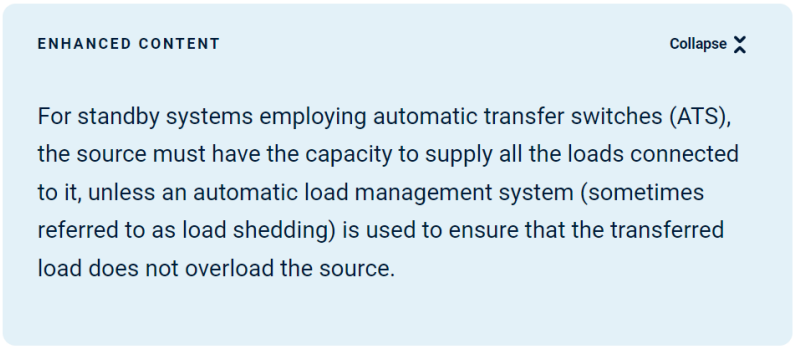

Figure 1: Enhanced Content from Article 702.4(A)(2) of the NEC 2023 on NFPA Link

While the Enhanced Content is not enforceable, it is a clear indication of the Article's intent and demonstrates that there is incomplete language within the written code. **This section does not consider that current technological safety features can be used to ensure that optional standby systems are not overloaded by transferred load.**

The Tesla Powerwall is an example of an energy storage system that has built-in safety features to prevent overloading. While this meets the intent of the code, the lack of explicit language in this section could force Powerwall systems to have back-up circuits sized in a manner that limits the homeowner's ability to select which loads to use during an outage, increases the cost of installation, and limits the growth of renewable energy deployment. These impacts are significant and amendments to Article 702.4 should be implemented to account for systems that can safely prevent overloading. **The amended language should allow systems with overload protection safety features to size back-up circuits to the requirements in 710.15 for stand-alone systems.**

Tesla Powerwall Safety and Functionality

Tesla's Powerwall systems are engineered to safely manage load demand while providing the optimal home backup profile for our customers. The Powerwall achieves this through the following functionality.

- Real-time monitoring of the house electrical loads connected to the system
- In the event of automatic transfer, the system ensures it can back-up the connected load to prevent overloading
- If the load exceeds the Powerwall capacity, it prevents overloading by requiring manual transfer

Each system has a site-specific design to ensure that the Powerwall's output capacity is sufficient for any single load in the backup circuit. This, in combination with the features listed above, enables the customer to safely manage which loads they want to use during a grid outage. Flexible load management is important to customers as they experience unique grid outage events that often differ in length, severity, and circumstance.

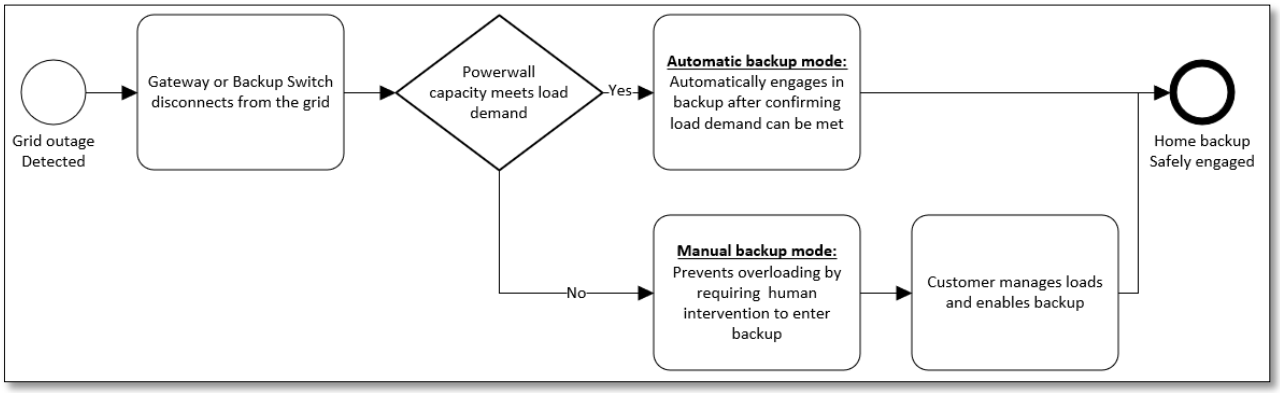

Figure 2: Example flow of Automatic and Manual Backup modes that ensure the system does not get overloaded upon transfer

Historically, Powerwall installations have used Article 710.15 for determining which loads can be included in the electrical back-up circuit. Over 90% of recorded outage events for these installations were backed up using automatic back-up mode. Meaning that the system ensured there is sufficient capacity, and rating, for real-time load demand when initiating automatic backup. In the instances where real-time load demand exceeds the available power, the Powerwall prevents overloading from occurring by entering a manual backup mode.

Impact to Energy Storage System Deployments in Minnesota

This gap in the written NEC 2023 code introduces significant risks to energy storage system deployment in Minnesota while having no safety benefit or impact. If left unresolved, jurisdictions will be left to interpret compliance of this code which is incomplete, and unclear, on its intent. This will result in increased labor and materials costs, reduced back-up functionality, and reduced customer satisfaction.

Minnesota has a rapidly growing energy storage market. If broadly enforced, without consideration of the product's safety features, we estimate that less than 10% of customers would qualify for whole home back-up. The resulting increased cost for electrical work would be approximately $1,700/installation. The bulk of this cost would likely be passed down to customers. The impact of this will only grow as energy storage deployments increase in the state.

Impact to Customers

Outside of the additional cost burden to the residents of Minnesota, this also has the potential for limiting back-up flexibility for our customers.

Tesla has developed its whole home backup offerings based on customer demand and value expectations. Powerwall system capacity is designed, and sold, to cover all typical loads both on-grid and off-grid. This is fundamental to the value proposition of energy storage systems. Reducing the number of house electrical loads that can be backed up has had the effect of limiting customer choice.

Residential customers have demonstrated a preference for the flexibility to select loads they connect to their energy storage system. They do not want to pay the expense associated with a much larger system or for a separate backup panel that limits that choice (i.e., paying more for less flexibility). The language change proposed in this document achieves a balance that meets the intent of overload prevention, while preserving the freedom to choose which electrical loads they want to use during a grid outage.

Proposed Language Amendment to 702.4(A)(2)

Below is our suggested language for an amendment to Article 702.4(A)(2) of the 2023 National Electrical Code. Suggested language is in red text.

Option 1

2) Automatic Load Connection.

If the connection of load is automatic, an optional standby system shall comply with 702.4(A)(2)(a) or (A)(2)(b) in accordance with Parts I through IV of Article 220 or by another approved method.

(a) Full Load. The standby source shall be capable of supplying the full load that is automatically connected.

(b) Energy Management System (EMS). Where a system is employed in accordance with 750.30 that will automatically manage the connected load, the standby source shall have a capacity sufficient to supply the maximum load that will be connected by the EMS.

Exception: Battery energy storage systems used primarily for grid-interactive applications and employing EMS control in accordance with 750.30 shall be permitted to provide automatic load connection with a standby capacity sized in accordance with 710.15.

Option 2

2) Automatic Load Connection.

If the connection of load is automatic, an optional standby system shall comply with 702.4(A)(2)(a), 702.4(A)(2)(b), or ~~(A)(2)(b)~~ 702.4(A)(2)(c) in accordance with Parts I through IV of Article 220 or by another approved method.

(a) Full Load. The standby source shall be capable of supplying the full load that is automatically connected.

(b) Energy Management System (EMS). Where a system is employed in accordance with 750.30 that will automatically manage the connected load, the standby source shall have a capacity sufficient to supply the maximum load that will be connected by the EMS.

c) Battery energy storage systems meeting all of the following conditions shall be permitted to provide automatic load connection with a standby capacity sized in accordance with 710.15.

(1) The ESS is listed and installed in accordance with Article 706

(2) The primary application of the ESS is for grid-interactive functions

(3) The ESS employs EMS control in accordance with 750.30 to prevent connection in an overload condition

Summary

Either of the proposed amendments would allow a pathway for system sizing in accordance with 710.15 for grid-interactive systems with stand-alone capability and would have the following benefits.

- Reduces cost per installation by reducing electrical work and equipment
- Allows more customers to have whole-home back-up for flexible load management during grid outages
- Ensures the transferred load does not overload the source
    - Transferred load: Electrical home loads in the back-up circuit
    - Source: Optional standby system (i.e., Powerwall)

Without an amendment to Article 702.4(A), the 2023 National Electrical Code will lack clear direction for grid-interactive energy storage systems that have safety features built-in to prevent overloading the source upon transfer during an outage. This will result in jurisdictions enforcing overly restrictive requirements that are not based on safety, increase the cost to the customer, and provide fewer options for back-up which reduces the value proposition to the customer.

If you have any questions about this proposal, or the potential impacts of this issue, please contact our team.

Sincerely,

Tesla Compliance Engineering