



V2X BIDIRECTIONAL CHARGING SYSTEMS

Best Practices for Service
Connection or Interconnection

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Vehicle-to-Everything (V2X) bidirectional charging systems can discharge from the EV battery to serve a customer's onsite load or export to the grid while providing for mobility needs.

This study does not consider specific compensation mechanisms, technology incentives, resource procurement strategies, and program designs to unlock these benefits. Instead, the best practices and recommendations here are tools to overcome technical and process barriers to V2X bidirectional charging systems.

Specifically, this study considers two V2X bidirectional charging system use cases: equipment that requires (1) service connection for load and non-parallel operation, or (2) interconnection for parallel operation.

V2X bidirectional charging systems are either V2X DC (stationary inverter in charger) or V2X AC (inverter function onboard vehicle). The V2X DC configuration is commercially available in today's bidirectionally-capable vehicles and chargers, including offerings from Ford, Sunrun, Nuvve, Fermata Energy, Nissan, Blue Bird, Thomas Built, Rhombus, and Lion Electric.¹ In contrast, the enabling standards for V2X AC configuration are still in development.

¹ Additional V2X bidirectional power flow products are expected soon from dcbel, GM, Stellantis, Wallbox, Hyundai, Kia, Lucid, Volkswagen, Rivian, and BYD.

V2X Bidirectional Charging Systems Offer Significant Grid and Customer Benefits:



Unlock Latent Energy
Storage Capacity to Support
the Grid



Support Customer and
Community Resilience



Reduce the Cost of EV
Ownership

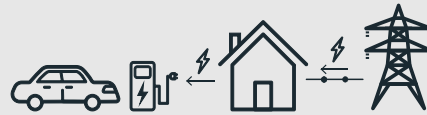
Common V2X Bidirectional Charging System Configurations:

Unlocking V2X bidirectional charging requires standardized practices and, where warranted, interconnection frameworks to:

- Allow for V2X bidirectional charging systems during this early stage of market development
- Quickly scale to accommodate future market development
- Efficiently integrate with existing processes
- Promote premium customer experience via flexible entry points
- Anticipate potential for customers to incorporate other types of DERs
- Reduce patchwork across different states and utilities

ENERGIZATION:

A. LOAD-ONLY MODE



No generator interconnection and little-to-no review required

B. ISLANDED (FOR BACKUP)



No generator interconnection and little-to-no review required (e.g., notification-only, similar to fossil-fuel backup generator)

INTERCONNECTION:

C. PARALLEL, NON-EXPORT (discharge < site load)



Can fit within existing non-exporting small generator interconnection frameworks

D. PARALLEL, EXPORT (discharge > site load)



Can fit within existing exporting small generator interconnection frameworks

Key Recommendations for Utilities and Regulators

1. If a notification, approval, or interconnection pathway for distributed energy resources exists, it is unlikely that a new process would need to be created for V2X bidirectional charging systems. For example:

Islanded systems (B) fit into existing processes for fossil fuel backup generators



Grid-parallel exporting systems (D) fit into existing processes for grid-parallel exporting energy storage systems

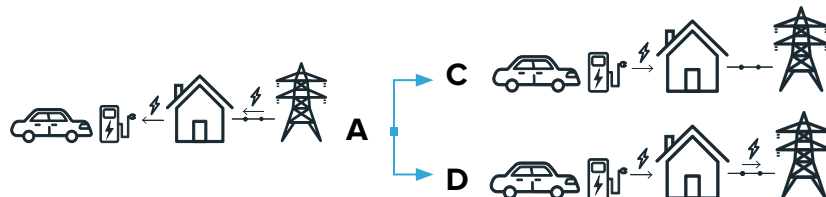


2. The appropriate process, technical requirements, forms, timelines, closeout documentation, and applicable fees for each configuration should be clear and readily accessible. Any requirements for site plans or single-line diagrams to be certified by a Professional Engineer (PE) should be communicated early in the process.

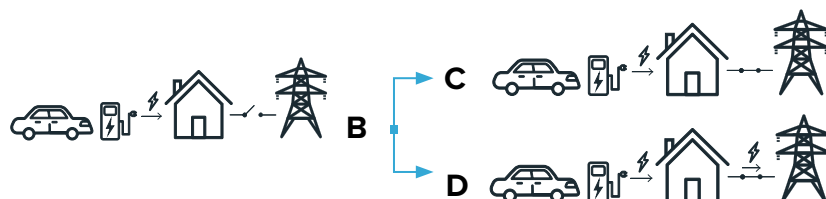
3. Grid-parallel systems should not be prohibited from operating in islanded mode during an outage if the appropriate equipment is installed.

4. Flexible process entry points are critical to unlocking V2X bidirectional charging value for the grid and customers. Equipment should be permitted to notify or seek approval for any configuration upon installation and then notify or seek approval for a different configuration in the future. For example:

Load-only systems (A) should be permitted to seek small generator interconnection at a later date.



Island systems (B) should be permitted to seek small generator interconnection at a later date.



Key Recommendations Continued:

5. Size thresholds for “small generator or stationary storage IX” interconnections may need to be revisited so relatively small V2X bidirectional charging systems do not get inappropriately routed to large generator interconnection processes.

6. A dispute resolution process should be used to mediate disputes via a third-party (i.e., other than the public utilities commission).

7. Interconnection timeline data should be published and segmented by configuration.

8. As distribution engineers gain experience with standard configurations, any configuration requiring a site assessment should transition to a virtual inspection and, ultimately, a notification-only approach.

9. Interim pathways prior to finalized standards being adopted should be set to approve V2X AC systems (inverter function onboard the vehicle) that use in-development standards and low-cost safety equipment.



Key Takeaways

Avoid reinventing the wheel.

V2X systems can fit within existing processes.

Minimize unnecessary review.

Load-only and islanded systems should require little-to-no interconnection review.

Provide customers with flexible options.

Systems initially used in load-only or islanded modes should be permitted to seek grid-parallel interconnection at a later date.

UNLOCKING EVs AS A STRATEGIC GRID RESOURCE

Interested in learning more about V2X bidirectional charging systems? Join Vehicle-Grid Integration Council (VGIC) and contribute to pioneering market development for V2X bidirectional charging systems, managed charging, and other VGI applications.

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