Smart Electric Power Alliance

Case Study: National Grid—V1G/V2G and Demand Response

The State of Bidirectional Charging in 2023

September 2023

In Partnership with

CLEAResult® ev.energy Fermata Energy

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About SEPA

The Smart Electric Power Alliance (SEPA) is dedicated to helping electric power stakeholders address the most pressing issues they encounter as they pursue the transition to a clean and modern electric future and a carbon-free energy system by 2050. We are a trusted partner providing education, research, standards, and collaboration to help utilities, electric customers, and other industry players across three pathways: Electrification, Grid Integration, Regulatory and Business Innovation. Through educational activities, working groups, peer-to-peer engagements and advisory services, SEPA convenes interested parties to facilitate information exchange and knowledge transfer to offer the highest value for our members and partner organizations. For more information, visit www.sepapower.org.

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Utility Program: National Grid

V1G/V2G and Demand Response

V1G Background

National Grid has been on a managed EV charging journey that began with its first pilot in 2019, and since then has been continuously innovating and expanding its EV load control capabilities into bidirectional charging. Through its Charge Smart MA passive managed charging program with ev.energy, National Grid in Massachusetts has been able to shift 82% of weekday charging to off-peak hours through on-bill incentives ranging from 3¢ - 5¢ per off-peak kWh. Its recently-ended Connected Solutions EV offering provided active load curtailment of approximately 0.4 kW per enrolled vehicle. In return, customers earned $50 for enrolling and $25 per year for staying in the program. National Grid has recently launched a monthly off-peak EV subscription plan in New York with ev.energy; peak load reduction results from this V1G program are forthcoming.

Expansion to V2G

Beginning in 2021, National Grid began introducing V2G export into its Connected Solutions Daily Dispatch Program, a seasonal program for commercial customers. Daily Dispatch is open to any technology, including V2G, that can reduce loads on the grid at peak times. The program offers $200 per kW per summer (e.g., if a business discharges 100 kW on average for every event over a summer, they earn $20,000 per summer). By allowing any technology to participate in Daily Dispatch, including electric vehicles with bidirectional charging, National Grid sought to further improve the business case for its customers to adopt EVs, while also testing a new variation of demand response. The first V2G export in this program was a Thomas Built school bus owned by Beverly Public Schools; using a Proterra bidirectional charging system, the bus discharged on average about 70kW during demand response events in 2021 and 2022.

Economic Incentive Structure

To access V2G capabilities from a broader customer base, National Grid leveraged the same customer value proposition and interconnection process as its existing Daily Dispatch offering. From a safety and grid interconnection standpoint, National Grid views the bidirectional charging system as equivalent to stationary battery systems as long as there is an inverter for each charging system (i.e., if a residence or business has two or more chargers, each system needs its own inverter). By expanding from V1G to V2G, National Grid enables customers with suitable vehicle duty cycles to utilize more EV battery capacity (from an average of 1 kW to 7 kW per vehicle); during demand response events that last between 2-3 hours, that difference is further compounded and can provide 14-21 kWh in potential load reduction. From a customer perspective, a single event will cause at most a 35% reduction in their state of charge, and for the majority of events, they will only see a 10-20% reduction in battery level.

In the future, National Grid expects to have dynamic charging solutions that work for almost every customer in its service territory. For some customers, the simplicity of off-peak rebates will still be right for them, while others will be able to access more dynamic charging solutions like V2G exports. National Grid expects the majority of customers to fall somewhere in the middle, and in a fully-electrified transportation future, that will equate to a significant amount of value for both customers and the grid.

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