

Insights of the UD EV R&D Group into the Viability of Vehicle-to-Grid Operations in PJM's Energy Markets

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Distributed Storage Behind the Meter

Our goal is to integrate electric vehicles into the upcoming DER service paradigm using Vehicle-to-Grid (V2G) storage operations. There are key factors that must be completed before we can achieve this goal.

- Registration and participation in PJM markets
- Cost effective distributed storage (batteries already purchased)
- Use EVs and EVSE as an energy storage resource
 - i. EVSE stay in one place, that is the registered resource, active when connected to an EV.
- Now switching DSM registration to SG registration.



Our Retail Level Interconnection

- Distribution utility uses their standard service meter; we pay for kWh via their meter, they have no need for our submeter data, but we would provide it if asked.
- Originally we registered as DSM for PJM regulation-only.
- Since we were backfeeding at customer service drop, that violated PJMs DSM terms at service drop. Thus we had to register the meter of record as the muni's substation meter at 30 kV. Easy to prove no backfeeding there. (Utility was perplexed that PJM was imposing restrictions on backfeeding on their distribution feeders, but helped up qualify.)
- For SG registration, we are now completing Newark Muni and DP&L interconnection agreements. Many mismatches between forms and equipment, but we believe are able to interconnect in both utilities.
- Safety assurance is via SAE J3072 and IEEE-1547, as UL does not apply. J3072 makes EV prove IEEE 1547 compliance, if not, no backfeeding allowed.



Our Metering System

- Each EVSE contains a revenue grade meter on just the controlled DER. This meters the EV's power response to the AGC signal from PJM. A/S performance is based on the power meter reading.
 - i. Meter certified by TESCO to ANSI C.12 at 0.5%
- Each service drop/customer has a standard utility meter. The site owner pays their normal kWh charges to utility. This can be net metered so that backfeeding is credited, if so, the net over time is always load..
- Due to the fact that all storage suffers energy losses from energy conversion. The EV storage cannot be a net generation over time. (If the car is driven, that is additional load.)



Layout of Our Telemetry

- We use internet-connected bidirectional chargers to receive a dispatch signal (based on PJM's AGC control) and to send performance data to PJM.
- EVSE when commissioned establishes a secure channel to aggregator with certificate.
- Our EVSEs communicate to an aggregation server, which distributes the AGC to active DERS, and adds up the metered power response from each DER to report the sum back to PJM.
- The Aggregator previously communicated directly with PJM, but we are currently going through a CSP.
- Our AGC and all metering is logged and available for audit.
- kWh billing is via the utility's normal processes and data flow.



Operation of V2G Regulation Services

- EVSEs and EVs are very reliable, very fast-responding for A/S.
- Although one car cannot be counted on, with only a dozen cars we have moderate reliability; very rarely fail to make our bid.
- In our V2G operations we are not compensated for energy “generated”.
- We are compensated for the sale of regulation services in MW-h (hours we had a given number of MW available.)
- We have to motivate the EV users to plug in even when no charge is needed; giving the EV owner part of the A/S revenue is one way to do that.



How Does a Lack of NEM Hinder Our Operations?

- We got NEM when registered as DSM. PJM is disallowing NEM when providing the same service within a SG registration, which we now face.
- We calculate that, without NEM our operations are penalized 47% of the revenue earned from regulation.
 - This is due to paying for the electricity stored but returning it to the utility for free; the more cycles of A/S, the more revenue goes to the local utility.
- State jurisdiction: The Delaware Code Title 26 Chapter 10 Section 1014 (e)(1 & 4) ensure that we receive a equal credit for energy returned to the grid if return is part of grid services for PJM or another grid entity.
 - For DER registered as SG doing A/S, disallowing net metering does not seem consistent with at least the intent of Delaware code.
 - No policy purpose is served by gifting the local utility according to the number of cycles requested by PJM. (We already pay for those cycles in losses.)



End

