



# Bring Your Own Battery Study

## February 2023 Executive Summary

### Battery Study Background (through 1/31/23):

	Florida (CLOSED)	North Carolina
Active participants	9	58
Unenrolled participants	2	4
Study timeline (12 mos.)	11/1/21 – 10/31/22	4/1/22 – 3/31/23
Event opportunities	60	50
Events called	50	38
Incentives paid	\$2,000	\$6,200 (+\$5,800 due at 3/31)

*\*Note: Study in SC did not move forward due to unforeseen regulatory hurdles*

### Unenrollment Reasons:

- Devices offline for prolonged period & customer nonresponsive to reconnection efforts
- Too many events
- Customer moved & transferred system ownership
- Dissatisfied with study device settings (Self-supply customer)

### Study Learnings – New Highlights:

- Due to the regulatory landscape and our inability to export to the grid, we are leaving available capacity on the table, particularly during winter peaks, night, and solar fade (duck curve issue). Ability to export to the grid would also eliminate control latency issues as home load would be perfectly offset.
- Involvement of Pink Energy in marketing and acquisition, for a fee, resulted in 10 customer enrollments in 3 weeks and a smoother device provisioning experience. However, Pink Energy's abrupt closure has directly impacted study participants' ability to address repairs/maintenance when device issues arise. Ability to leverage vendor established customer relationships during acquisition should be explored upon program expansion, with consideration of alternative support resources, outside of Duke Energy, should the need arise.
- Battery mode, self-supply (common in NC) vs. backup storage, determines the potential value derived from a device during a demand response event. Utilizing self-supply mode is effective for capitalizing on TOU offerings; however, commonly results in drained batteries by peak load times which renders them useless for demand response purposes. Opportunity exists to consider two separate incentive driven pilot / program paths based upon battery mode.
- Changes in battery mode and device responsiveness were regularly observed (e.g., a device responded appropriately during one event but not the next, with no clear reason). If program were to be scaled, device mode, responsiveness and behavior during/after events would need to be actively monitored and issues addressed after each event. Ideally, controls and flags to assist in this level of monitoring would exist on the aggregator platform, and the aggregator would take an active role in identifying, reporting on, and helping to resolve device issues.
- Customers are expressing interest in learning more about the intent and results of the battery study. Opportunity exists to include some study findings, as appropriate, in the NC closure email.
- Data analysis:
  - Assumptions & Constraints:

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Feb 28 2023

- Small sample size of devices (9 in Florida, 58 in North Carolina) may not be representative of customers who would enroll in larger program
- Battery dispatch is limited to zeroing out the house load (battery cannot export to grid)
- Duration of battery dispatch is limited by inability to discharge battery to less than 50% capacity
- Technical learnings:
  - Average kW dispatched varied by jurisdiction, event hour, timing of event (e.g., month and/or time of day), and battery mode (self-supply vs. backup)
    - See “Appendix A – Aggregate FL & NC Event Summary & Detail tables” (slides 7-10) within presentation deck for details
  - Devices are not operating at full efficiency during events (e.g., battery is not fully offsetting house load despite available capacity)
  - The average power discharged from the batteries was significantly less than the house load, due to be a combination of control issues (latency described below) and units failing to respond to events (declining participation)
    - An increase in customer initiated opt outs, devices breaking down/going offline, and devices otherwise not responding to events has been observed over time
    - See “Appendix B – NC Event Participation & Response Summary” (slide 11) within presentation deck for details
  - Undesirable device behaviors, including overcompensating for the house load (exporting power) and undercompensating (drawing grid power with battery power available), have been observed due to control latency with dynamic house load.
    - Virtual Peaker worked with SolarEdge to address issue and a firmware update was released in November 2022; however, latency issues and resulting device behaviors persist
      - Note: Generac latency issues were not as significant because data is refreshed at 1-minute rather than 5-minute intervals
    - Virtual Peaker is in the process of adapting the algorithm to take advantage of new firmware potential, which should resolve issue
      - Note: Algorithm updates may not be released until after the study concludes

### Prior Learnings – July 2022 Update:

- Customers have reported that the incentive is too low when considering the volume of events (5/month) and the cost of the technology.
- Manufacturer participation was limited to Generac and SolarEdge. For full-scale program, a determination should be made as to which manufacturers, and how many, we need to participate to get desired benefit.
- Explicit service level agreements, including with manufacturers who have SOWs with the aggregator, should be in place to ensure timely issue resolution throughout.
- Several devices were improperly configured during provisioning or ran into technical issues during the study, not associated with the DR events, which required manufacturer intervention to research and resolve. There should be explicit agreement amongst all parties on how customer device issues should be addressed when they arise.
- We have encountered several challenges with the Virtual Peaker platform and controls. When considering expansion, platform requirements should be vetted by all stakeholders before selecting a tool.

## Competitive Landscape: Utility Battery Pilots / Programs

	Duke Energy	Green Mountain Power	Xcel Energy	Portland General Electric	National Grid
Program/Pilot name	Bring Your Own Device Battery Study	Bring Your Own Device Program	Battery Connect	Smart Battery Pilot	Connected Solutions Battery Program
Aggregator	Virtual Peaker	Virtual Peaker	Unknown	Virtual Peaker & Kite Systems	EnergyHub
Incentive	\$200 <i>\$100 upfront &amp; end of study</i>	Up to \$10,500 <i>upfront or monthly credits</i>	\$1,250 upfront <i>% returned if participation &lt;12 months</i>	Monthly bill credits: \$40/month if grid charged \$20/month if solar charged	\$275/kW per summer <i>Performance based</i>
Term	12 months	10 years	12 months <i>Ends September 2022</i>	5 years	Customer Choice <i>Incentive rate locked 5 years</i>
Potential events	5/month	5-8/month on average <i>Peak event driven</i>	100/year	Unknown	Up to 60/summer <i>Called June-Sept</i>
Eligible battery systems	Generac SolarEdge	Enphase Generac SolarEdge Sonnen Tesla	SolarEdge Tesla	Generac Sonnen Sunverge SolarEdge Tesla	Enphase Generac Sol-Ark SolarEdge Sonnen SunPower Tesla
Potential capacity taken	50% of battery capacity	Customer choice	80% (charge & discharge)	Unknown (charge & discharge)	Max 3-hour event duration
Event notifications	2 hours	4 hours	None	Unknown	Unknown
Battery mode requirements	None	Back-up power	None	Unknown	Unknown