

Grid Integrated Resources

Update to Energy/Ancillary Services Proposal

DERSTF

March 26, 2018

Summary

Updates to our proposal to comply with Order 841:

- Nodal energy settlement
- Energy used to charge storage for later resale purchased at wholesale

Originally posted but not presented at the March 2 DERSC meeting, updated here for clarity and completeness.

Update: Nodal Energy Settlement

On Feb. 15th, FERC Order 841 specified that energy storage withdrawals and injections must be settled at nodal (Order 841 at 289). We extend this to apply to GIRs in general and update our proposal to comply.

- All energy sales by GIRs will be settled at the appropriate nodal LMP.

Update: Storage Charging Energy

Order 841 also specified that energy storage withdrawals are not retail sales. We update our proposal to comply.

- If storage is collocated with other DERs, additional metering rules apply:
 - Storage resource must have PJM-approved metering that measures energy entering the storage device from any out of market source (e.g., behind the meter solar).
 - Metering must enable determination of energy injected from storage vs. other behind the meter sources.

- Energy purchased for charging is calculated as:

$$\frac{\text{Injections from storage} - (\text{non market charging} * RTE)}{RTE}$$

Where RTE is storage round trip efficiency.

- Injections from storage are applied to purchased energy in last in/first out order.
- Settling against specific intervals maintains price signals and prevents arbitrage.

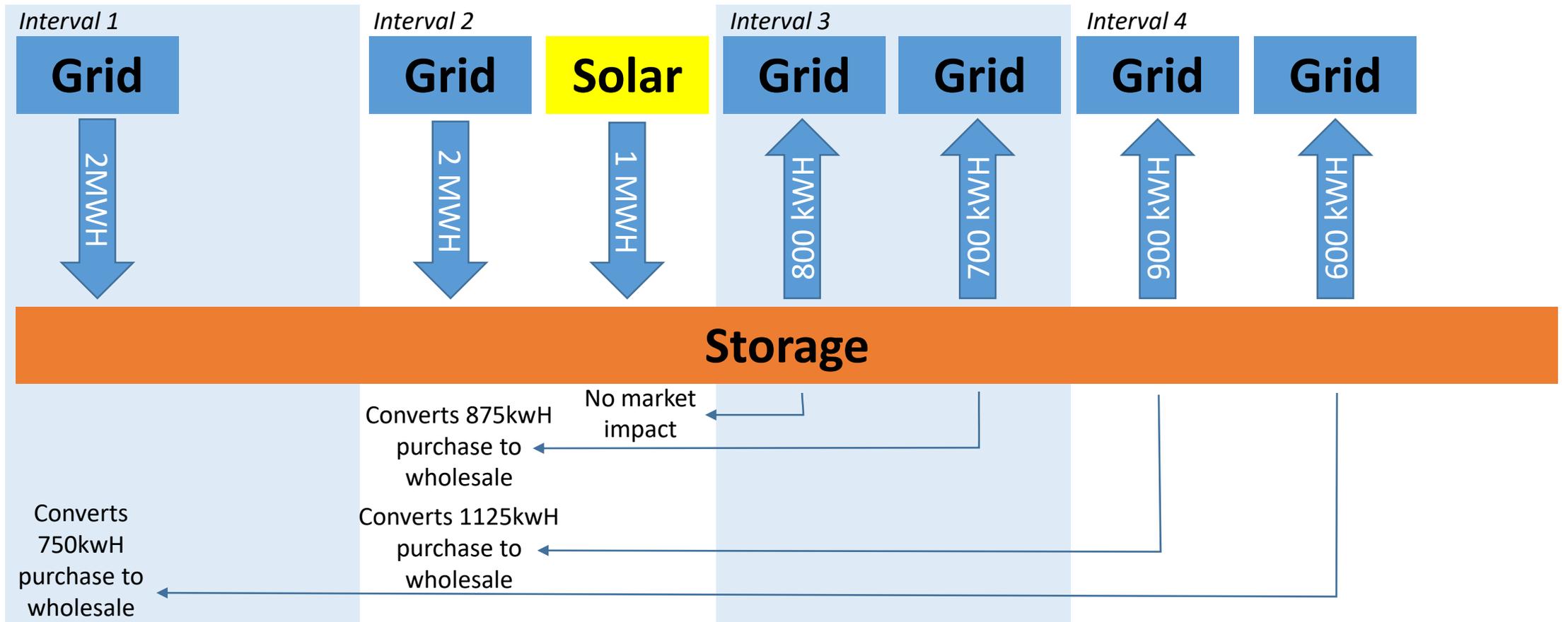
Storage Charging Energy Example

A 5MWh storage device with 80% efficiency co-located with solar. Storage device starts scenario at zero charge.

Interval	Charge from Grid	Injection from Storage	Charge from Solar	Notes	Wholesale purchase
1	2MWh	0	0		750kWh
2	2MWh	0	1MWh		2MWh
3	0	1.5MWh	0	First 800kWh comes from solar. Remaining 700kWh injection offsets $700/0.8 = 875\text{kWh}$ from interval 2.	
4	0	1.5MWh	0	Represents $1.5\text{MWh} / 0.5 = 1.875\text{MWh}$ purchase, offsets remaining 1.125MWh from interval 2 and 750 kWh from settlement 1	

Same Example Graphically

Time →



Storage Charging Energy Settlement

Settlement proceeds by one of three paths:

- 1. LSE bills for charging energy at wholesale.** PJM's only role is informational.
 - Charging energy reported to LSE.
 - LSE uses this information to adjust retail bill if necessary.
- 2. LSE does not bill for charging energy at all.** PJM informs the LSE and settles the wholesale purchase.
 - Charging energy reported to LSE to adjust retail bill if necessary.
 - PJM adjusts wholesale energy accounting so GIR is billed for charging energy and LSE is not.
- 3. LSE bills for charging energy at ordinary retail rate.** PJM settles the wholesale purchase and backs out retail energy charges.
 - PJM adjusts wholesale energy accounting so GIR is billed for charging energy and LSE is not.
 - GIR receives "charging retail adjustment" credit on charging purchases at energy component of retail rate for each interval.
 - LSE receives opposite offsetting charge.