Draft proposed accounting methodologies to calculate wholesale stored energy for ESR with ability to serve retail load during an outage/emergency

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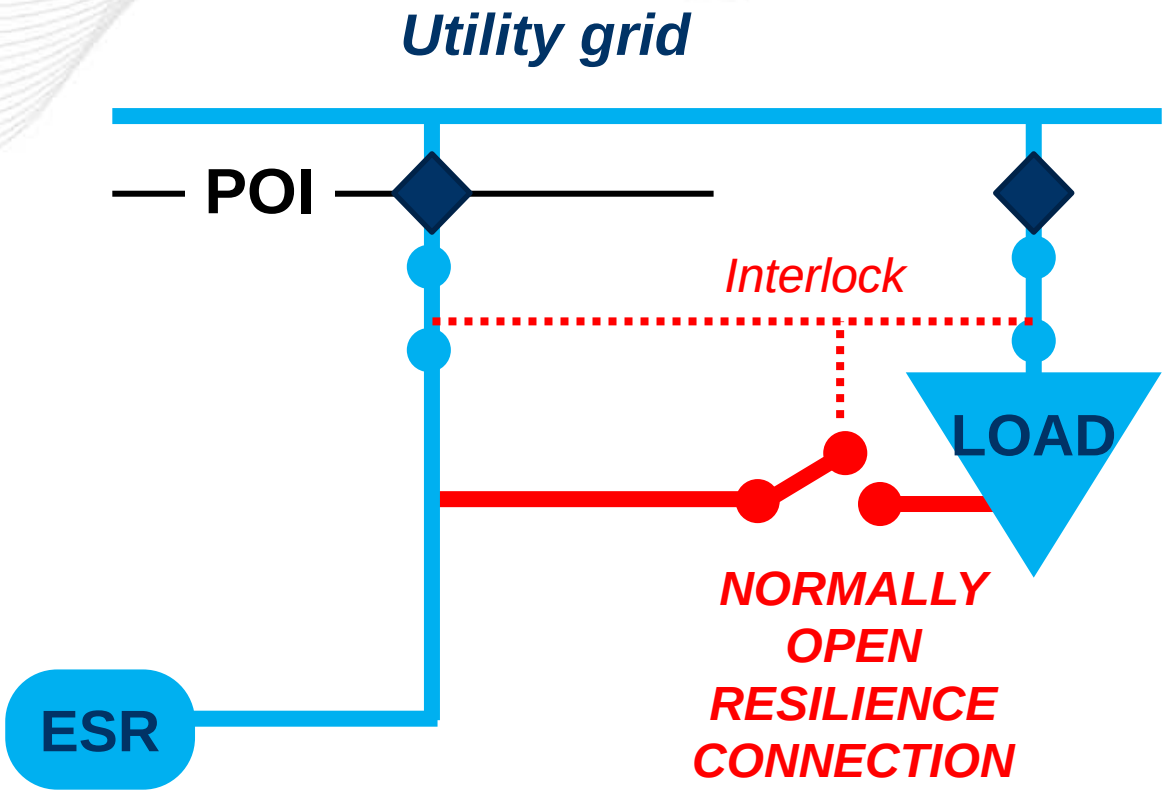
Use Case: Front of Meter ESR w/ Resilience Connection to Load

- "Wholesale Stored Energy" is a withdrawal that is a direct sale to the ESR.
- Withdrawn energy is sold to an LSE as "Load" if it is later served to retail load.
- Total withdrawals = "WSE" + "Load".
- Daily settlement for this use case: 100% of the withdrawals are considered WSE.
- Monthly accounting process to reverse pro-rata share of withdrawals for each interval from "WSE" to "Load" using monthly ratio of "Load" to "Withdrawals".
- Several methods described below for calculating "Load" vs "WSE".



Interlock among switches allows closed resilience connection only when disconnected from grid on both sides.

Draft Language for “Wholesale Stored Energy”

Draft OATT Def’ns - “**Wholesale Stored Energy** shall mean:

i. Energy that an Energy Storage Resource purchases from the PJM energy markets and stores for later resale into the PJM energy markets, and:

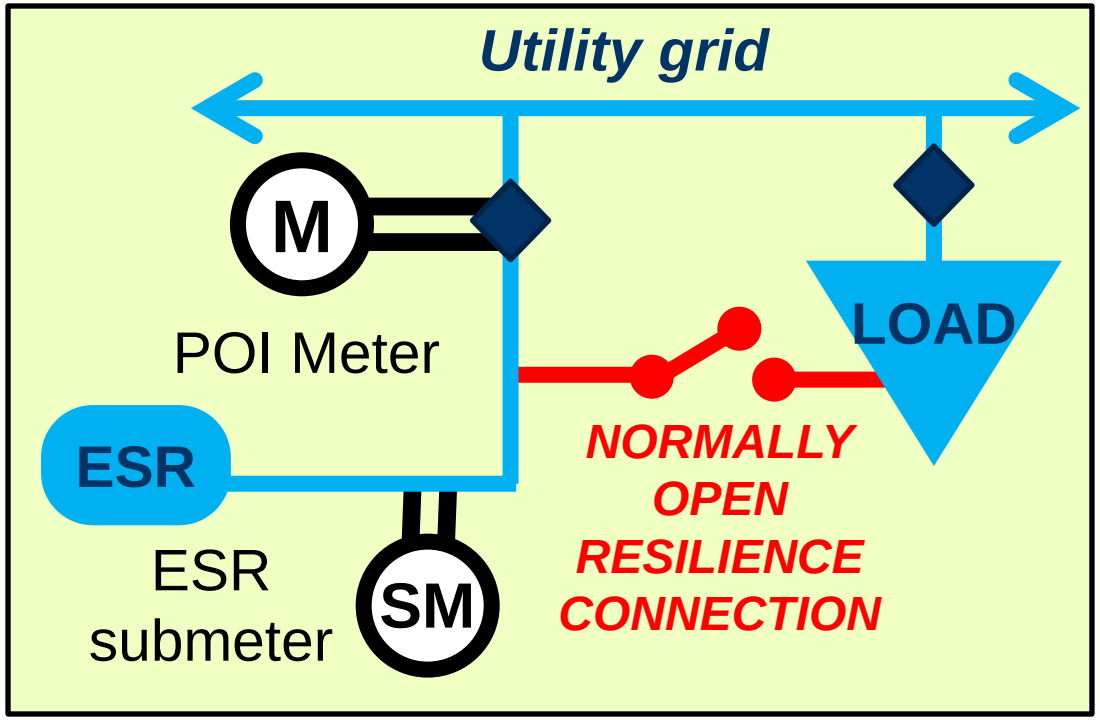
ii. Energy at an Energy Storage Resource that is lost to conversion inefficiencies, provided that such inefficiencies are an unavoidable component of the conversion, storage, and discharge process that is used to resell energy back to the PJM energy markets”

Draft OA Schedule 1 and OATT Attachment K Appendix:

“The sale of **Wholesale Stored Energy** shall be at the wholesale locational marginal price.”

Quantity Def'ns - ESR Submeter Method for ESR Alone Case

- ***ESR Injections*** = monthly **Σ**ESR submeter value when submeter MW is producing AND when POI MW injects (alternately, when N.O.R.C. is open).
- ***Wholesale Losses + Stock Change =*** monthly **Σ**ESR submeter
  - This measures energy that went into the ESR but didn't come out, either because it was lost or it increased the stock.
  - Decreases in stock net against losses.
  - Should stop **Σ** if N.O.R.C. open
- **POI withdrawals** = monthly **Σ**POI meter when withdrawing



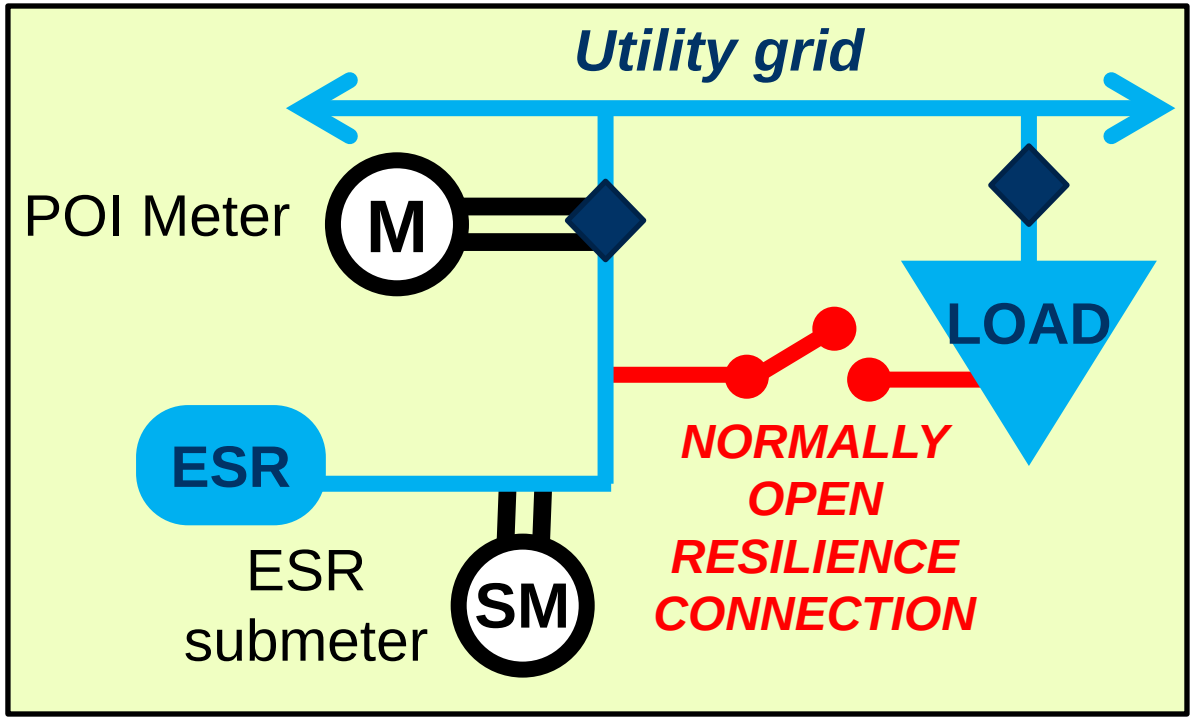
Summary of ESR Submeter Method for ESR Alone Case

***Load* = ΣPOI withdrawals – *ΣESR Injections* – ΣESR Submeter**

***WSE* = *ΣESR Injections* + ΣESR Submeter**

- Premised on direct measurement of:
  - Wholesale Stored MWh and
  - Wholesale Losses

See Appendix for derivation



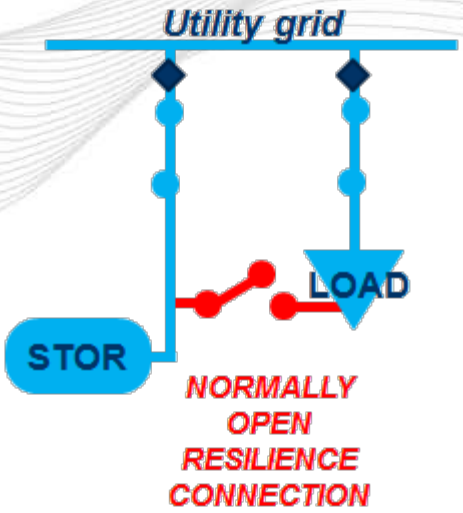
Next Steps

- Discuss roles for:
  - Establishing definitions for data values
  - Performing calculations
  - Verifying meter configurations
  - Owning metering

Appendix: Note On Meter Logic

Note on Meter Logic

- Sums in this presentation are all over a monthly period.
- Sum of meter values “when producing/injecting” or “when withdrawing” requires a meter than has a separate positive energy channel and negative energy channel.
  - I.e., ~instantaneous outbound power must be summed separately from ~instantaneous inbound power, without netting the two.
- In some cases, ~instantaneous logic on power might need to be applied to two meters simultaneously (denoted with “Meter XYZ MW”):
  - e.g., “When Meter XYZ MW is injecting AND Meter ABC MW is injecting, sum positive values from Meter XYZ”.
  - Logic must be applied BEFORE summing over any significant interval.

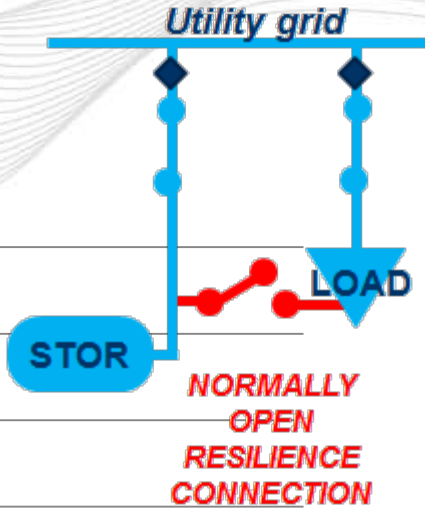


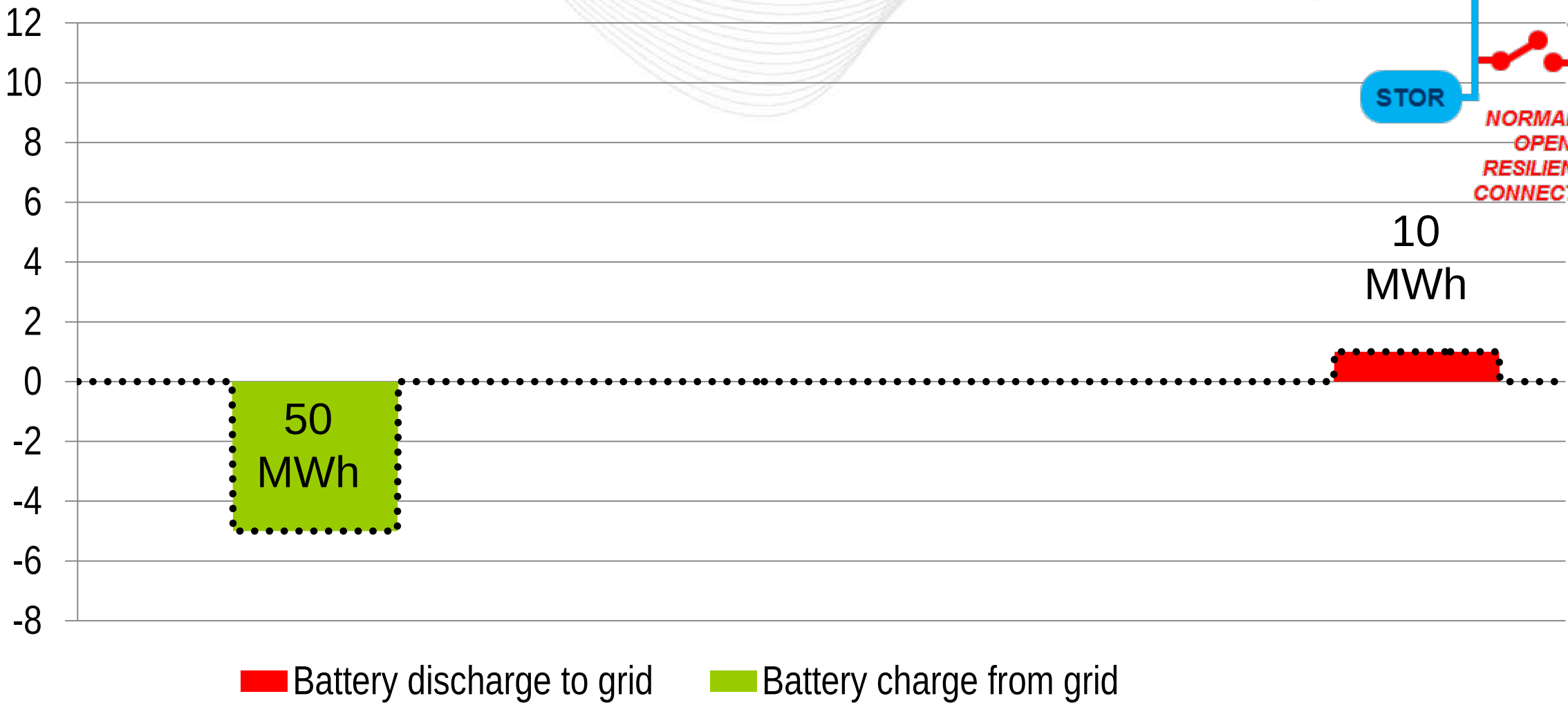
Appendix: Derivation Details for ESR Submeter Method for ESR Alone Case

Definitions

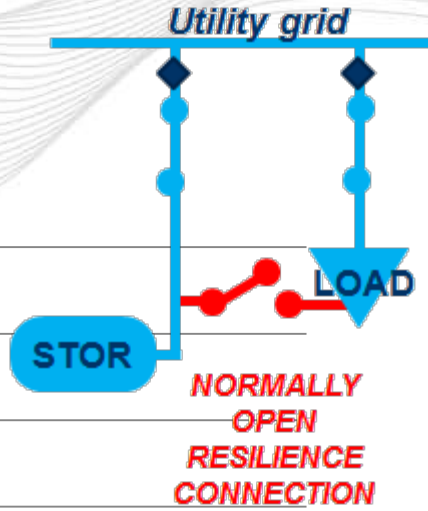
- Wholesale Stored Energy is the (draft) tariff definition.
- It includes Wholesale Stored MWh plus Wholesale Storage Losses.
- Wholesale Stored MWh are MWh that go Grid→ESR and then ESR→Grid.
- Wholesale Storage Losses are unavoidable losses associated with storage of Wholesale Stored MWh.

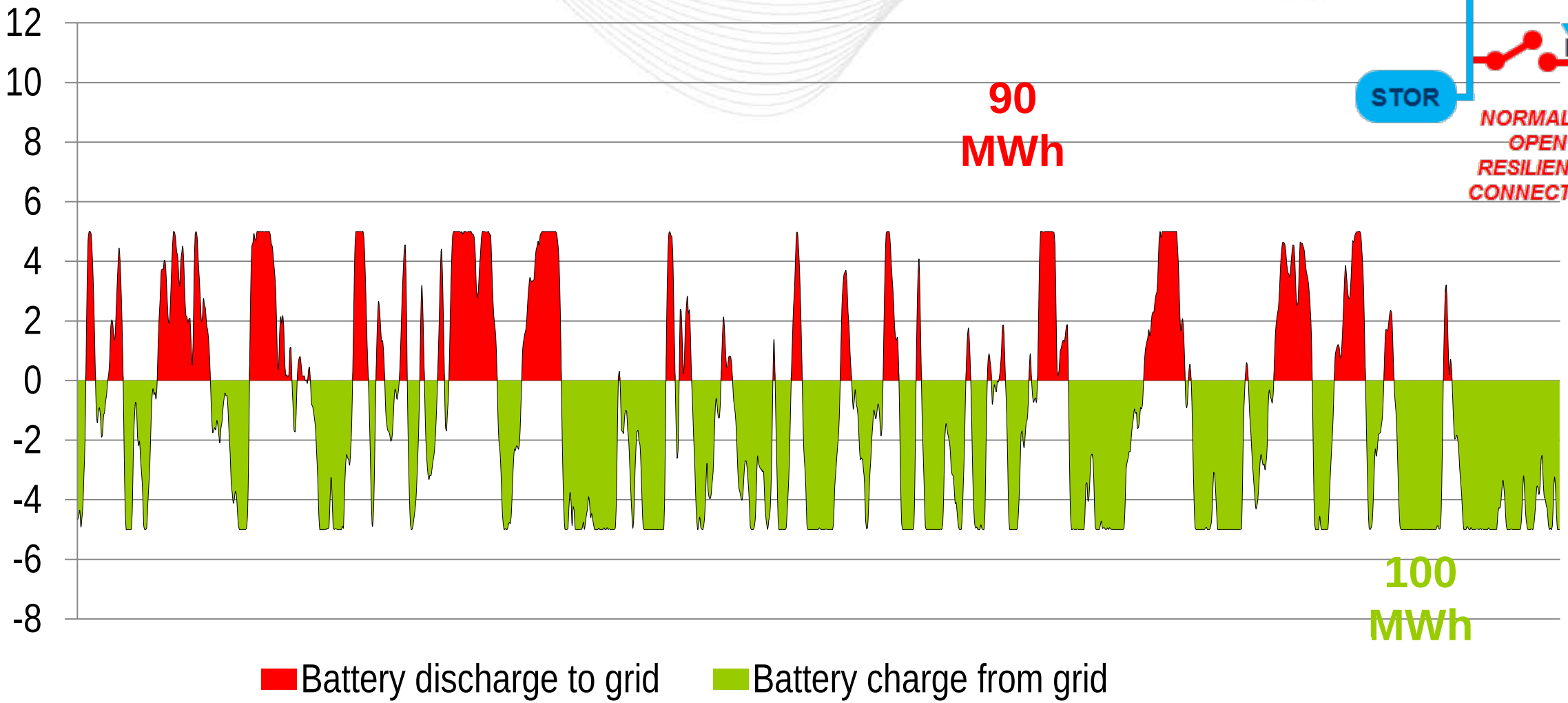
40 MWh of Energy That Are Not “Wholesale Stored MWh”



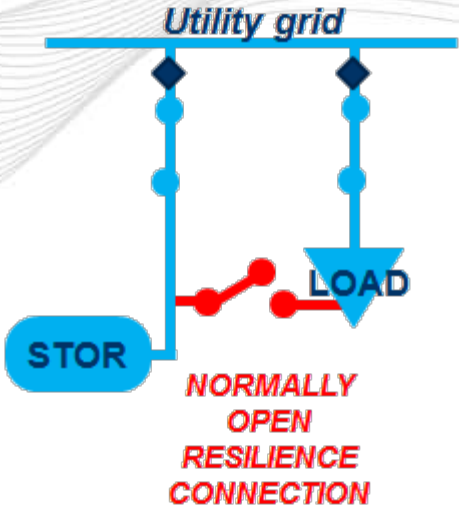


90 MWh that ARE “Wholesale Stored MWh”





ESR Submeter Method for ESR Alone Case



- Wholesale Stored MWh = MWh that both flow:

  Grid → ESR --AND-- ESR→ Grid

Over a long period of time relative to ESR storage capacity:

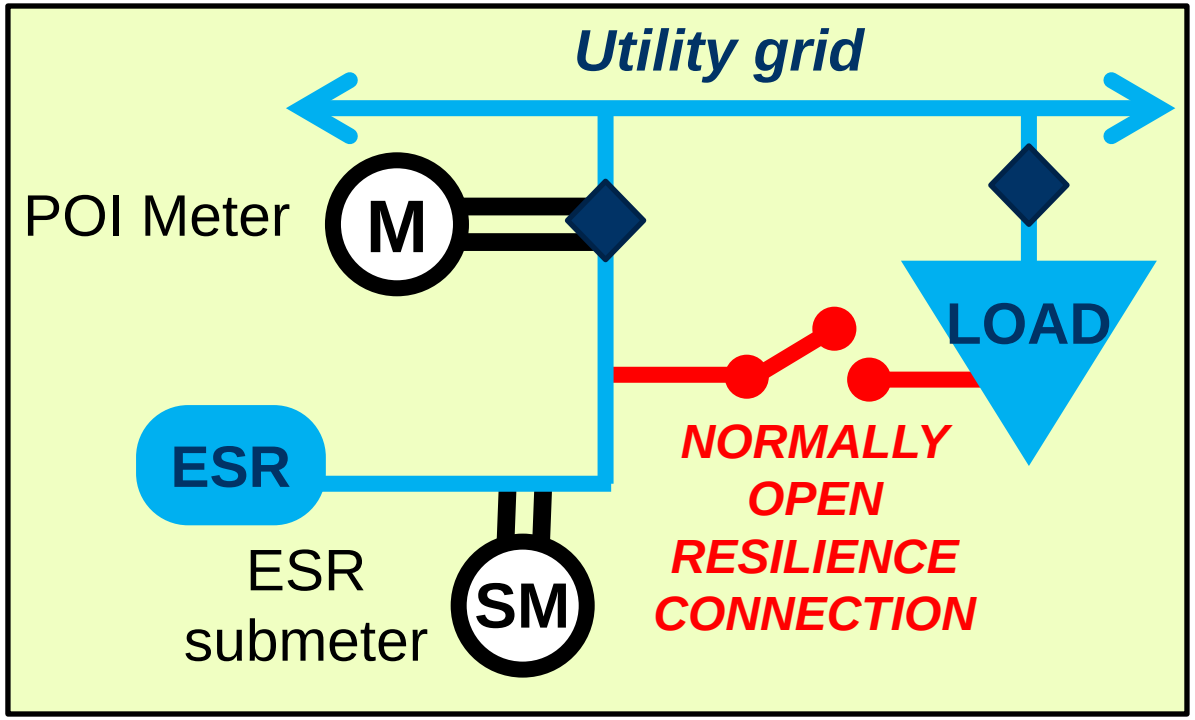
- Wholesale Stored MWh = MIN (Σ**ESR Injections to Grid,** Σ**ESR Withdrawals from Grid)**

Without co-located generation, with significant losses + small stock changes →
ESR Injections are always < ESR Withdrawals

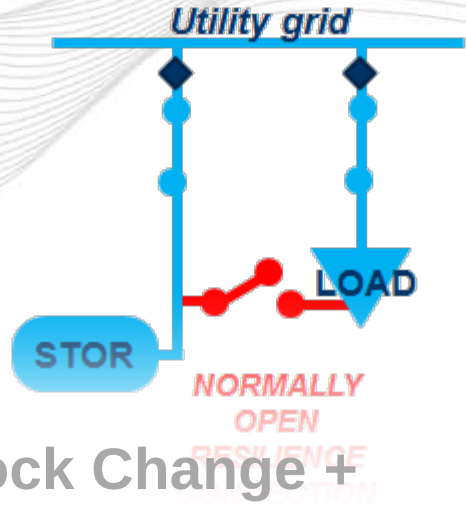
So: Wholesale Stored MWh = ESR Injections to Grid

ESR Submeter Method for ESR Alone Case

- ***ESR Injections*** = monthly **Σ**ESR submeter value when POI MW injects AND ESR submeter MW is producing
- ***Wholesale Losses + Stock Change =*** monthly **Σ**ESR submeter
  - This measures energy that went into the ESR but didn't come out, either because it was lost or it increased the stock.
  - Decreases in stock net against losses.
- **POI withdrawals** = monthly **Σ**POI meter when withdrawing.



ESR Submeter Method for ESR Alone Case



1. **Wholesale Stored MWh = *ESR Injections***

2. **POI withdrawals =**
   - ***Wholesale Sale to ESR*** → **Wholesale Stored MWh +** Wholesale Storage Losses + Wholesale Stock Change +
   - ***Sale to LSE for Retail*** → **Load**

3. **POI withdrawals = *ESR Injections* +** Wholesale Storage Losses + Wholesale Stock Change + **Load**

4. **Load = POI withdrawals – *ESR Injections* –** (Wholesale Storage Losses + Wholesale Stock Change)

Summary of ESR Submeter Method for ESR Alone Case

Wholesale Sale to ESR = ESR Injections **+** ***Wholesale Losses + Stock Change***

Sale to LSE for Retail = **POI withdrawals –** ***ESR Injections*** **–** ***(Wholesale Losses + Stock Change)***

- ***ESR Injections*** = monthly sum of ESR submeter values for instants when POI injects AND ESR submeter is producing.
- ***Wholesale Losses + Stock Change =*** monthly sum of ESR submeter.
- **POI withdrawals** = monthly sum of POI meter withdrawals.