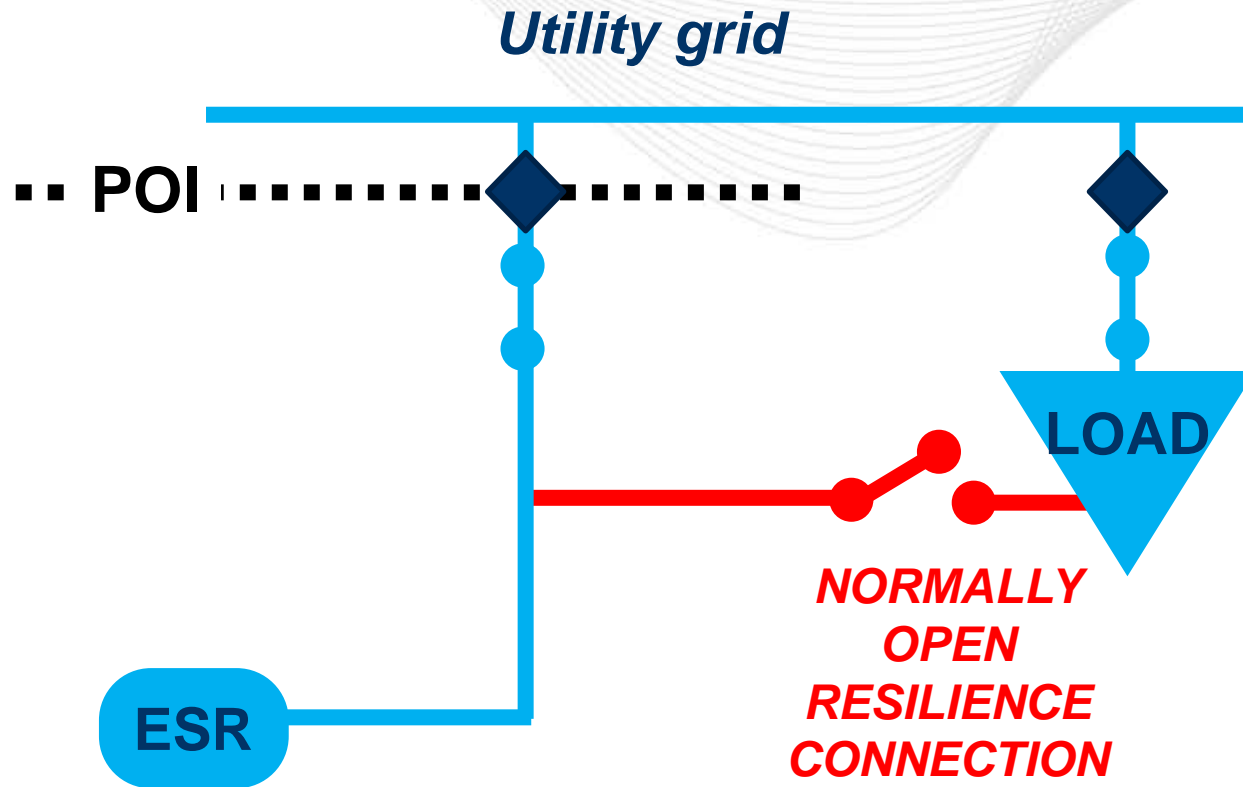


Appendix: other potential accounting methodologies to calculate wholesale stored energy for ESR with ability to serve retail load during an outage/emergency

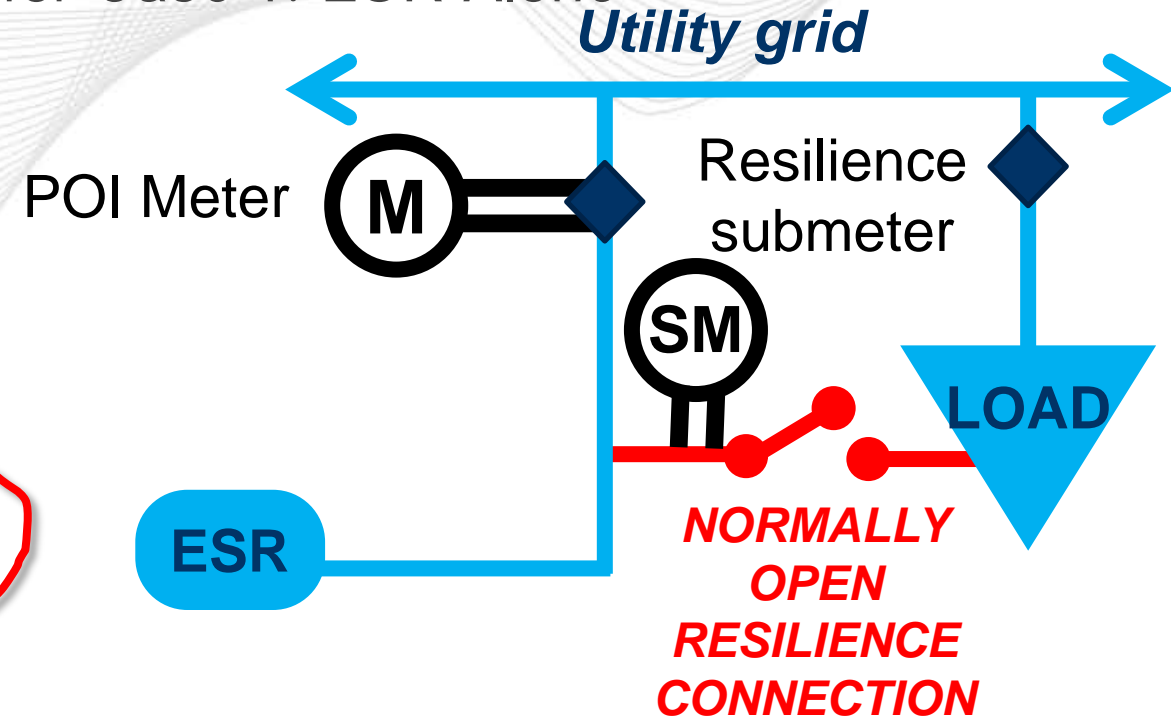
Andrew Levitt, Senior Market Strategist – Emerging Markets
DER Subcommittee
May 21, 2018





Resilience Submeter Method for Case 1: ESR Alone

- 1. Load = Resilience Submeter (SM)
- 2. POI withdrawals = $\left\{ \begin{array}{l} \text{Wholesale Stored MWh} + \\ \text{Wholesale Storage Losses} + \\ \text{Wholesale Stock Change} + \\ \text{Load} \end{array} \right.$
 - Wholesale Sale to ESR* (orange) is associated with the first three items.
 - Sale to LSE for Retail* (pink) is associated with the Load item.
- 3. *Wholesale Sale to ESR* = $\Sigma \text{POI Withdrawals} - \Sigma \text{Resilience Submeter (SM)}$



Derive "Virtual Resilience Meter" = ESR Submeter MW – POI Meter MW

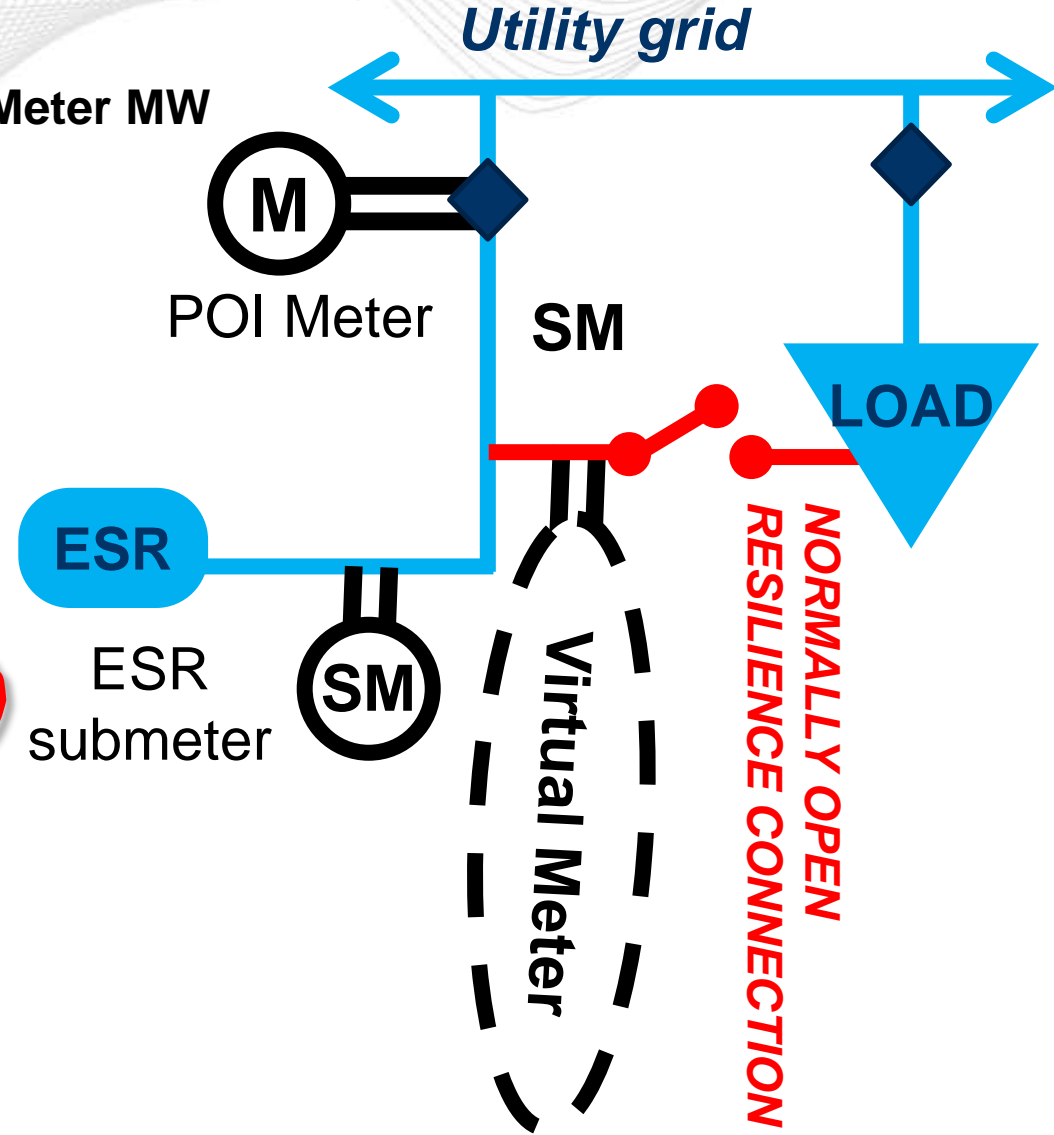
1. Load = Virtual Resilience Submeter (SM)

2. POI withdrawals = $\left\{ \begin{array}{l} \text{Wholesale Stored MWh} + \\ \text{Wholesale Storage Losses} + \\ \text{Wholesale Stock Change} + \\ \text{Load} \end{array} \right.$

Wholesale Sale to ESR

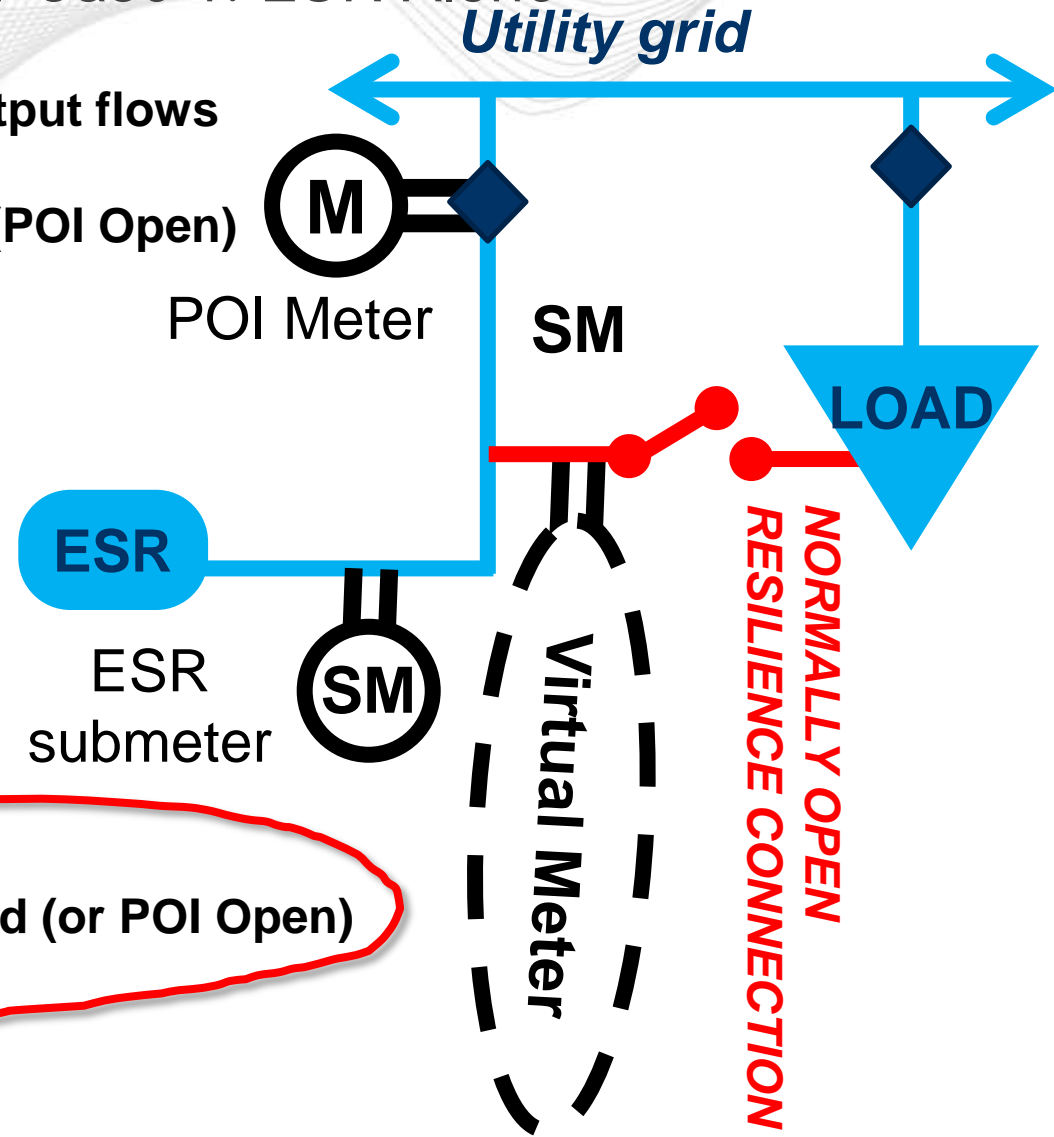
Sale to LSE for Retail

3. *Wholesale Sale to ESR* = Σ POI Withdrawals – Σ Virtual Resilience Submeter (SM)

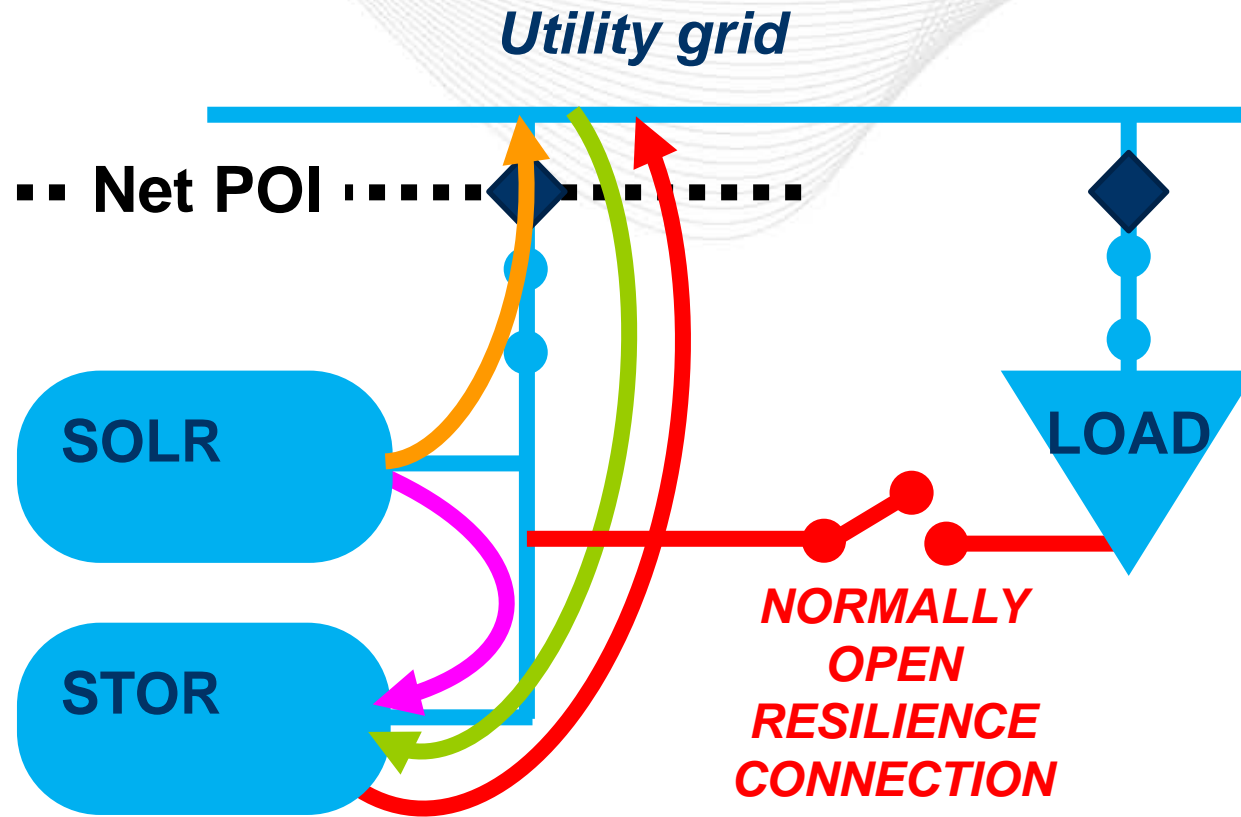


Use switch status to determine direction ESR submetered output flows

1. Load = ESR Submeter when NORC Closed (POI Open)
 2. POI withdrawals = Wholesale Stored MWh + Wholesale Storage Losses + Wholesale Stock Change + Load
- Wholesale Sale to ESR }
Sale to LSE for Retail →



$$3. \text{ Wholesale Sale to ESR} = \Sigma \text{POI Withdrawals} - \Sigma \text{ESR Submeter when NORC Closed (or POI Open)}$$



- Solar to grid
- Battery charge from solar
- Battery discharge to grid
- Battery charge from grid
- Net POI

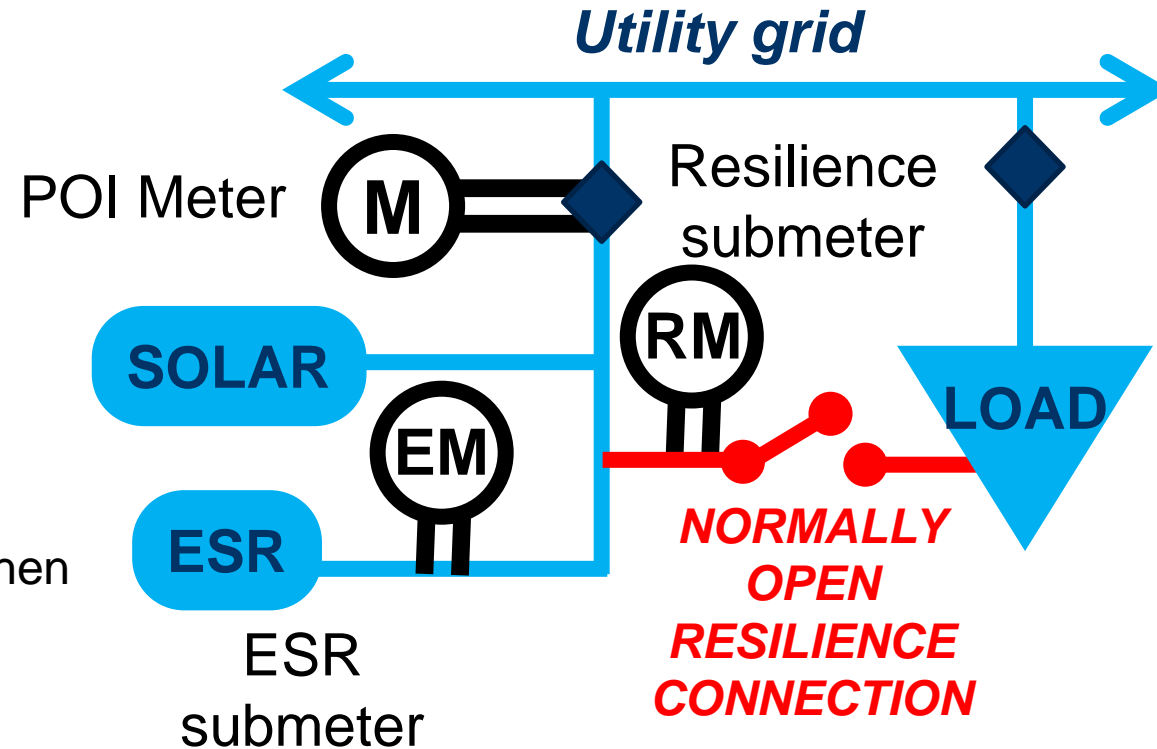
Resilience Submeter Method for Case 2: ESR + Gen

1. DER MWh->Load = Resilience Submeter (RM)
2. *ESR MWh->Load* = Σ ESR submeter production IF RM MW are outbound (or IF POI open)
3. ESR MWh->Load = Stored Self-Supply MWh + Stored Grid MWh
4. Stored Grid MWh/Total Stored MWh = *ESR Withdraw from Grid/Total ESR Charging*
5. ESR Grid MWh -> Load = (ESR MWh->Load)*(Stored Grid MWh/Total Stored MWh)
6. POI withdrawals = Wholesale Stored Energy + (Stored Grid MWh->Load)

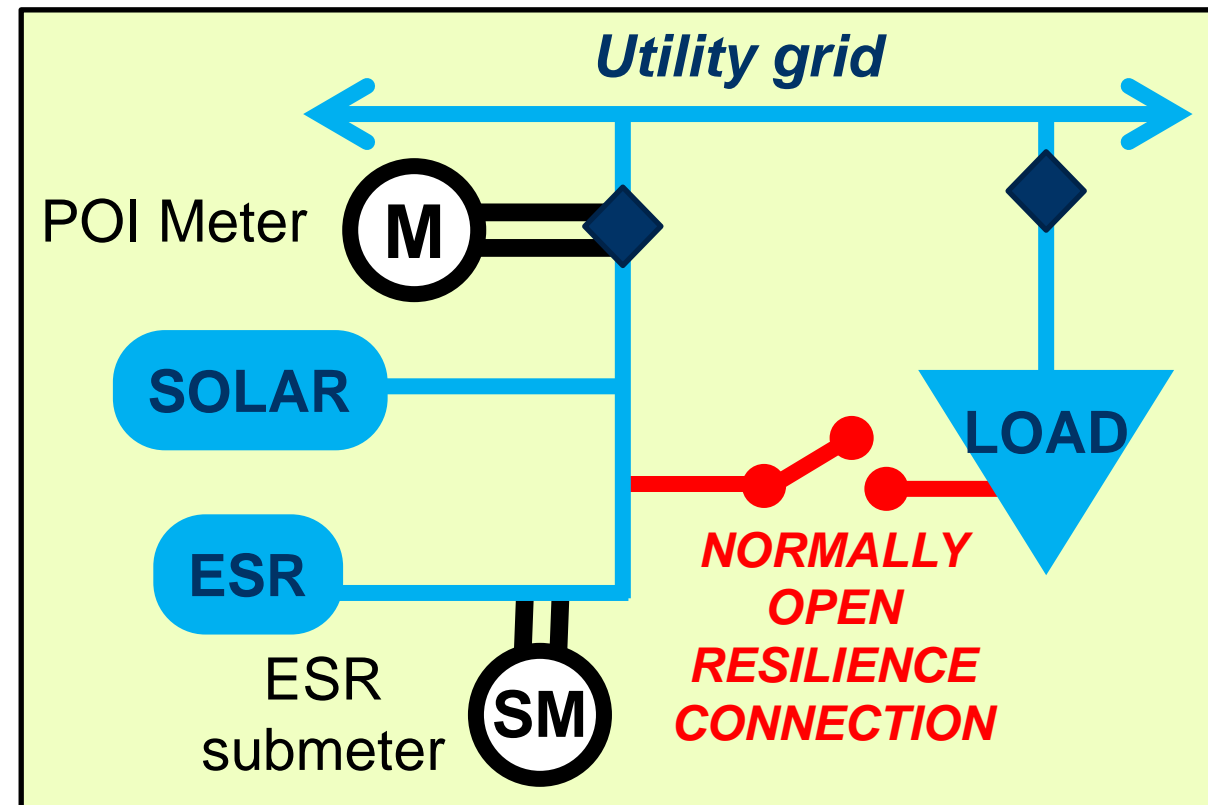
Wholesale Sale to ESR = Σ POI Withdrawals - (*ESR MWh->Load*)* (*ESR Withdraw from Grid/Total ESR Charging*)

ESR withdraw from grid = monthly Σ ESR submeter value when POI MW AND ESR submeter MW both withdraw

Total ESR Charging = monthly Σ ESR submeter value when withdrawing



- **ESR Withdrawals** = Σ ESR submeter when ESR submeter MW withdraws AND when POI MW withdraws (alternatively, when N.O.R.C is open).
- *Total ESR Charging* = Σ ESR submeter withdrawals.
- **ESR Injections** = Σ ESR submeter when submeter MW produces & POI MW injects (alternately, when N.O.R.C.open).
- *Wholesale Losses + Stock Change* = Σ ESR submeter
- **POI withdrawals** = monthly Σ POI meter when withdrawing.

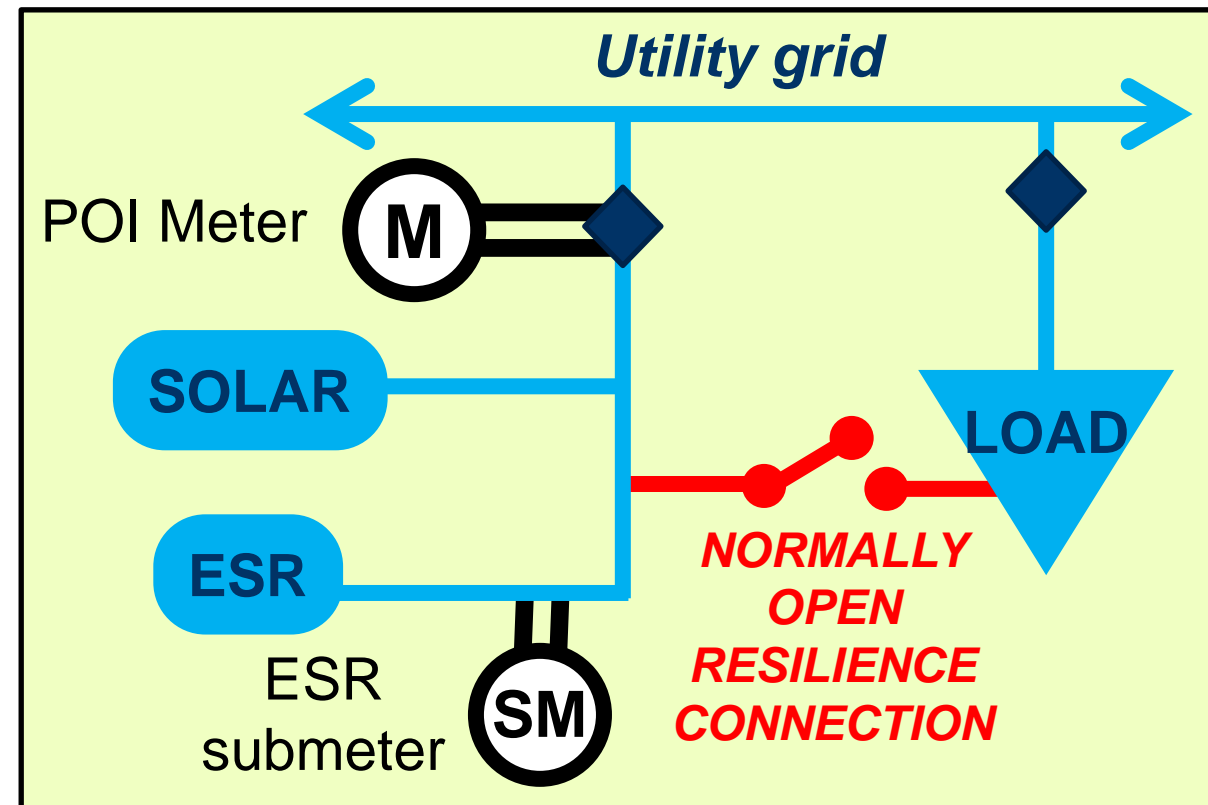


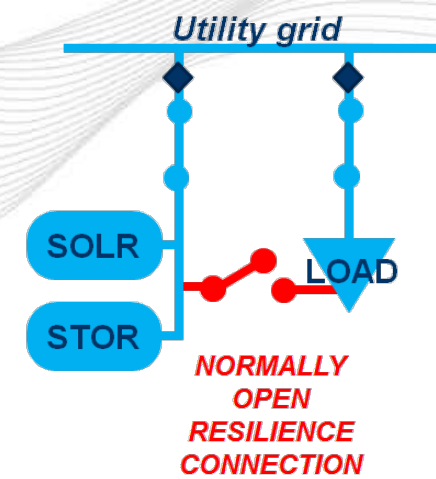
$$Load = \Sigma POI \text{ withdrawals} - \text{MIN}[ESR \text{ Injections}, ESR \text{ Withdrawals}] - \Sigma ESR \text{ Submeter} * (ESR \text{ Withdrawals}) / (Total \text{ ESR Charging})$$

$$WSE = \Sigma POI \text{ withdrawals} - Load$$

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

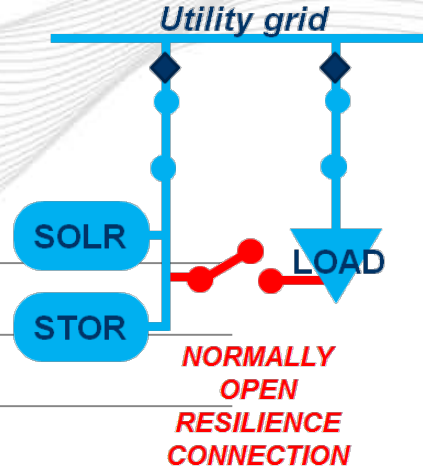
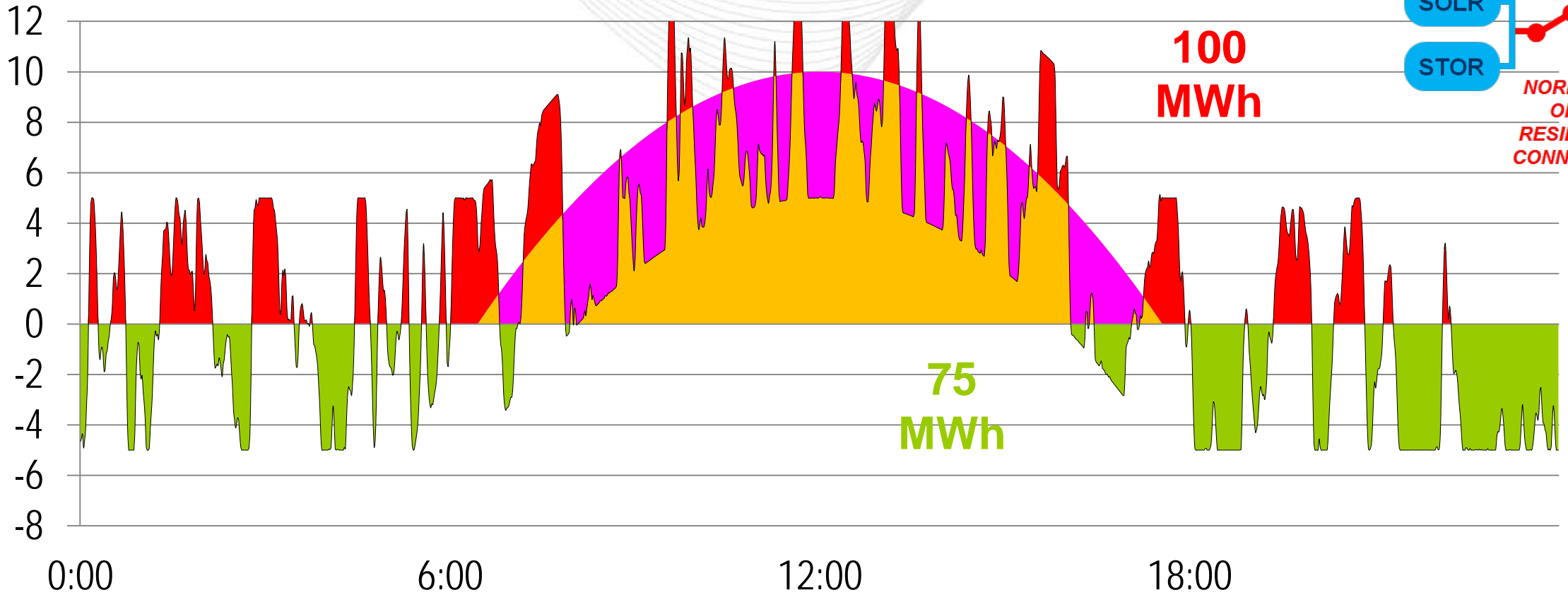
See Appendix for derivation





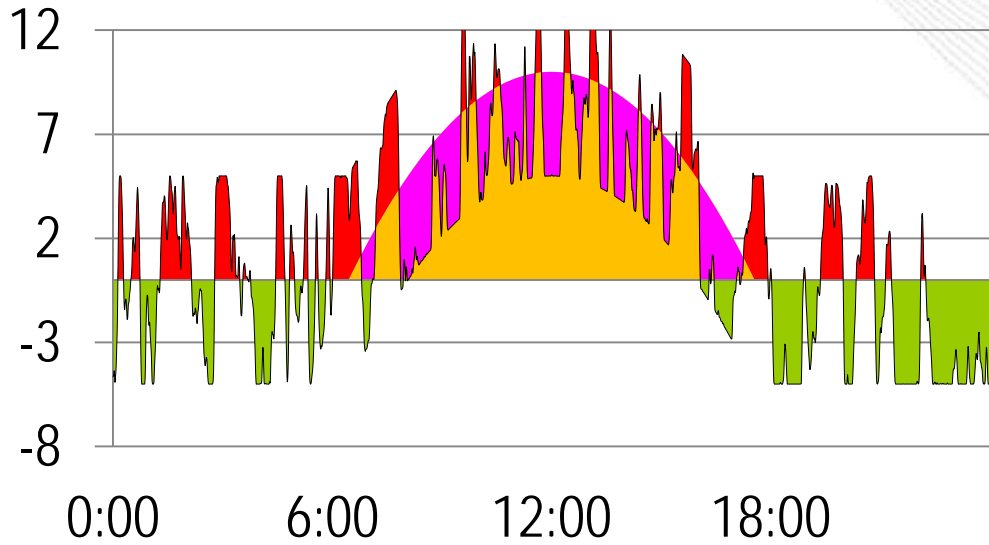
Appendix: Derivation Details for ESR Submeter Method for Case 2 – ESR + Gen

75 MWh that ARE "Wholesale Stored MWh"

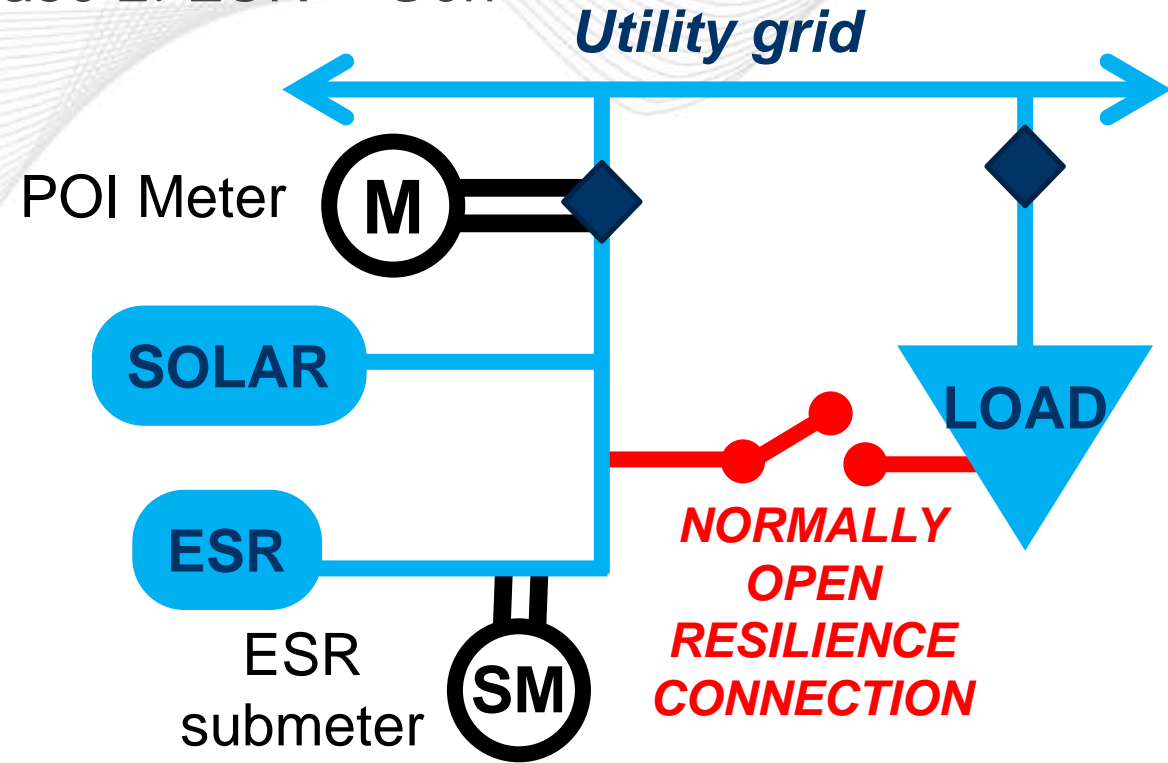


- Solar to grid
- Battery charge from solar
- Battery discharge to grid
- Battery charge from grid
- Net POI

ESR Submeter Method for Case 2: ESR + Gen



- ESR withdraw from grid
- ESR inject to grid
- ESR charge from solar
- Solar inject to grid
- Net POI



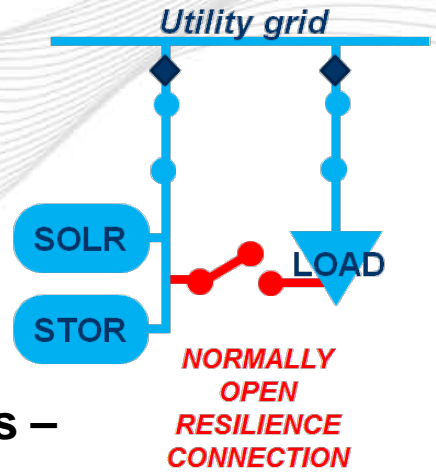
ESR withdrawals from grid = \sum ESR submeter value when POI MW and ESR submeter MW both withdraw

ESR injections to grid = \sum ESR submeter value when POI MW injects AND ESR submeter MW is producing

Wholesale Losses + Stock Change = $(\sum \text{ESR submeter}) * (\text{ESR Withdraw from Grid}) / (\text{Total ESR Charging})$



ESR Submeter Method for Case 2: ESR + Gen



1. Wholesale Stored MWh = MIN [ESR Injections, ESR Withdrawals]

2. POI withdrawals = Wholesale Stored MWh +
Wholesale Storage Losses +
Wholesale Stock Change +
Load

3. Grid Load = POI withdrawals –
Wholesale Stored MWh –
(Wholesale Losses +
Wholesale Stock change)

A. ESR injections are less

A. POI withdrawals –
ESR Injections –
(Wholesale Losses +
Wholesale Stock Change)

B. ESR withdrawals are less

B. POI withdrawals –
ESR Withdrawals –
(Wholesale Losses +
Wholesale Stock Change)

Wholesale Losses + Stock Change = $(\sum \text{ESR submeter})^*$
 $(\text{ESR Withdrawals from Grid}) / (\text{Total ESR Charging})$