Continuous Storage Facility Metering – September 2024 Update

Update of October 2021 Presentation with Lessons Learned

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Agenda

- What is a Continuous Storage Facility (CSF)
- CSF Metering and Telemetry Considerations
- Original Proposed Best Practices from 2021
- Lessons Learned since 2021
- Proposed Best Practices for Metering and Telemetry - Revised
- Appendix 1: Other observed metering configurations that create un-needed complexity and potential problems - Revised
- Appendix 2: Tariff References
- Appendix 3: January 22, 2024 MRWG Presentation on Charging Load vs. Station Service Load

What is a CSF?

- A Facility that is directly metered and can store energy for later release and respond to economic dispatch
  - Must be able to consume and inject at least 100 KW
  - Can offer to consume when prices are low and generate when prices are high via price/quantity pairs
  - May also offer to regulate
  - Full requirements are in Section III.1.10.6 of the Tariff
- In ISO systems it consists of three assets:
  - A dispatchable Generator
  - A dispatchable load (DARD)
  - An Alternative Technology Regulating Resource that may provide regulation service

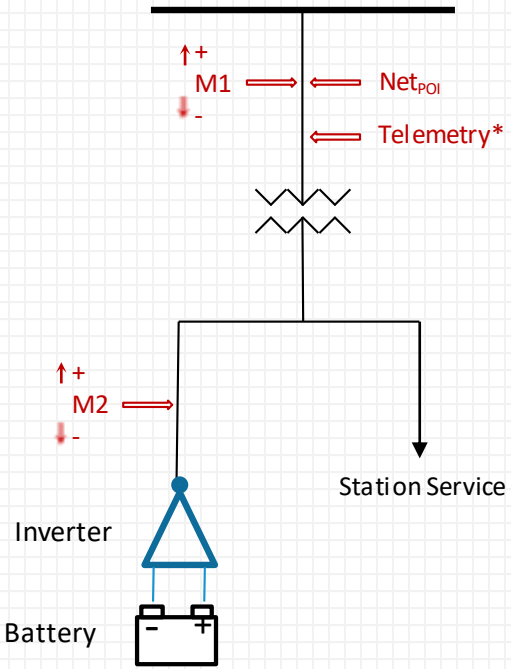
CSF Metering Considerations - RQM

- RQM required for both load and generation in all intervals
  - These values may both be (and often are) non-zero in the same interval
- Like all generators, generation must be reported net of any station service load
  - Station service is load used to support gen when not supplying net power
- CSF's are exempt from being charged for capacity
  - This exemption applies to the entire CSF, including Station service
- The charging load of a CSF (but not the station service load) is also exempt from Schedule 9 transmission charges that are based on the load during the local system monthly peak hour (RNS Rate is zero)
  - To get this exemption, the charging load must be set up as an exempt Network Load Asset that does not include any station service load

CSF Metering Considerations - Telemetry

- Because a CSF may provide regulation, 4 second telemetry is required
- Telemetry must include the entire CSF, including station service
- Telemetry for MW will be positive when the CSF is generating and negative when it is load (single set of telemetry)
- Telemetry may be used to profile 5 minute interval data for generation and load if RQM is hourly

Electric Storage Metering Proposed Best Practice (Original from 2021)



Telemetry: Located (or compensated to) at the same point as M1 and MW will be positive when there is net generation and negative when there is net load.

RQM: Net$_{POI}$ = M1

Note that both M1 and M2 must have separate registers for generation and load, and that either may record non-zero values for both generation and load in the same interval.

*For a large CSF, the POI transformer may be included in the ISO's Power System Model. If that is the case, the telemetry point would be on the low side of the POI transformation.

ENERGY SETTLEMENT:

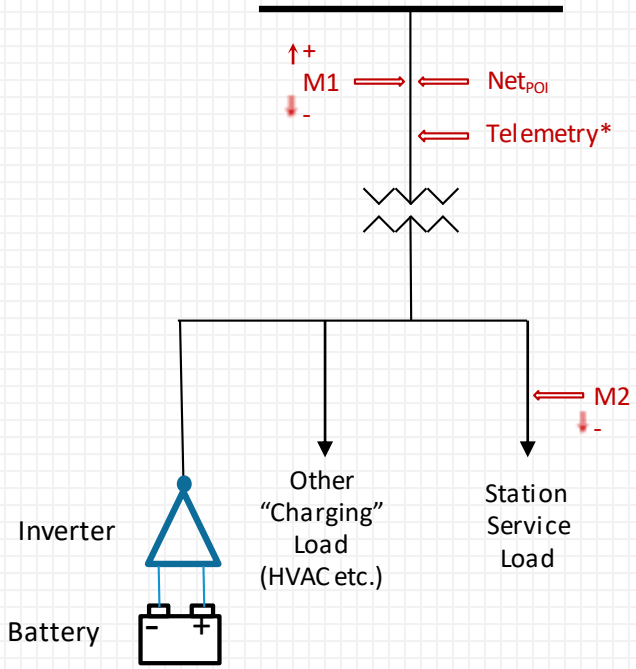
Gen Asset: Net$_{POI}$ (generation register)
DARD: Net$_{POI}$ (load register)

Regional Network Load reporting of Charging Load is from M2
Any charging load occurring at M2 that may occur during the local system monthly peak hour is reported for the exempt Network Load Asset. Station service is included within the non-exempt network load.

Lessons Learned since 2021

- Under the original proposed best practices, the concept was to use a second meter on the charging load associated with a Network Load asset set up to be exempt from Schedule 9 RNS charges, and report the station service based network load as the difference between the POI metering and that second meter
- We have become aware that a significant portion of what was originally thought to be station service load is actually charging load (based on FERC Order 841) since it is required for a BESS facility to operate as a CSF
  - This includes HVAC systems used to maintain the BESS at operable conditions
- Meter engineers from two utilities have expressed concern that directly metering the charging load for the purpose of reporting Network Load is problematic
  - Rapid cycling of the storage facility between charging and discharging from moment to moment while providing regulation service is incompatible with calculating station service network load from the two meters. The time variance (drift) between the two meters can significantly impact the calculation.
- Under a revised best practice, the second meter is instead set up to measure the Station Service (non-Charging) load, which is not as volatile as charging load may be

Electric Storage Metering Best Practice (Sept. 2024 Update)



Telemetry: Located (or compensated to) at the same point as M1 and MW will be positive when there is net generation and negative when there is net load.

RQM: Net$_{POI}$ = M1

Note that M1 must have separate registers for generation and load, and that either may record non-zero values for both generation and load in the same interval. M2 measures only non-charging station service load and must be an interval meter as it is used for Regional Network Load reporting for Station Service.

*For a large CSF, the POI transformer may be included in the ISO's Power System Model. If that is the case, the telemetry point would be on the low side of the POI transformation.

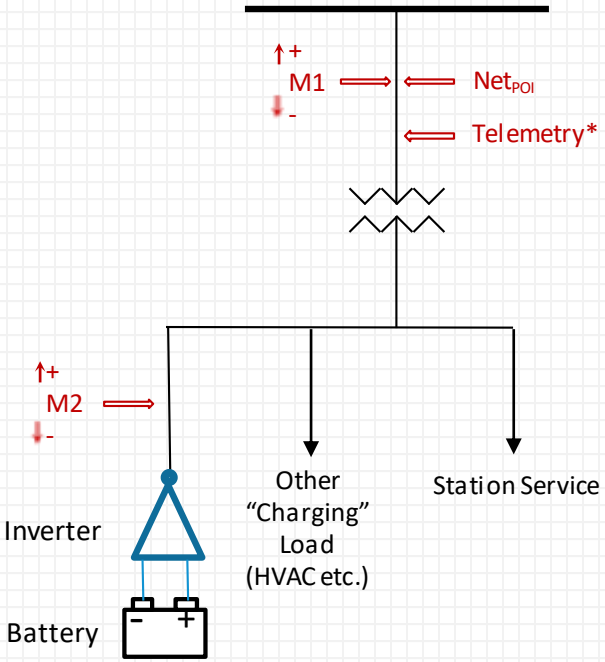
ENERGY SETTLEMENT:

Gen Asset: Net$_{POI}$ (generation register)
DARD: Net$_{POI}$ (load register)

Regional Network Load reporting
Charging Load MW = M1-M2 (during monthly local system peak hour)
Station Service Load MW = M2 (during monthly local system peak hour)
Any charging load that may occur during the local system monthly peak hour may be reported for the exempt Network Load Asset. Station service is included within the reported non-exempt network load.

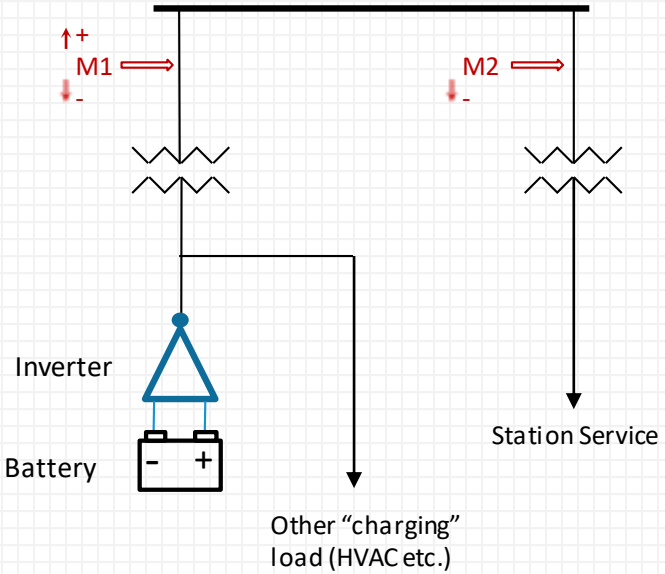
APPENDIX 1 – CSF METERING CONFIGURATIONS THAT ARE OVERLY COMPLICATED AND/OR PROBLEMATIC

Electric Storage Metering – Problematic Design 1 (revised)



- For energy market reporting for the generator and DARD, just the two registers of M1 are required, M2 is not needed
- Without a meter for just the charging energy or just the station service, the required exemption of charging energy from transmission costs is not possible
- Even if M2 was able to be installed to measure all charging load, this configuration is problematic.
  - For a CSF providing regulation, we can expect rapid power flow changes to occur between the maximum consumption and the maximum generation.
  - If the time clocks between M1 and M2 become even slightly out of synch, significant error in the calculation of station service load may result.
  - A better design moves M2 to the station service load (see slide 8), where it can be directly reported as part of a non-exempt RNL Asset
    - In such a design, the exempt charging load may be derived as the difference between M1 and M2, where M2 measurement is more stable since it represents only station service load
    - Any minor time clock drift between the two meters will have negligible impact to the reported value for the exempt Network Load asset

Electric Storage Metering – Problematic Design 2 (revised)



- **Net_{POI}=M1 + M2**
- Telemetry as well as revenue quality interval data must be installed and summed from both M1 and M2 locations, an un-needed complexity
- While this design does allow for M1 to be used to report RNL for the exempt RNL Asset and M2 to report station service load as part of a non-exempt Network Load Asset, it creates an issue for energy market reporting:
  - Energy reporting logic must be different depending if generation is > station service load or not.
    - When generation exceeds station service, generation must be reported net of station service.
    - When station service load is greater than generation, net station service must be reported as part of a load asset
    - Since the facility can transition between load and generation many times within a single interval, complying with these requirements may be administratively infeasible

APPENDIX 2: TARIFF AND GOVERNING DOCUMENT REFERENCES

Treatment of charging load and station service

Net RQM requirement for generators

Market Rule 1 - III.13.7.5.2. Calculation of Capacity Load Obligation and Zonal Capacity Obligation.

The following loads are assigned a peak contribution of zero for the purposes of assigning obligations and tracking load shifts: **load associated with the receipt of electricity from the grid by Storage DARDs** for later injection of electricity back to the grid; **Station service load that is modeled as a discrete Load Asset** and the Resource is complying with the maintenance scheduling procedures of the ISO; load that is modeled as a discrete Load Asset and is exclusively related to an Alternative Technology Regulation Resource following AGC Dispatch Instructions; and transmission losses associated with delivery of energy over the Control Area tie lines.

SECTION II
ISO NEW ENGLAND OPEN ACCESS TRANSMISSION TARIFF

II.21.3 Exception to Payment for Regional Network Service: Regional Network Service charges associated with an Electric Storage Facility's charging load: The applicable Local **Network RNS Rate shall be reduced to zero for monthly Regional Network Load associated with the charging load of an Electric Storage Facility**. The reduction to zero of the applicable Local Network RNS Rate shall only apply to the Schedule 9 charges. **This discount will only be applied to Electric Storage Facility charging load that (a) is reported under a separately identified Regional Network Load that does not include station service load or any other load** and (b) is providing one or more of the following services to the ISO: reactive power voltage support, operating reserves, regulation and frequency response, balancing energy supply and demand, or addressing a reliability concern. Electric Storage Facilities shall be considered to be balancing energy supply and demand when they are responding to ISO dispatch instructions in the Real-Time Energy Market. The applicable Local Network RNS Rate will be applied to Electric Storage Facility charging load unless it is reported as described in (a) above and is providing one or more services as described in (b) above.

SECTION II
ISO NEW ENGLAND OPEN ACCESS TRANSMISSION TARIFF

- II.22.3 Network Resource Obligations: The following obligations of the Network Customer are specific to a generator Network Resource.
- "(c) Station Service: When the Network Customer's **generation facility is producing electricity, the Network Customer must supply its own station service power**. If and when the Network Customer's generation facility is not producing electricity, the Network Customer must obtain station service capacity and energy from another supplier or another of its resources."

Market Rule 1 Accounting Manual M-28

- 7.2.3 Generator Assets
- “(2) Generator Assets directly connected to the PTF system must be reported net to the PTF boundary. Where PTF boundary metering is not utilized, Generator Assets that are directly connected to the PTF system may be reported either **net** to the generator terminals or to the PTF boundary. Generator Assets connected to the non-PTF system must be reported **net** to the point of interconnection with the utility(s) to which they are directly connected in accordance with ISO New England Operating Procedure 18 and as the Generator Assets are consistently defined in accordance with ISO New England Operating Procedure 14 Section II.A.”

Market Rule 1 Accounting Manual M-28

- 7.2.4.3 STATION SERVICE LOAD
- "**Station service load is energy utilized by Generator Assets when not delivering net generation to the power grid**. This load may include energy while a facility is economically dispatched off-line, on a maintenance outage, starting up, or shutting down. This type of load does not include energy utilized for the construction of new facilities. Station service loads may be modeled as an Asset Related Demand if they meet the Asset Related Demand eligibility criteria. Otherwise, station service load must be reported as part of a Load Asset that is not an Asset Related Demand."

APPENDIX 3:

January 22, 2024 MRWG Presentation on Charging Load vs Station Service Load at Electric Storage Facilities

Charging Load vs. Station Service Load at Electric Storage Facilities

Implementation of FERC Order 841 rules associated with the transmission cost exemption for charging load

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Topics to Cover

- What are Electric Storage Facilities?
- Distinction Between charging load and Station Service Load
- What does ISO-NE consider as charging load?
- Current Implementation

What are Electric Storage Facilities?

- Facilities that participate in wholesale markets as either a Binary Storage Facility (BSF) or Continuous Storage Facility (CSF)
  - See Section III.1.10.6 of Market Rule 1 for more details
- This presentation applies only to these two participation models

Distinction Between Charging Load and Station Service Load

- Both Charging energy and net Station Service energy must be reported as part of a Load Asset and charged LMP
- Unlike Station Service, charging load may be exempt from Schedule 9 transmission cost allocations so long as it does not include any other loads
  - This was required by FERC under Order 841, and is referenced in II.21.3 of the OATT
  - Transmission cost allocations are based on reported Network Load
    - MW demand during the local system monthly peak hour, NOT energy based

From FERC Order on ISO-NE Order 841 Compliance

"Order No. 841 finds that efficiency losses are charging energy and therefore not a component of station power load. Thus, charging energy lost to conversion inefficiencies should be settled at the LMP as long as those efficiency losses are an unavoidable component of the conversion, storage, and discharge process that is used to resell energy back to RTO/ISO markets and are not a component of what an RTO/ISO considers onsite load. With respect to directly integrated and other ancillary loads, Order No. 841 provides RTOs/ISOs flexibility to determine whether they are a component of charging energy or a component of station power."

What does ISO-NE consider Charging Load?

- The actual AC power from the bulk power system used to charge the Storage Facility
- Loads that are an unavoidable component of the charge/discharge process
  - This includes HVAC load where the HVAC is used to maintain BESS within operating parameters per the manufacturer
- Charging load does not include any loads without which the BESS could still operate as a BSF or CSF

Current Implementation

- When a new Network Load asset is registered, the associated Participating Transmission Owner who owns the Local Network may check a box indicating that the asset represents charging load and will be exempt from the applicable Schedule 9 charges
  - If any non-charging load is included, its associated Network Load asset is not exempt from the applicable Schedule 9 charges
- In the event of a disagreement between the Participating Transmission Owner and the Storage Facility owner, in accordance with Order 841, the ISO will make a determination after consulting with both parties

Questions