
Presentation to the PJM Net Energy Metering Senior Task Force

Metering Considerations

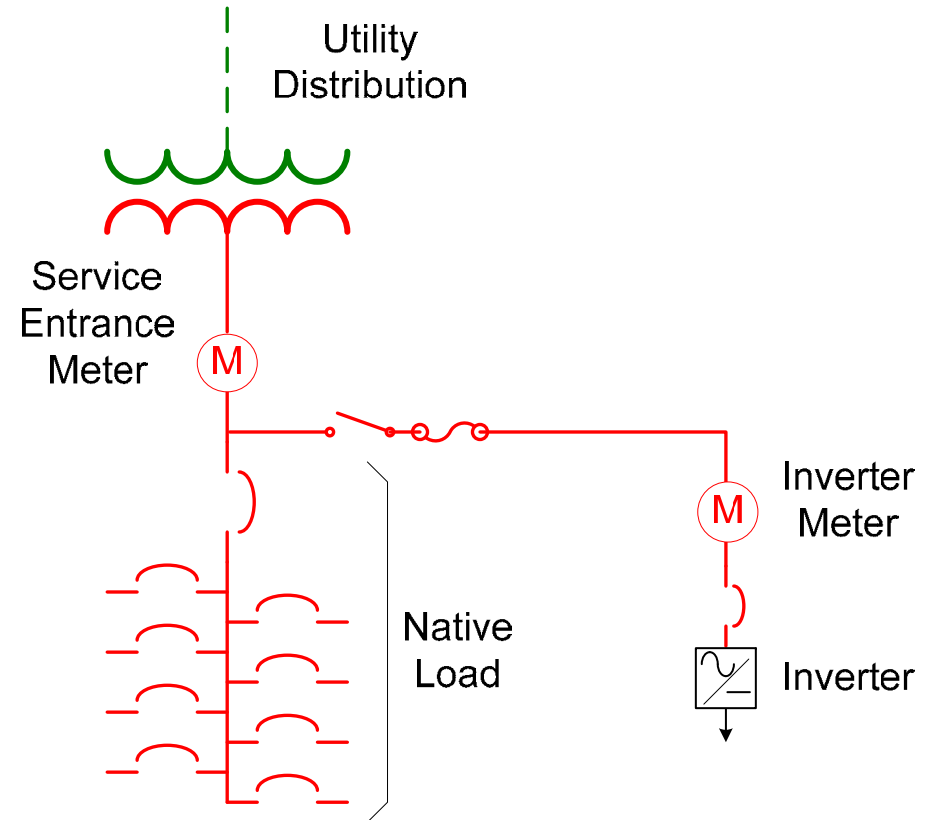


Metering Subjects

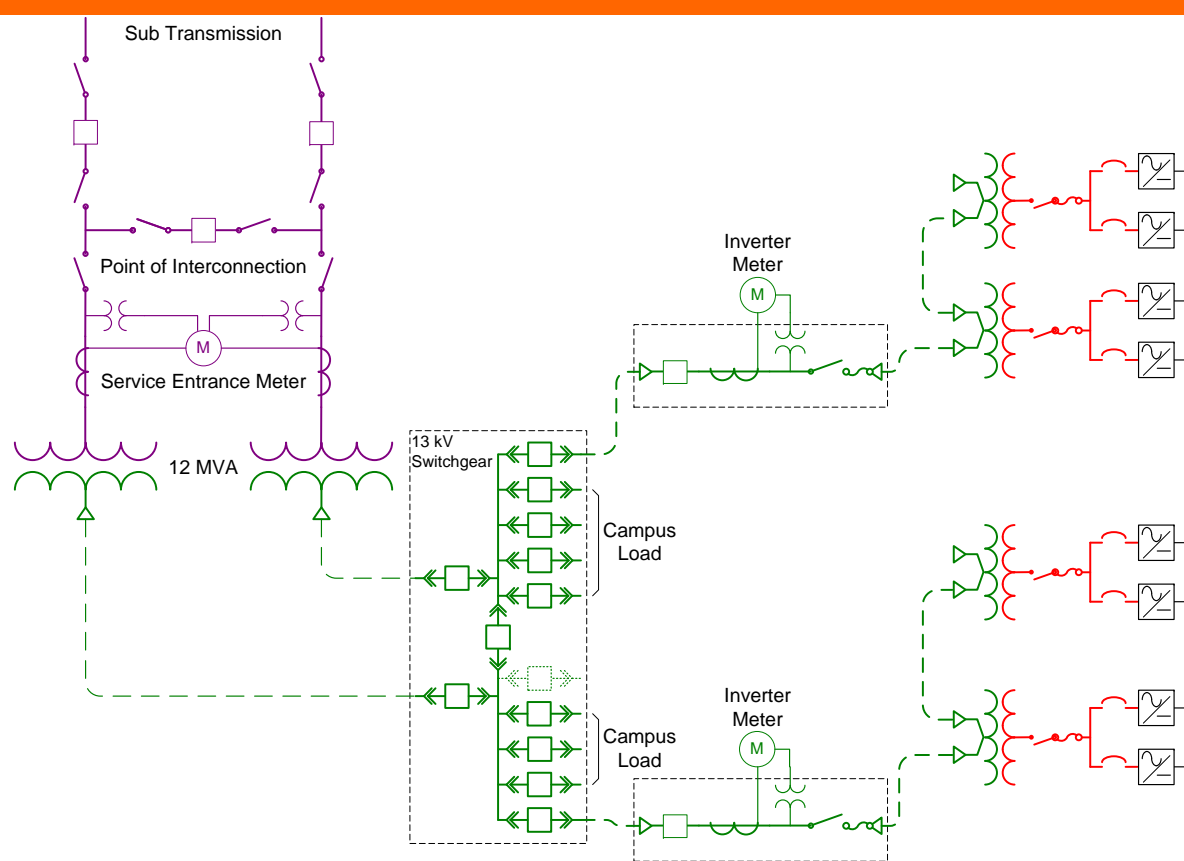
- Metering Definitions
- Solar Renewable Energy Certificate - NJ Guidelines
- Settlements Metering vs Real Time Metering
 - Why worry about clouds
- Meter Data Registers & Communication

Meter Locations for PV connections

- When solar is added to an existing residential service:
 - The Service Entrance Meter is changed to a meter that measures energy in both directions.
 - A 2nd meter is installed to measure Inverter production.
 - Inverter meters are used to earn SRECs
 - NJ Inverter meters are to be revenue grade performance (C12.1-2008)
 - Inverter meters are typically not installed, read or maintained by the utility
 - Inverter meters originally were not required for < 10 kW systems.
 - All new systems have Inverter meters.

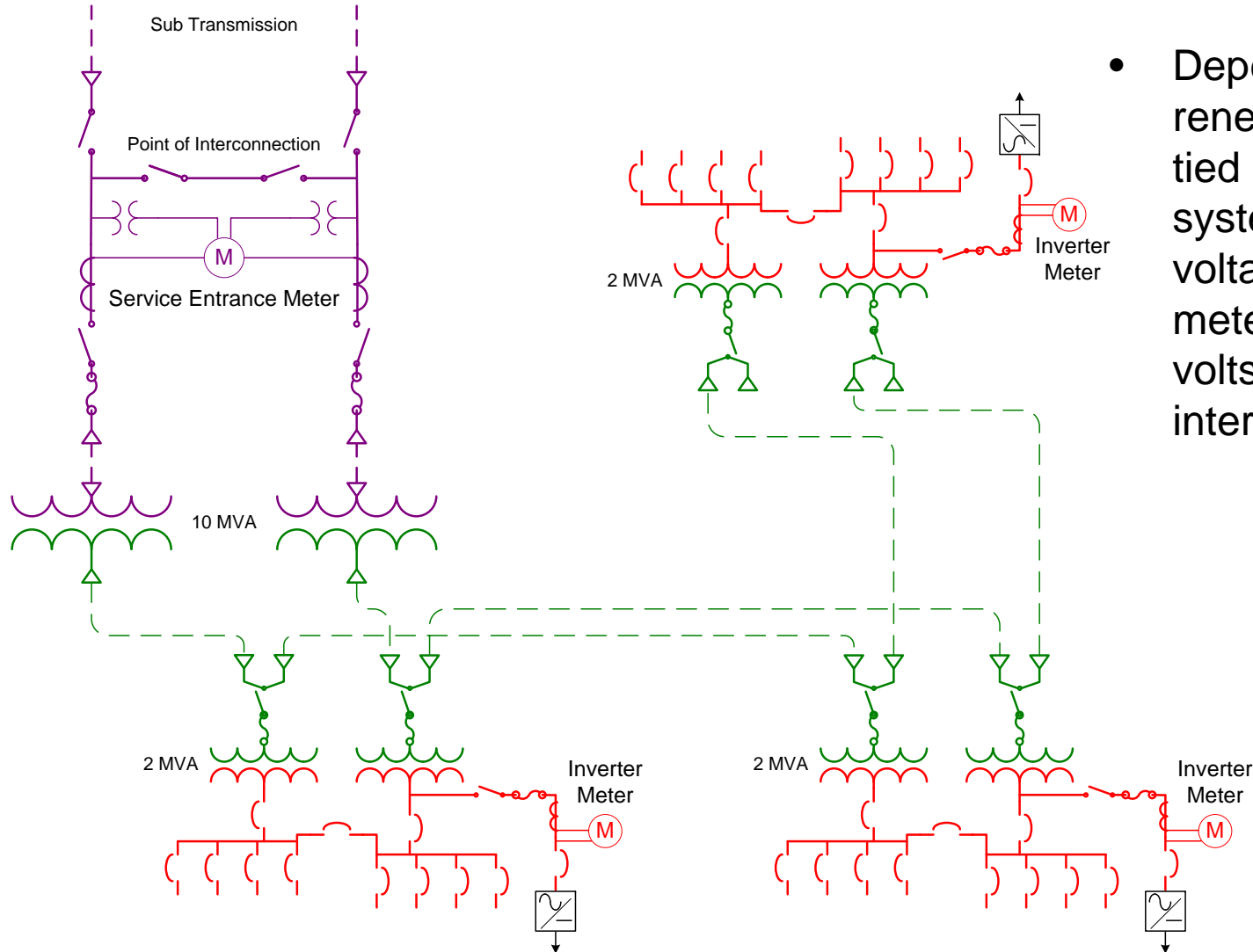


SREC Meter Locations



- 3/9/12 NJ Clean Energy clarified rules for Inverter meter location.
- The inverter meter must be located at a point that will reflect the electrical generation that is delivered to the customer's facility and/or to the point of interconnection.

Another Case



- Depending on how renewable generation is tied into the existing system, the correct voltage for the Inverter meter could be 480 volts, 13 kV or the interconnection voltage.

Distributed Generation Connections

- Net Metering under State Tariff
- Non Export Generation Behind the Meter
- Merchant Generation under State Tariff
- Merchant Generation in PJM Energy Market
- Merchant Generation in PJM Capacity Market

Settlements Metering vs Real Time Metering

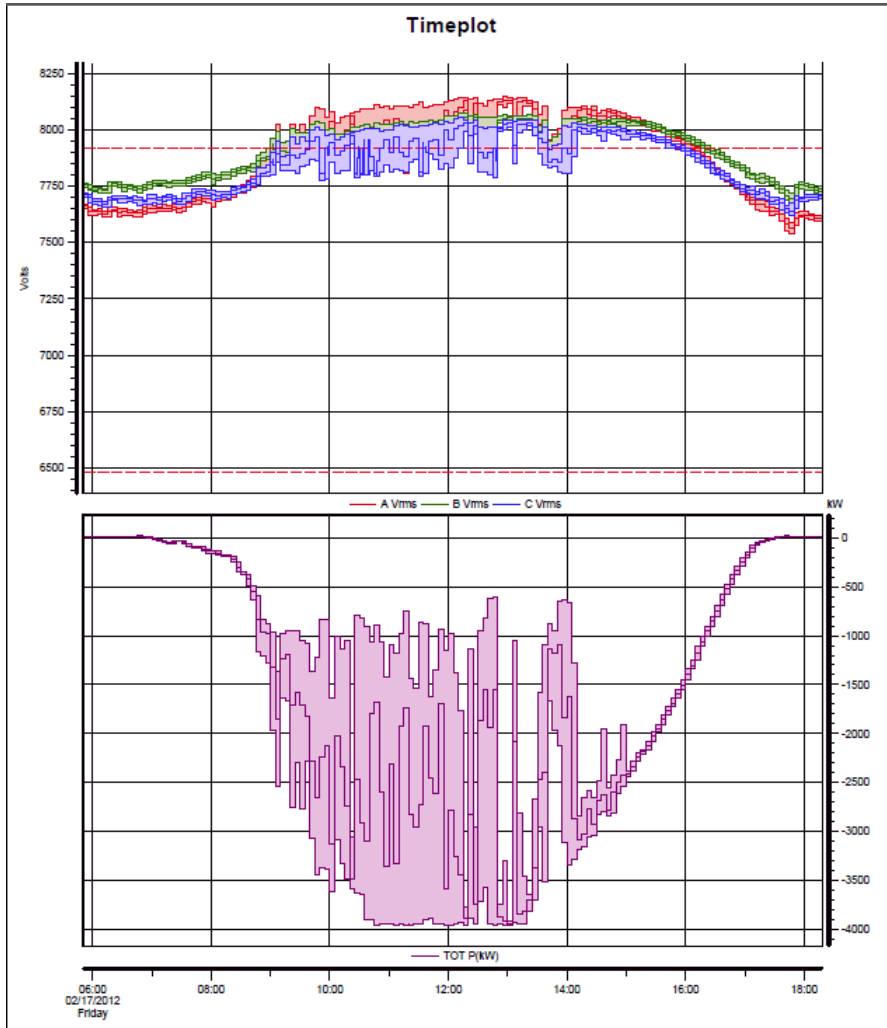
- PJM Capacity Market participants must provide Real Time Data.
- To support power quality and other operational concerns, EDCs may need Real Time Data.
- For Large (> 100 MW generators) Real Time Metering systems may be designed to be independent and redundant to Settlements Metering Systems.
(Independent instrument transformers)
- For Distributed Generation (< 20 MW) shared instrument transformers may make sense. Metering CTs may be better sized to the customer load / PV system capacity. Metering CTs provide better low current performance than Relay CTs.

Settlements / Real Time Metering

- Meter Enclosure containing
 - Settlements Metering,
 - +kWh, -kWh
 - Real Time Metering,
 - +kWh, -kWh
 - +kVARh, -kVARh
 - voltage
 - And Communication equipment.



Why should clouds matter?



- Feeder voltage management may be challenged by some distributed generation installations.
- Clouds may cause PV output to fall by 80%.
- For moderately large PV systems near the end of a feeder, voltage swings may be problematic.

Meters – Data Registration / Comm

- Several kinds of meters can be used for Net Metering:
 1. Electromechanical meter w/ kWh register (dials)
 2. Solid State meter with total kWh (-kWh) displayed
 3. Solid State dumb meter with a smart system
[System reads meter frequently to create interval data.]
 4. Solid State meter with interval data and remote communications
- While two (single direction) meters could be used, this is not expected to be broadly utilized.

Many Meters Measurement vs. Registration

- Meters have different internal connections and terminal arrangements for different configurations of electrical services.
- For a method of registering and communicating energy data, a utility will use several different inventory items:
 - Self Contained Meters: Fm 1S, 2S, 12S, & 16S
 - Self Contained may be Class 200, 320, or 480.
 - Transformer Rated: Fm 3S, 4S, 35S, 36S, & 9S

Meter Registration @ PSE&G

- The largest volume of Net Meters are on residential services. These are metered with a residential solid state meters with (2) total kWh registers.
 - Fm 2S, Class 200
 - Fm 2S, Class 320
 - Fm 12S, Class 200
- The remaining meters are capable of storing (2) channels of interval data (15 min or 30 min). Data may be read either:
 - Visual read of Total kWh display values (< 150 kW only)
 - POTs (wired) modem
 - Digital wireless modem

Data to model PV as Generators

- Small PV net metering installations may have lower cost meters installed.
- Estimating Exported energy from total monthly export data requires three assumptions:
 - What is the shape of the generation profile?
 - What is the shape of the load profile?
 - Will there be enough net meter points on each PJM bus to make estimates statistically valid?

Another Question

- Does the exported energy of many small consumers, each with small PV installations (<6 kW) have a discernable impact on generator bus totals?