JOINT UTILITIES
OF NEW YORK

Interconnection Technical Working Group

Monitoring and Control Discussion

January 18th, 2017

NYSEG nationalgrid Orange & Rockland Rockland Electric Company conEdison People. Power. Possibilities. Central Hudson A FORTIS COMPANY RG&E

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Monitoring and Control: Background

- Monitoring is the ability to observe the performance of various assets on the distribution system at pre-determined intervals.
- Control refers to signaling of distribution assets and DERs to take actions to satisfy system operational goals in near real-time.
- The Joint Utilities are currently focused on solar PV; however monitoring and control requirements can be applicable to other DG technologies.
- Monitoring and control of distributed generation can help to ensure that line sections are appropriately de-energized to ensure worker and crew safety, as well as system reliability, power quality, and planning/forecasting.
- A distribution feeder with solar PV will need monitoring and control to meet broader NY REV requirements as well as NYISO standards, providing market parameters, etc.
  - "The DSP distribution grid operator will need to have the ability to monitor and measure key aspects of system operation including…DER status including voltage, current, and generation on a near real-time basis for DERs of a capacity higher than some nominal amount or that are in locations where likely to impact distribution grid performance criteria." - PSC chair Audrey Zibelman.

Source: Audrey Zibelman, "Reving Up The Energy Vision in New York", IEEE power and energy magazine -Volume 14 – May/June 2016 issue – page 23

Monitoring: Why Is It Necessary?

- Monitoring of the distribution assets and solar PV on the distribution system is essential for maintaining the reliability of the grid.

- Monitoring data allows utilities to efficiently implement distribution management systems (DMS), day-ahead forecasting, distribution automation, as well as other daily and long term capabilities outlined in REV.

- Enhanced utility monitoring capabilities will increase the situational awareness and performance of solar PV on the utility grid.

- Enhanced utility monitoring can inform forecasting, planning and provide data collection to help ascertain the value that solar PV can provide to its system, ultimately promoting reliable, flexible, and efficient operations.

Joint Utilities Current Monitoring Requirements

- Monitoring is currently required for solar PV 1 MW and above.
  - Level of Monitoring irrespective of the threshold will be decided based upon system configurations (e.g. delivery voltage level, feeder minimum load level etc.).
- Monitoring parameters outlined in "REVing Up the Energy Vision in New York," are expected to be provided on a near real-time basis.
- Monitoring at the point of generation must include:
  - Metering values at the point of common coupling (PCC), per phase voltage and current, and three phase values for real (watts) and reactive (vars) power.
  - Open or closed status, live-line protection status (i.e. hot line tag), and SCADA Alarms.

Source: Audrey Zibelman, "Reving Up The Energy Vision in New York", IEEE power and energy magazine -Volume 14 – May/June 2016 issue – page 23

Joint Utilities Future Monitoring Requirements

- Monitoring will be necessary for solar PV systems 100 kW and above.
  - Multiple PV applications > 50kW on a feeder that exceed 100kW in aggregate shall require monitoring based upon the aggregate total.
  - Monitoring at lower levels of PV is needed to meet the Joint Utilities current and future system needs due to elevated level of PV adoption.
  - Different size thresholds could be established for smaller systems that may only require monitoring and not control.
    - Monitoring of smaller systems would benefit control center's monitoring capability as rolled out per the JU's SDSIPs, engineering alarms, distribution planning data, etc.
  - Many distribution circuits have minimum loading below 1MW, and during certain contingency situations minimum loading of distribution circuits can decrease further.
  - Aggregate PV generation that exceeds minimum loading of the circuit could escalate the need for monitoring of smaller PV systems.
    - Retrofitting solar PV systems with monitoring capabilities could become a costly, and potentially un-enforceable, problem for both utilities and developers.
  - FERC NOPR : Monitoring and control is required for DER, Energy storage and DR at 100kW or above.

*Source: FERC Notice of Proposed Rulemaking, "*Electric Storage Participation in Markets Operated by Regional Transmission Organizations and Independent System Operators*", November, 2016*

Joint Utilities Future Monitoring Requirements

- Distribution Management Systems (DMS) will require monitoring of solar PV systems below 1 MW for successful implementation to provide net benefits to utility customers.
  - DMS models will require monitoring of DG below 1 MW for power flow convergence and to provide functionality such as Volt-Var Optimization and Fault Location, Isolation, and Service Restoration (FLISR).
  - DMS platforms are currently being installed.

Control: Why Is It Necessary?

- The ability to control and dispatch/curtail solar PV is vital to the reliable, efficient, and safe operation of the distribution grid, in normal and alternate circuit configurations and also as a result of recently new anti-islanding protection requirements.

- Utilities require direct control of the assets for disconnection in the case of maintaining system safety and reliability during abnormal system conditions.

- Enhanced control capability is important to meet the NYISO requirement for DER market participation, Volt/VAR control, frequency control etc.

- In instances where control is required, monitoring will also be required.

Joint Utilities Current and Future Control Requirements

- Current Requirements For Control:
  - An electronic recloser with SCADA is used to control systems 1 MW and above. For systems below 1 MW, a SCADA connected RTU may be required based upon system configurations (e.g. delivery voltage level, automatic feeder switching, etc.).

- Future Requirements For Control:
  - Control will be required at solar PV system level 100kW and above.
    - Multiple PV applications > 50kW on a feeder that exceed 100 kW in aggregate shall require control capability based upon the aggregate total.

Monitoring and Control: Benchmarks

❑ Germany

- Germany requires remote monitoring and control for all DG over 100 kW.
- Transmission System Operators must pursue all options before curtailing renewable DG, the rules are less clear for Distribution System Operators.
- Germany is spending $300 Million to retrofit inverters on 315,000 solar systems, according to CA PUC.
  - This retrofit is mainly to program for voltage/fault ride-through capabilities – incorporating the whole smart inverter functionality will be more costly.

Source: Distributed Generation in Europe – Physical Infrastructure and Distributed Generation Connection, KEMA 2011
Source : Smart Grid Today – EPRI: Germany faces $20 Billion in upgrades, 2014

Monitoring and Control: Benchmarks

❑ Hawaii

- The increased variability and greater geographic dispersion of generation requires increased levels of grid operation controls, based on real time visibility of grid conditions such as voltage, generator performance, and localized fault.

- They plan to add intelligence and controls throughout the distribution circuit and substation along with two-way communications to monitor and control inverter operation, switching, regulation of voltages and management of power flows on distribution feeders.

- The platform and capabilities that are required to allow bi-directional communication between the utility and elements of the grid (including customer-sited advanced inverters), and control over key functions of those elements. The platform must contain monitor and control functions, be TCP/IP addressable, be compliant with IEC 61850, and provide cyber security at the transport and application layers as well as user and device authentication.

Source: Utility Dive - *http://www.utilitydive.com/news/smart-sharing-sun-saturated-hawaii-debates-first-tou-community-solar-propo/423585/*

Monitoring and Control: Joint Utilities Recommendations

- Monitoring at 100kW (use aggregate of applications >50kW from single developer on one feeder).
- Control at 100kW (use aggregate of applications >50kW from single developer on one feeder).
- Polling Frequency
  - Real time monitoring will be required.
  - Sampling rate for solar PV performance will typically range from 2 seconds to 10 seconds.
    - Depends on technical capability of utility system, solar PV size and type of grid service it provides.
- Standards
  - The Joint Utilities recommend the use of inverters that are firmware upgradeable to enable future smart inverter capabilities.
  - Customer's PV inverter interconnecting directly to the JUs system may be difficult to integrate with Utility's existing standardized system; RTUs or communication firewall might need to be installed for cybersecurity purposes.
    - Solar PV inverters will require utility industry standard protocols such as DNP, Modbus, IEC 61850 etc.

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