

## Roll Call

Babak Enayati  
Mike Conway  
John Bonazoli  
Paul Krell  
Cindy Janke  
Nancy Stevens  
Brian Ritzinger - DPU  
Mike Jacobs - Union of Concerned Scientists  
Mike Brigandi - NSTAR  
Bob Andrew - NSTAR  
Reid Sprite - S1  
Julien Amouyal - S1  
Gerry Bingham - DOER  
Jim Perkinson NGRID - Advanced Grid  
Dave Forrest - ISO NE  
Jon Black - ISO NE  
Dan Mungovan - Ngrid, networks  
Chris Riffle - Unitil  
Efrem Tagliamonte - AE  
Janos Rajda - SMA  
Eric Every -Solectria  
Allison Smith - NESCOE

## Via phone

Mike Coddington - NREL  
Jeanie Piekarz, NGrid  
Neil LaBrake - NGrid  
Pat Retelle - Borrego Solar

1) The meeting kick off by Babak and introduction 10 mins

2) Micro-grid / Resiliency Interconnections 9:10 AM-10:30AM

a. MA Resiliency grants will promote off-grid capability for critical infrastructures during emergency events

b. Current interconnection practices for DG with intentional islanding capabilities

c. Interconnection hurdles related to facility capacity? i.e. Battery storage systems may have oversized power capacity to enable more energy output (2:1, kW: kWh, power: energy)

- IEEE1547 to include microgrids in renewables

- DER MS - Management System, detects microgrid mode, sheds loads, balanced load:gen
- Utility plans for future
  - Jim Perkinson - Ngrid
  - 3 projects - all scaled differently
  - MA - City of Northampton, disaster event support 5, 10, 20 day - critical loads for town. Pumping stations, building backup,
  - NY - NYSERDA, 10MW shared community underground micro-grid proposed. Operates in parallel with grid normally, providing ancillary services. Multiple customers in this case, makes it difficult to balance or assign priority to customers within this microgrid
  - NY - Buffalo Niagara Medical complex w/ EPRI - main gen at facility to support surrounding residential load.
  - Gerry - microgrid isn't the primary goal of the resiliency grant funding - emergency gen load/critical load and microgrid not synonymous
  - NSTAR - CHP being repurposed as a 'micro-grid' in many areas
  - Unitil - No current micro-grid projects. Technical challenges include personnel, training. Micro-grid must have voltage control, frequency, etc.
  - WMECO - Nothing in Western MA - CMLP (CT), working with state on a projects to run dedicated lines from customer-owned generation to other adjacent customers - Power quality is a concern.

How are back-up systems being treated in intx - no additional intx

How are back-up systems being treated when ancillary services are desired - additional capacity must be applied-for in the intx application

- Reid - interconnection in parallel vs total off-line (islanded or back-up)
- Bob Andrew - Payment for ancillary services comes from ISO
  - What is the value of that market? (20M/year for all regulation)
  - Has to be dispatchable by ISO - is then considered additional Intx capacity
- Dave Forrest - FERC regs have allowed other generators to provide regulation, even load can provide regulation.
- John Black - value of regulation may not be there right now
- Gerry -
  - Emergency gen doesn't follow intx procedures, because it does not operate in parallel
  - Potential review process for adding capabilities to existing back-up gen
  - DOER referring to single-customer, single back-up as "nano-grid"
- Paul
  - Single-facility, customer hosted - non export is important for detection and separation. While running in parallel, no voltage control, no freq control - but those functions are enabled when islanded
  - Communications for micro-grid management is an important cog, authority and responsibility of that
- Janos
  - 1547.4 working group - interconnection of microgrids. When interconnected, they are in grid-freq and grid-voltage follow mode. When islanded, controller must set freq and voltage for the micro-grid. 2MW microgrid in CA Santa Rita jail; 300kW solar, wind,

fuel cell - static disconnect switch can disconnect entire compound from grid and isolate within 1/2 cycle - no voltage interruption.

- CERTS developed by University of WI
- Mike Coddington
  - 1547.4
- Dave Forrest
  - 1547 establish based on small penetration of DER - Transmission was not involved. Now that penetration has increased ISO's and RTO's are involved - Visibility is critical for ISO oversight and operation
  - Interconnection issue - impact study practices, currently assume all generation running concurrently. FERC allows for Net Export study, if ISO and T&D company agree that the outputs are limited, and sufficient protection exists
- Reid
  - Micro-grid using utility lines are some point. Fault scenarios in larger microgrids - sectionalizing must be implemented.
- Babak
  - Net generation (max reverse power) can be solved by installing 32R relay (reverse power relay)
- Gerry
  - Energy storage counting towards net metering, issue in CA
- Dave Forrest
  - ISO looking closely at solar vs peak load (noon vs 5-6pm) - peak shaving midday, moving it to the end of the day.
  - If a battery is used for peak shaving, load off-setting
- Mike Brigandi
  - Fault current contribution for generation is a consideration for systems that use reverse power relay
- Reid
  - Policy, but - franchise rights , crossing public roads with private cable. Public applications - police station + library for example
- Cindy
  - Watch-dog timer required for back-up gens with ATS - additional relay that takes out switch

3) Break 10:30AM-10:40AM

4) Network Interconnections on the high-side of secondary network 10:40AM-12PM

a. This technique has been successful in other parts of the country for working around network protectors

b. Do MA utilities currently allow these interconnections?

c. Is this seen as a viable strategy for MA utilities with networks?

- Reid
  - CHP in NYC on spot networks, within buildings, on high side of network (15kV class)

- Small CHP plants around city to feed in distribution level, possibly to replace a large centralized solution
- Creates metering issues (importing and exporting through same meter), rate and tariff issues
- What are fault duty restrictions? Is this feasible?
- Dan M. - Ngrid stance
  - Challenges - interlocking substation breaker with gen breaker (DTT) - breaker opens often, no always during fault
  - Substation Breaker -> network transformer, no line reclosers or fuses added to reach. Additional fault current can desensitize the substation breaker tripping. Introducing device on 15kV line is additional point of failure
  - Substation relay may need to be changed to directional relaying - typical, network feeders come from same substation bus, so if any feeder is fault, all feeders experience same voltage sag, same potential, no varying fault flow. Once generator is online, different source potentials can develop. Directional relaying could be needed on all of the feeder breakers to differentiate those sources
  - Ngrid obligation for providing alternate feed? Ngrid takes circuits out for a week at a time (resilient based on other feeders). How is the agreement navigated with the customer? Do they need to carry all those DTT features to a second feeder, be studied on a second feeder?
- Reid
  - Customer may isolate the generator with some load, so backfeed is limited or negated.
  - Serving local load, non-export could be ways to mitigate
- Dan M.
  - Peak shaving could present economic issues with customer (minimum import).
- Reid
  - Eliminating the technical issues could solve for those economic issues.
- NSTAR
  - Bob - NSTAR will evaluate any proposal. Major hurdles - physical vault space for the additional equipment (switches).
  - Reliability - on secondary side, very high - on primary, feeder is coming out frequently (maintenance, faults, annual testing)
- Mike B -
  - Higher fault currents at station transformers and network protectors are a concern, however each proposal will be evaluated
- Dan
  - Substation transformer - Resistive/reactive ground with particular X/R ratios, generator will alter that X/R ratio
  - Relaying is set to these network parameters / characteristics
- Unital - John
  - No additional comments
- WMECO - Cindy
  - Reliability, duct bank real estate.
- Reid
  - Addition of non-network loads to network primary? With preferred network
- Dan
  - Can be easily done on small networks. On larger networks, fault duty > 30kA, large gear will be tough to locate

- John
  - Common misconception - if generator is non-export, it will not contribute to fault current. This isn't entirely true, although it's current limited, the PV will contribute 120-130% of nameplate to that fault for several cycles.
- Mike Coddington
  - Addressing fault current: network fault current is very high, chances of inverter contributing significantly to that total fault current are very low
  - On scheduled outages: can be resolved through interconnection agreements with customer. Should not be insurmountable
- Janos
  - Curtailment used in current applications to prevent export onto network
  - Fault current contribution for inverters is not 90deg out of phase, it is in phase. So, it could subtract from net system fault (complex impedance)
  - Could potentially contribute out of phase with grid fault, to counter the grid fault
- Mike B
  - Could exacerbate feeder breaker desensitization
- Janos
  - IEEE 1547.6 document deals with network interconnections
  - Dan M. and Mike Coddington were both on the .6 committee, Mike is a resource for follow questions
- Mike Coddington
  - Preliminary work done with SEL on relays for network integration, some prelim results expected in 6 months. Application guide using SEL devices & advanced inverter capability

#### Misc Topics

- Gerry
  - Penetration Screen update
  - Tariff filing? (DGWG - topic)
- Mike
  - Utility Specific Standards
    - Ngrid - ESB 756C - under revision for RTU, PCC recloser threshold
    - NSTAR - Mike B has done a significant amount of work on it - working with Cindy to form a cohesive standard for NU. A few more months expected to navigate internal policies.
    - WMECO - Policies and technical standards exist, just haven't been combined to a central location
    - Unitil - in progress, prioritization has been an issue - Unitil has an existing technical document, will add TSRG topics to this.
  - Online applications
    - Cindy - WMECO is implementing Pre-app, Simplified and Expedited through web-based application, rolled into tracking and reporting
    - Uniti working on the same for simplified - Q4 2014
  - Ombudsperson position has become permanent

- Nancy is in this position permanently
- DOER has secured funding for Mike Coddington to continue
- Babak to continue as Chair - Mike to continue as Vice Chair

5) Lunch 12PM-1PM

6) Inverter ride-through and VAR support/voltage regulation capabilities 1PM-3:30PM

a. Dave Forrest will present ISO-NE's perspective on the NERC Integration of Variable Generation Task Force report on ride through.

b. Inverter manufacturers to present on current capabilities

- **Dave Forrest Presentation - ISO Ridethrough**

- Ultimate goal - DER ridethrough UF and UV events such that events on transmission system will not affect DER's
- To achieve worst case voltage dip, disable all local generators, have the fault fed by a remote source, over a larger impedance
- Dave's cases:
  - Min - light loaded seasonal (spring)
  - Max - summer peak
  - Both modeled at current DG penetration (very low)
- Follow up with Babak - Vars are a sink for fault current
- Babak
  - Ridethrough - balanced faults or unbalanced
- Dave
  - Balanced in this practice - SLG faults. Delta x wye-g most common at substations.
- Eric - Solectria
  - Symmetrical faults handled by PV very well, Asymmetrical faults, inverter perceives that differently
- Efre Tagliamonte - AE
  - Three-phase faults handled well, SLG depends on control scheme. Closed loop vs open loop
  - True closed loop approach
- Janos
  - SLG fault at MV or Tx level, will show up at inverter as unbalanced voltage. Inverter can supply same current, or unbalanced current - depending on what it wants to accomplish
- Dave
  - SLG fault on Tx systems does through Delta x Wye-g and looks like (2) suppressed phases instead of the (1) faulted phase

- **Frances Cleveland - CA SIWG Presentation**

- UL adoption - actively working on testing requirements for Phase 1 smart inverter functions
  - Expected completion date of June - July 2014

- Phase 1 includes: (7) critical autonomous functions
  - Phase 2: communications or communications scalability
    - Challenge to coordinate autonomous operation with existing volt/var control in capacitors, regulators, LTC's, etc
  - Autonomous operation can be used in instances with single inverter on a system, or in smaller systems. Otherwise, communications is essential
  - Sunspec alliance - inverter manufacturers working together on communications requirements, mediums, etc - 61850 abstract model, modbus for data - DNP3 or web service for Application protocol
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- Ngrid filed for 20MW smart inverter project
    - To test all of the functions in Phase I of CA SIWG and more
    - Power curtailment
  - Eric - Solectria
    - Variance from phase to phase on how a three-phase inverter treats sags on different phase (asymmetrical)
  - Babak
    - What type of ridethrough does ISO expect to implement? Straight kW, Var injection, stop-gating?
  - Paul
    - Concerns with autonomous units - how does it impact anti-islanding detection? Aggregate effect of multiple smart inverters on anti-islanding sensing

Adjourn 3:30PM

Next Meeting

9/17/14

NSTAR's Southborough office