Massachusetts Technical Standards Review Group

Quarterly Meeting

June 20, 2024

The Massachusetts Technical Standards Review Group

Agenda

9:00-9:05	**Administrative Items**
9:05-10:00	**Underfrequency Response Related to PV Inverters**
	• Griffin Anderson – Neo Virtus
10:00-10:45	**Sub-Committee Updates (15 min each)**
	1. IEEE 1547 Sub-Group
	2. System Impact Study Sub-Group
	3. Flexible Connections Sub-Group
10:45-11:15	**Group Study Status (15 min each)**
	• National Grid
	• Eversource
11:15-11:45	**Technical Standards Update from EDCs**
11:45-12:00	**Close Out & Final Discussion**
	1. Next scheduled quarterly meeting date
	a. Sept 26 1PM-4PM
	b. Dec 10 1PM-4PM
	2. Send topics for future meetings to
	a. Mike Porcaro (Michael.Porcaro@nationalgrid.com)
	b. Tony Morreale (tmorreale@ligconsultants.com)

June 20, 2024

Administrative Items

- Refer to TSRG Website for all information related to the group
  https://www.mass.gov/info-details/massachusetts-technical-standards-review-group

  - Membership
  - By-Laws
  - Reference Documents

  - Past Meeting Notes & Materials
  - Common Technical Guideline
  - Upcoming meeting info and registration link

- For any questions, suggestions, or to get on the mailing list email:
  - Chair Mike Porcaro - **Michael.Porcaro@nationalgrid.com**
  - Co-Chair, Tony Morreale - **tmorreale@ligconsultants.com**

Membership Update

The Massachusetts
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Membership Update

- Mrinmayee Kale (New Leaf) resigning as solar representative
- Greg Hunt (Zero Point Development) appointed as replacement by NECEC vote

Utility Membership

- Chair: Mike Porcaro, National Grid / **Michael.Porcaro@nationalgrid.com**
- John Bonazoli, Unitil / **bonazoli@unitil.com**
- Shakir Iqbal, Eversource East / **shakir.iqbal@eversource.com**

Non-Utility Membership

- Vice-Chair: Tony Morreale, LIG Consultants / **tmorreale@ligconsultants.com**
- *Gov/Cust Rep*: Brian Lydic, Regulatory Engineer, IREC / **brian@irecusa.org**
- *Solar Rep: Greg Hunt, Zero-Point Development* / **ghunt@zpeenergy.com**

Ex-Officio Membership

- Brian Ritzinger, Lead Engineer, Massachusetts DPU
- Katie Zilgme, DPU DG Ombudsperson

Underfrequency Response Related to PV Inverters

Griffin Anderson – Neo Virtus

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Underfrequency Response Related to PV Inverters

- Request for consideration received from Neo Virtus on 1/22/24
- Neo Virtus to provide overview of issue and request of TSRG

- On quarterly TSRG March Agenda, however time did not allow for discussion

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Michael Porcaro

From:	ganderson neovirtus.com <ganderson@neovirtus.com>
Sent:	Monday, January 22, 2024 9:57 AM
To:	Michael Porcaro; Bonazoli, John; shakir.iqbal@eversource.com; mkale@newleafenergy.com; Tony Morreale; Ritzinger, Brian (DPU)
Cc:	asharma neovirtus.com; mhendrickson neovirtus.com; atalbot neovirtus.com
Subject:	[EXTERNAL] MA-TSRG PV Inverter Under Frequency Response Control Requirements
Follow Up Flag:	Flag for follow up
Flag Status:	Flagged

CAUTION: This email originated from outside of the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe. If you suspect this email is malicious, please use the 'Report Phish' button.

Hello MA-TSRG Membership,

I've been encouraged raise questions about the implementation of requirements with the MA-TSRG. I am reaching out to the six of you because this was the only contact information I could find on the website.

I have been having discussions with transmission planning engineers at National Grid about the validity for PV system inverters to support under frequency response control functionality. At the moment, I have numerous PSCAD models (each project less than 5MW) only conditionally accepted, which is starting to cause issues. They are only conditionally accepted because these models do not support under frequency active power control.

I was hoping the MA-TSRG could review and provide insight on this discussion.

MY argument is per section 6.5.2.3.2 of IEEE 1547-2018, low-frequency ride-through performance:

"During temporary frequency disturbances, for which the system frequency is within the mandatory operation region, the DER"

6.5.2.3.2 Continues

"Shall, as applicable, modulate active power to mitigate the underfrequency conditions as specified in Table 22, depending on the DER performance category as described in Clause 4. Neither provision of energy storage capability, nor operation of DER at power outputs less than the power available in order to allow reserve for power increase in response to underfrequency (pre-curtailment), are requirements of this standard .102"

Note 102 follows:

"102 Pre-curtailment or other measures to provide frequency response reserve may be included in contractual agreements and interconnection agreements, which are outside the scope of this standard. The intent of the requirement in this standard is for the DER to only have the control capability in the DER to provide frequency response when the reserve exists, either due to specific contractual arrangements, dispatch control, or when curtailment exists for other reasons. Direction of active power can be negative (charging) for Energy Storage DER, e.g., return to frequency reduction via charging through droop or dispatch control, if operating for that purpose prior to trip."

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NEO Virtus Engineering

PV Inverters Underfrequency Response

June 20, 2024

Author: Griffin Anderson – MSE, EIT, Staff Engineer III

Co-Author: Michael Hendrickson – MSE, PE, Senior Engineer

Background

- The MA-TSRG developed the "Default IEEE 1547-2018 Settings Requirements" document in conjunction with ISO-NE. This is the Source Requirement Document (SRD) or guide is in use by Eversource, Unitil and National Grid in Massachusetts.

- This document is directly based off the settings requirements for a DER in Category III of IEEE 1547-2018.

- One of the requirements of DER in Category III is frequency droop operation, detailed in IEEE 1547-2018 section 6.5.2.7 "Frequency-droop (frequency-power)".

- Frequency droop control requires the DER to adjust its active power output from pre-disturbance levels according to Table's 23 and 24 in IEEE 1547-2018. Table 24 is exactly the same to Table VI in the MA-TSRG SRD.

- Hypothetically, during an underfrequency event the DER shall increase active power output.

- **However, this is not practical for a PV Inverter which is operating at maximum output power**.

- Some utilities are requiring PV inverter PSCAD models support this capability. This is causing significant delay's and lingering issues, as models are only garnering conditional acceptance.

IEEE 1547-2018 Requirements

- Per section 6.5.2.3.2 of IEEE 1547-2018, DER low-frequency ride-through performance -"*During temporary frequency disturbances, for which the system frequency is within the mandatory operation region, the DER*"

- 6.5.2.3.2 Continues - "*Shall, as applicable, modulate active power to mitigate the underfrequency conditions as specified in Table 22, depending on the DER performance category as described in Clause 4. Neither provision of energy storage capability, **nor operation of DER at power outputs less than the power available in order to allow reserve for power increase in response to underfrequency (pre-curtailment), are requirements of this standard .[102]**"*

- Note 102 follows -"*102 Pre-curtailment or other measures to provide frequency response reserve may be included in contractual agreements and interconnection agreements, which are outside the scope of this standard. **The intent of the requirement in this standard is for the DER to only have the control capability in the DER to provide frequency response when the reserve exists**, either due to specific contractual arrangements, dispatch control, or when curtailment exists for other reasons. Direction of active power can be negative (charging) for Energy Storage DER, e.g., return to frequency reduction via charging through droop or dispatch control, if operating for that purpose prior to trip.*"

- **IEEE 1547-2018 is referring to systems where an active power reserve exists. PV systems are not typically designed to operate with reserve power, as loss of power equates to loss of revenue.**

PV Inverter Operation

- Photovoltaic (PV) Inverters operate with a maximum power point tracking algorithm (MPPT). The MPPT algorithm will harvest the maximum power provided by the photovoltaic array at any given moment as irradiance varies, until the inverter limit is reached.

- The PV MPPT inverter does not operate with "active reserve capacity", and cannot support underfrequency droop.

- PV MPPT inverter systems are designed and submitted to export maximum power at all times. They are submitted with the understanding that no reserve capacity exists to support low-frequency droop, as defined by the MPPT algorithm.

- There needs to be a clear distinction between the requirements for ESS inverters and PV inverters. PV inverter underfrequency response test causes the PSCAD model to be built and tested for conditions that will not exist during actual system operation.

- Underfrequency droop is not possible for typical PV MPPT inverter systems.

Example

- NEO Virtus has often needed to obtain an updated PSCAD model from inverter manufacturers to implement underfrequency active power adjustment.

- This has taken inverter manufacturers up to six months to accommodate.

- The typical solution is to set the power setpoint of the inverter to much less than 1pu
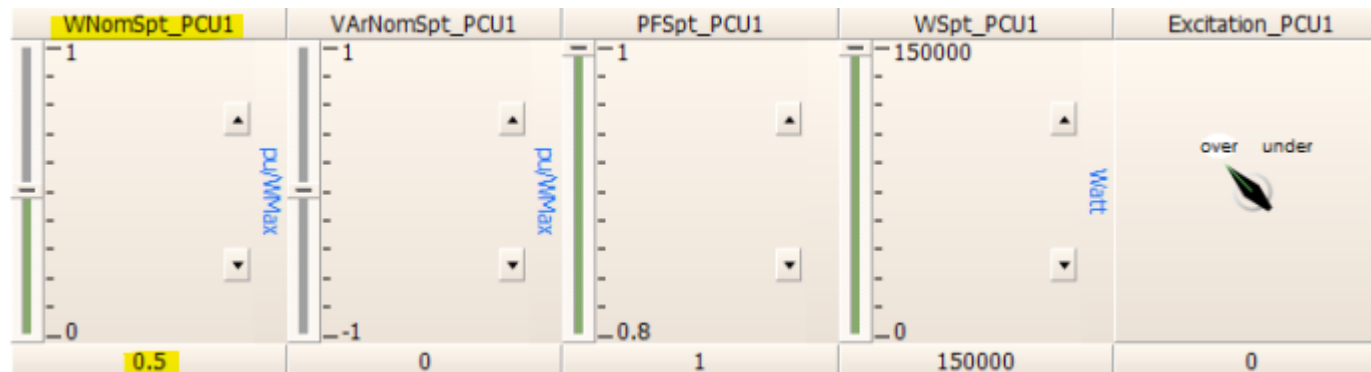
- This is essentially creating a condition where there is a active power reserve to support underfrequency droop.

Example Continued

- The graph on the right shows the underfrequency active power adjustment some utilities are requiring for PV systems.

- An operating condition was created, forcing the inverter to operate at 50% active power capability in order to create an active power reserve in the system.

- As stated in IEEE 1547-2018, the DER is **NOT required** to operate at power outputs less than the maximum power available in order to allow reserve for power increase in response to an underfrequency condition.

- To pass this test, a DER is required to operate at less than rated power output, in order to create a reserve condition.
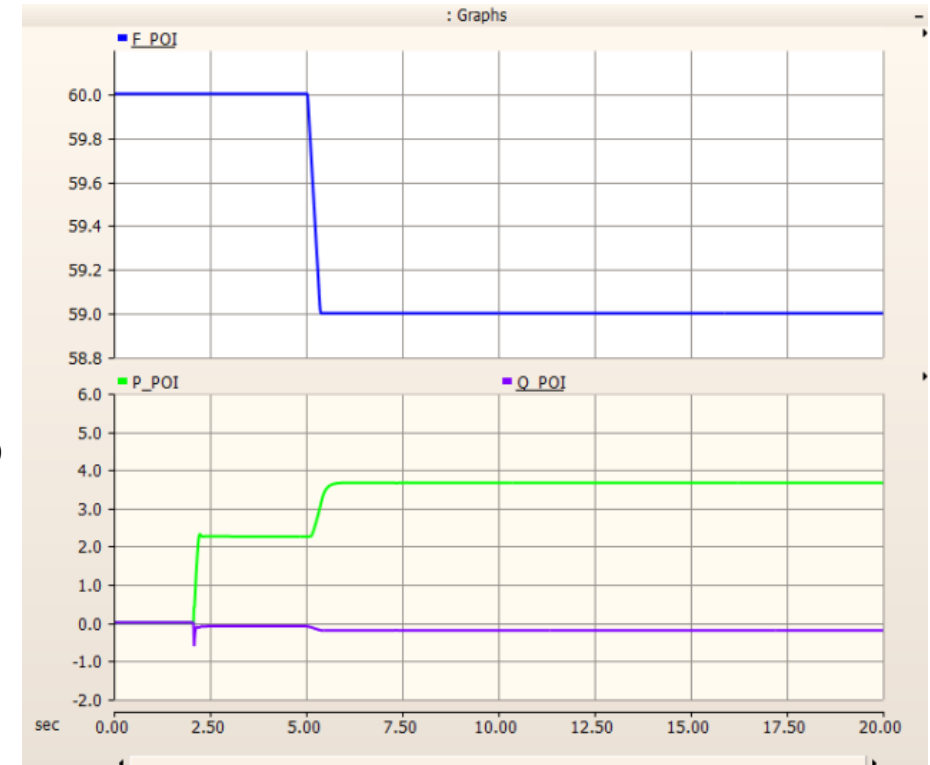
Summary

- Requiring the PSCAD models to support underfrequency active power adjustment for PV MPPT inverters, creates a condition not consistent with actual system operation.

- PV MPPT inverter systems are designed and submitted with no active power reserve.

- BESS systems have an active power reserve available, and can support underfrequency droop.

- There are multiple projects conditionally accepted where this issue is outstanding.

- In our experience, most utilities do not require PV MPPT inverters to provide underfrequency active power support. Utilities that require this functionality in the PSCAD models are causing projects to be delayed and increase costs for all parties.

- **NEO proposes underfrequency droop operation for a PV inverter not be required during PSCAD model verification testing and actual system operation.**

- Let's discuss!

TSRG
Inverter Repowering Update

Jeremy Kites

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Application Process

- Notice of change and new application is required
  - Specify existing and in-service equipment
  - Detail equipment to be changed
- Company determines the scope of study required
  - Most analysis will be reduced scope
  - Electric system is planned and operated with existing facility
  - Steady State capability is normally not a concern
  - If like for like, study may be able to be performed isolated from group studies
  - Anti-islanding (model of inverter) may be a concern

Design Requirements

- All new equipment must meet present requirements
  - Inverters
    - IEEE 1547 Setting Requirements
    - UL 1741 SB

- Design must meet requirements in present Interconnection Tariff and Common Guidelines
  - Need of SCADA and/or recloser for new Facility

- PSCAD models
  - Aligning with ISO requirements as needed

Operational Requirements

- Adhere to Operational requirements in present Interconnection Tariff and Common Guidelines

- Company reviews operational requirements in existing ISA
  - Determines what needs to be continued or removed

Flexible Connections Sub-Group Update

Mission Statement:

Center discussion on the use of technology, improved methods, and products that can enable dynamic management of DER assets on the grid .

As a SubGroup, our primary aim is to define and review Flexible Connections across industry. The goal being to enable DER projects in appropriate areas to interconnect to avoid significant distribution system upgrades, while reducing costs and timeframes associated with the standard interconnection process. This includes defining policy on how curtailment will work for DERs. Success may allow for faster and cheaper integration of DERs by increasing the hosting capacity of existing grid infrastructure and/or increased penetration of DERs to the grid.

Expected Group Output:

Deliverables and actionable next steps to be escalated/reported to the TSRG on the following:

- **Utility Controlled, Flexible Connections –** Use Cases, Thermal Constraints, Foundational technologies, scheduling, economics & markets, curtailment, studies, scaling.
- **Dynamic "Local" Control –** Enabling inverter functionality, Smart Inverter controls & Power Control systems, managing assets via Grid Services.

Bring/communicate any non-technical standard issues or topics to additional groups/DPU.

Team

First Name	Last Name	Company	First Name	Last Name	Company
Gerry	Bingham	DOER	Jon	Beniers	National Grid
Russ	Aney	Parallel Products	Michael	Porcaro	National Grid
Nachum	Sadan	GridEdge Networks	Justin	Woodard	National Grid
Doug	Pope	Pope Energy	Daniel	McDonough	National Grid
Greg	Hunt	ZP Energy	Gerhard	Walker	Eversource
Richard	Labrecque	Agilitas	Ryan	West	Eversource
Nigam	Trivedi	BlueWave	Michael	Taniwha	Eversource
			Jacob	Dusling	Unitil

Summary of Major Accomplishments & Upcoming Activities

Completed Activities:

DATE	DESCRIPTION OF ACTIVITY
12/11/2023	Kick off meeting with SMEs
1/22/2024	Review Flexibility SubGroup Charter, Defining Flexible Interconnections, Developer Feedback on Reporting
3/7/2024	Confirmed working definition and listed out scope
4/12/2024	Alignment on Initial Constraint Criterion (Thermal) and Initial Foundational Technologies (software, hardware/equipment, communication protocols - DNP3/IEEE 2030.5)
5/21/2024	Transmission system capabilities, impacts, & benefits and how this impacts our Flex Connect discussions moving forward. Thermal Constraints Data / Reporting for Viable Circuits – Preliminary List for early scaling.
6/18/2024	Initial IIRG – Flex Connect / DERMS language and deliverable list established for UL 3141, Failsafe items, & Data points

Upcoming Activities:

	Review UL 3141 criteria for equipment standardization
	Define fail safe mode operation/countermeasures
	Develop operation requirements to address voltage issues

Group Study Status

The Massachusetts Technical Standards Review Group

Group Study Status Update

- The EDCs have provided the below links for Group Study status updates
  - Status is updated monthly
  - Intended to be generally informative on Group Study timeline expectations
  - Included here for reference and general discussion, however Group specific questions may need to be deferred to a separate Group specific forum

- Eversource
  - https://www.eversource.com/content/residential/about/doing-business-with-us/interconnections/massachusetts/distribution-group-studies
- National Grid
  - https://gridforce.my.site.com/s/article/MA-Distribution-Group-Studies

Technical Standards

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EDC Technical Standards

- As needed, EDC technical standards may be updated
- Below is general discussion for awareness of major elements that may have been changed/amended/added within the last 12 months

Eversource (April 27, 2023)
- No new updates

Unitil (May 1, 2000)
- No new updates

National Grid (January 2024)

- No new updates

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SMART Phase II Order – DPU 20-145-D

- Order issued by DPU June 4, 2024
  - Link to Order 20-145-D

- Requirements of the Order are being worked through by EDCs for implementation plans. Includes:
  - Billing implications
  - Metering arrangements

- EDCs expecting to work through implementation approach, preparing for more robust update at next TSRG quarterly meeting

National Grid Flexible Interconnections Program

- Website with full information:
  - https://gridforce.my.site.com/s/article/ACTIVE-RESOURCE-INTEGRATION-ARI-FLEXIBLE-INTERCONNECTIONS-PILOT

- Seeking interest from solar cases and storage cases, for both ARI and Local Power Controllers
  - **ARI**
    - **Energy Storage ARI Pilot Criteria & Eligibility Requirements**
    - **Solar ARI Criteria & Eligibility Requirements**
  - **Local Power Control**
    - **Local Power Control Participation Guidance**

- To submit a request for pilot consideration a customer must:
  1. Review pilot eligibility requirements to self-assess whether the application is a possible candidate
  2. Prior to *2/28/2025* send an email to NationalGridARI@nationalgrid.com to submit a request for consideration. Example requests language and content listed on the website.
  3. Once received, the application will be added to the possible candidate pool for consideration by National Grid. Requests received on or after *2/28/2025* will not be considered.
  4. National Grid will provide responses to all requests in as timely a manner as possible, indicating denial or acceptance into the pilot.

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Closing

- **Next meetings**
  - Sept 26, 2024
  - Dec 10, 2024

- **Please send any topic requests for future meetings to Chair and/or Vice Chair**
  - **Michael.Porcaro@nationalgrid.com**
  - **tmorreale@ligconsultants.com**

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Appendix

Procedures – Rules of Order

- Raise hand to be recognized by the Chair (right to speak)
  - Hand raises to be recognized in order
  - All welcome to speak at this point (members and non-members)
- You want to bring up a new idea before the group.
  - After recognition by the Chair, present your motion. A second is required for the motion to go to the floor for discussion, or consideration.
  - Making the motion is intended to be brief. Discussion/substance on the topic follows
  - Ex. Speaker states *"I make a motion to adjust the site MW size requiring reclosers from 500kW to 1MW in the Common Guideline";* Someone else says *"Second"*
- Chair states the motion on the floor and opens discussion for all
  - Only one motion will be discussed at a time
  - Ex. Chair states *"A motion has been made to adjust the site MW size where reclosers are required from 500kW to 1MW. Please proceed with discussion"*

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Procedures – Rules of Order

- No member can speak twice to the same issue until everyone else wishing to speak has spoken to it once.
- Members who *repeat* comments or arguments will be ruled out of order.
- When there has been enough discussion
  - Make a motion to close the debate. Also referred to as "calling the question". This cuts off discussion and brings the assembly to a vote on the pending question/motion only.
  - Called naturally when Chair recognizes that all discussion has stopped
  - Ex. Speaker states *"I move to close the discussion"*
- Once discussion is closed, move to vote:
  - Ex*. "All those in favor of the motion on the floor, which is to adjust the site MW size where reclosers are required from 500kW to 1MW, please raise your hand"*
  - Requires a 2/3rds vote to pass

Procedures – Topic Identification

- Each topic brought up must focus toward either:
  - Update Common Technical Standards (CTS), as repository of consensus items coming from TSRG discussion
  - Shorter term issue requiring resolution, not fundamental practice in CTS

- Pre-Meeting Topic Submission
  - Submit in writing to Chair & Co-Chair 3 weeks prior to quarterly meeting to appear on agenda
  - Submitter presents on the topic with clear:
    - Background on issue of concern
    - Ask for resolution/actions/next steps
  - Discussion amongst all present at TSRG (members and non-Members)
  - Vote by membership at conclusion of discussion for next steps/consensus

Procedures – Sub Groups

- Where a topic has non-consensus, warranting additional investigation, subgroups may be formed
  - Following a non-consensus outcome after topic discussion, any person (member or non-member) may propose that the topic be taken to Sub-Group
    - Person proposing must state the proposed sub-group direction/purpose
  - Of those in attendance at the quarterly meeting, a minimum of 5 individuals (members or non-members) must volunteer to support the sub-group in order for it to proceed
    - If less than 5, then the topic is logged in a tracker as "unresolved"
  - Sub-Group lead(s) must be identified at the time of subgroup creation
- Sub Group scope must be achievable before next quarterly (~3 months)

Procedures – Summaries

- Whether the topic comes from the quarterly meeting or from a sub-group, the discussion will be summarized in meeting minutes or in a separate summary document. Summarization to generally include:
    - Definition of topic discussed
    - Group activity in working through the topic
    - Group consensus items
    - Group non-consensus items, including stakeholder positions

- Summaries to be assembled by
    - Quarterly meeting topics: Chair/Vice Chair
    - Sub-Group topics: Sub-Group Lead

Procedures – Summaries

- Summaries to be shared with TSRG membership at least 2 weeks prior to quarterly meeting
  - To be voted on by membership at quarterly (2/3 vote to pass)
  - "Approval" of summary signifies that TSRG is in agreement with it as written

- For Sub-Group summaries that may be of an urgent nature, warranting vote prior to the next scheduled quarterly:
  - Sub-Group lead(s) to notify Chair/Vice Chair
  - If expediting of the vote is warranted, Chair/Vice Chair to organize interim meeting and/or impromptu vote via email amongst membership