AVANGRID
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The IBERDROLA Group

June 12, 2025

Transmission Studies for Ch. 324 Interconnections

Central Maine Power
An Avangrid company

General Updates

- Clusters 03, 05, 14 were issued revised IAs (allocations of remaining network upgrade changed due to withdrawals)
- Cluster 06 in the Detroit-Guilford Area. The PPA for the transmission upgrade was withdrawn. The cluster is to be issued revised IAs.

"ASO" Studies – ISO-NE Coordination

Reliability Committee (iso-ne.com)
https://www.iso-ne.com/static-assets/documents/100013/a09_03_pp_5_6.zip

ISO-NE Memo on Ongoing Order No. 2023 Compliance Proposal Implementation Activities
memo_re_order_2023_implementation.pdf (iso-ne.com)

New Cluster Updates

- CMP is anticipating to start the ASO cluster study in October 2025 following the beginning of ISO-NE's Transitional Cluster Study (TCS).

- ASO Cluster Study Process
  - Level 4 projects with distribution IA as of September 1, 2025.
  - Includes projects over and under 1 MW
  - The invoices and study agreements to be sent at the end of September 2025.
  - Proposed dates and timeline are contingent on ISO-NE's advancement with the TCS.

- CMP has worked with MREA and CCSA on the exclusion criteria from participation in the transmission cluster for projects under 1 MW.

New Cluster Updates (< 1MW Projects)

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Projects in Queue < 1MW: 75 (>80% of Level 4 projects in queue)

Transmission Study Process – Projects < 1 MW

1. Limited Transmission Screen – pass/fail for entering into ASO phase 1 & 2
   - 2-month estimate – completed by early September for ASO window
   - Estimated $150K Study Cost, reconciled at the end, study deposit required upfront (per MW)
   - Will send out screening study agreements by 6/20
   - Study agreements and payments to be returned by 6/27
   - *If projects that meet inclusion criteria don't enter in Screen – automatically entered into ASO*

2. ASO Cluster Study – Phase 1 & 2
   - Projects that show adverse impact during Screen will be included into ASO

3. Screen Inclusion Criteria – Projects < 1MW
   - Projects in area's of grid concern & in-service date later than January 1st, 2026
   - All other projects will be grandfathered from ASO
   - Transmission screens for new projects entering the queue will be conducted in parallel of Ch. 324 Distribution SIS

30 Projects < 1 MW meet Inclusion Criteria and require Transmission Study/Screen

Included Projects

- List of projects < 1 MW meet Inclusion Criteria and require Transmission Study/Screen

PRJ 200
PRJ 481
PRJ 669
PRJ 698
PRJ 712
PRJ 731
PRJ 772
PRJ 781
PRJ 795
PRJ 811
PRJ 813
PRJ 820
PRJ 829
PRJ 841
PRJ 852
PRJ 864
PRJ 886
PRJ 890
PRJ 901
PRJ 902
PRJ 903
PRJ 908

Excluded Projects

- List of projects which will be excluded from the cluster study

PRJ 185
PRJ 404
PRJ 555
PRJ 620
PRJ 653
PRJ 658
PRJ 718
PRJ 724
PRJ 725
PRJ 728
PRJ 732
PRJ 737
PRJ 741
PRJ 745
PRJ 746
PRJ 751
PRJ 758
PRJ 765
PRJ 768
PRJ 778
PRJ 796
PRJ 798
PRJ 801
PRJ 803
PRJ 806
PRJ 807
PRJ 808
PRJ 809
PRJ 812
PRJ 814
PRJ 818
PRJ 821
PRJ 823
PRJ 834
PRJ 845
PRJ 848
PRJ 849
PRJ 854
PRJ 855
PRJ 856
PRJ 859
PRJ 863
PRJ 865
PRJ 868
PRJ 870
PRJ 874
PRJ 880
PRJ 885
PRJ 887
PRJ 888
PRJ 896
PRJ 920
PRJ 921

Questions

Appendix

The remainder of the slides are for reference. Most material has been discussed at prior webinars and remains as useful information for those who may not have attended previously or are looking for past updates not currently addressed during this month’s webinar.

Who to Contact with Section I.3.9 Questions?

Please email the below team should you have any questions related to the i.3.9 process.

- CMP - Interconnection Services CMP-Interconnection.Services@cmpco.com
  - A team member will acknowledge your email and follow up internally to provide you with a timely response.
    - Should your project need any further assistance please contact Nate Pelletier Program Manager, Interconnection Services
      - Email Address: Nathan.Pelletier@cmpco.com

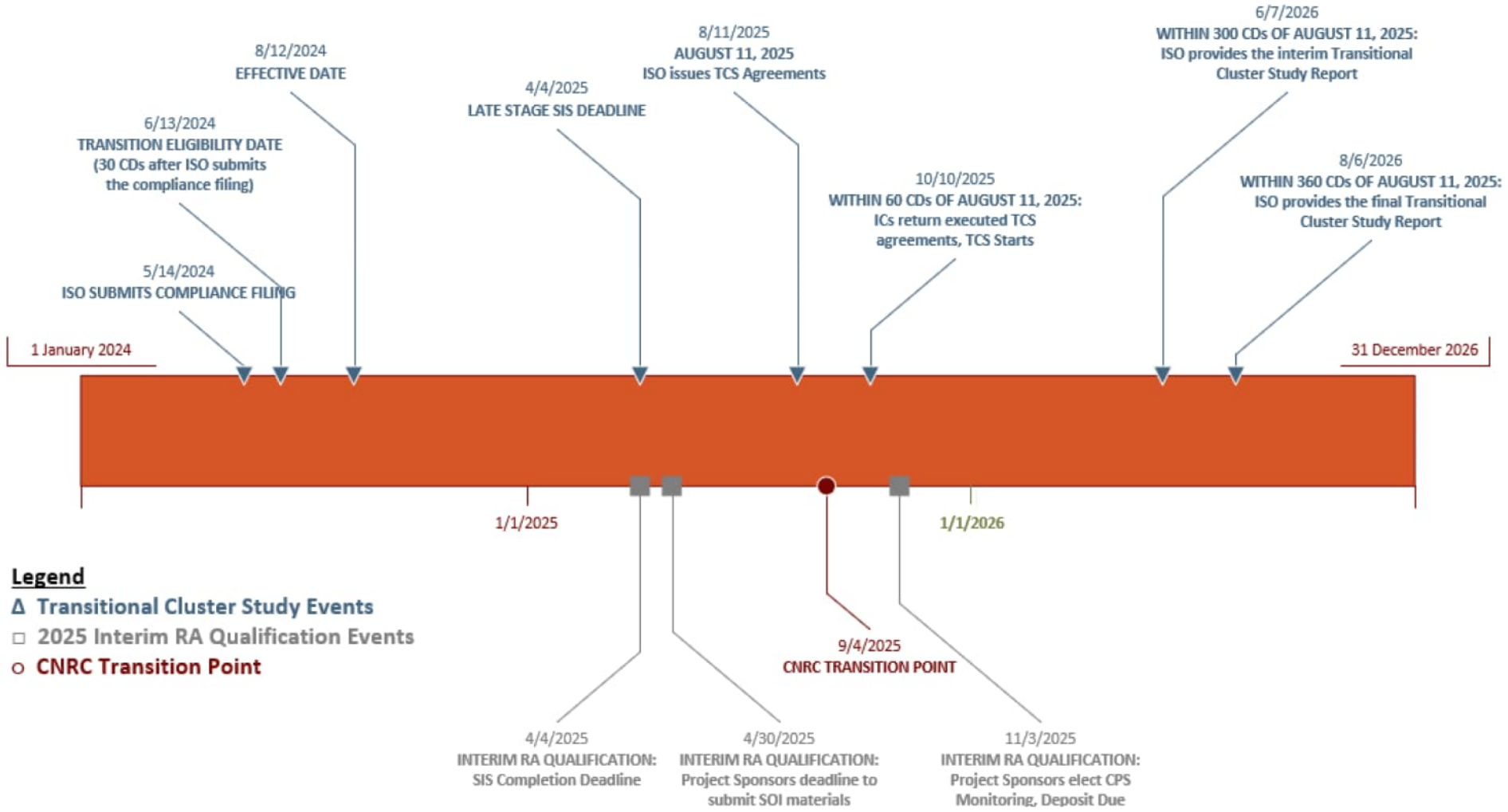
- Also, please routinely check CMP's public queue, at the below link/location, which is updated bi-weekly for any i.3.9 updates related to your project.
  - Link: Interconnection (cmpco.com)
    - Location of interconnections public queue

New ASO Cluster Study

- Two phase approach
  - Phase 1 will include steady-state analysis and PSCAD model testing
  - Phase 2 will include steady-state, short-circuit, stability and PSCAD analysis
- Attrition window with one-time opportunity to derate (no distribution restudy)
- Align with ISO-NE Order 2023 compliance study timeline
- Coordinate with the start of the ISO-NE cluster process
  - The TCS is not prescriptive as to study milestones: when can models be obtained from ISO-NE, when the ISO-NE mitigation be known to the affected TO, when will the ISO-NE PSCAD study begin. Anticipate process to evolve with lessons learned from TCS.
- ASO cluster study will closely follow TCS cluster timeline. Projects will have limited time window to complete study work and receive I.3.9. approvals after the completion of the TCS study and prior to the beginning of the new TCS cycle

New Cluster Updates

- ISO-NE's proposed narrowly tailored date changes for Transitional Cluster Study
- New cluster request window will open 60 calendar days after the previous cycle has completed

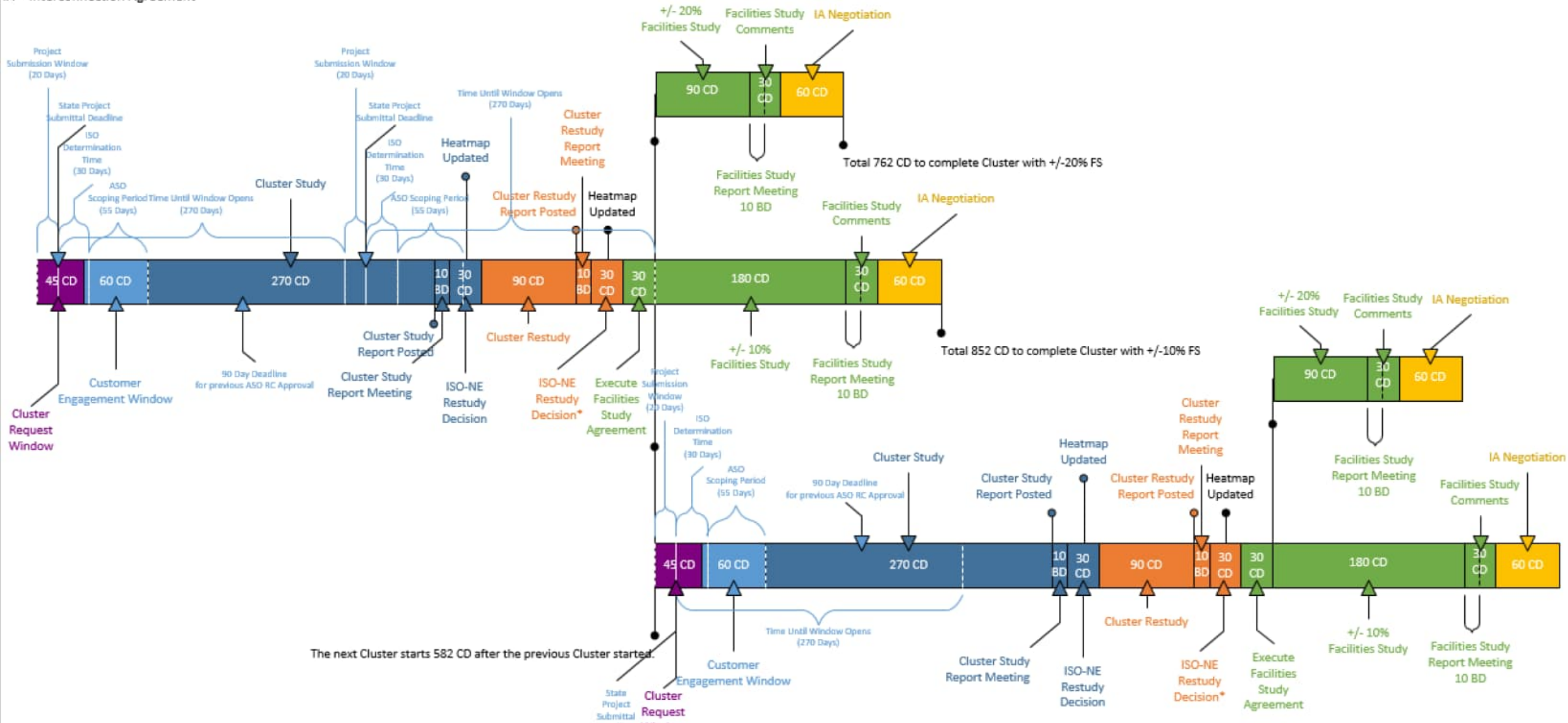


Central Maine

ISO-NE Order 2023 Timeline

Key

CD = Calendar Days
BD = Business Days
FS = Facilities Study
IA = Interconnection Agreement



Level 3 Aggregate Study Milestone Details

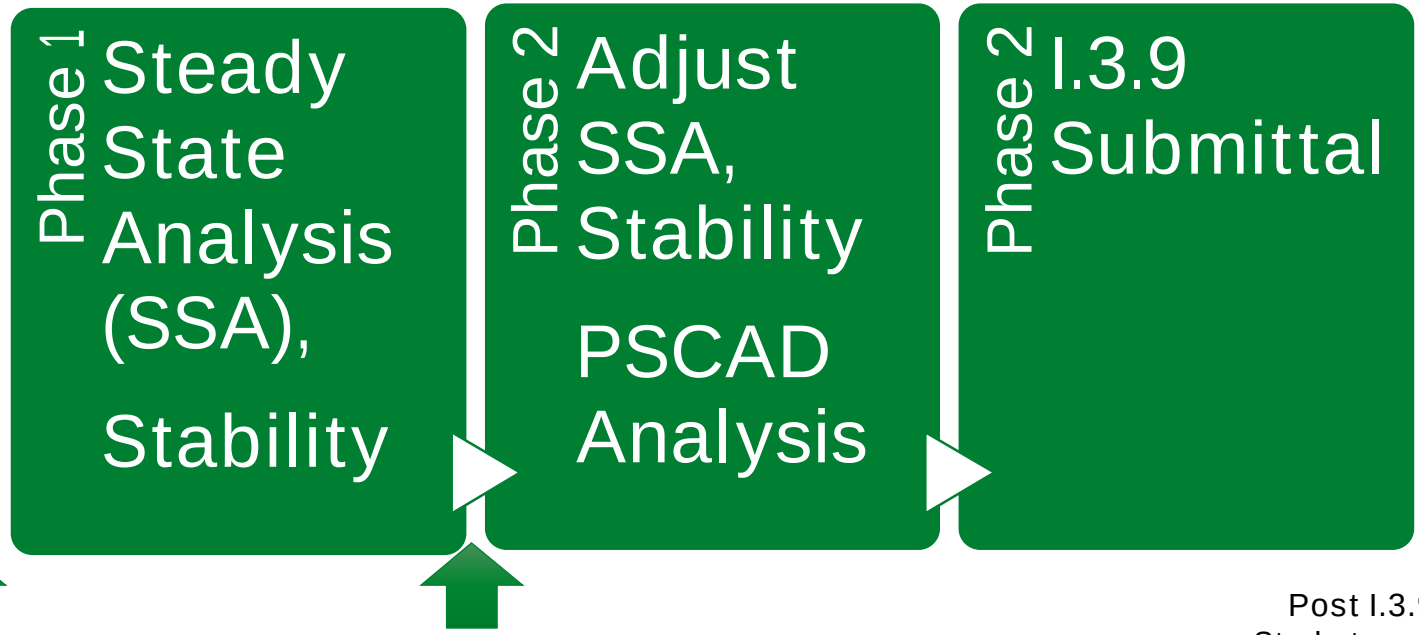
High-Level Cluster Milestone	Milestone Detail
Data Gathering & Model Build	Project Specific Data Gathering
	Data Review & Identify Deficiencies
	Address Issues
	Review D-ckt Data
	Address D-ckt Issues
	Model Updates
	Complete Data Reviews & Update Models
Scope Development	Study SOW Planned
	Study SOW Plan Discussed with ISO-NE
	ISO Review & Comment
	Create Detailed Scope with Base Cases
	SOW Reviewed & Comments Provided by ISO-NE
	Model Updates
Steady State & Short Circuit Needs Identified	Analyses
	Results Review
Mitigation Identified & Analysis Complete	Mitigation Proposed & Evaluated
	Final Recommendations
	Cost Allocation
PSCAD	PSCAD
Report Development & Reliability Committee Approval	Report Development
	Incorporate PSCAD
	Report Reviewed & Comments Provided by ISO-NE
	ISO-NE Comments Addressed
	Results Check-in
	PPAs Prepared
	Reliability Committee & I39 Approval

Results Check-in

Process Improvements – Filed September 1, 2021

Proposed Process

Milestones and Financial Commitments



Phase 1 Begins
Cluster Study Agreement

Non-refundable Study Fee

Phase 2 Begins
Non-refundable Study Fee

Post I.3.9 Approval
Study true-up with remaining projects

Projects with I.3.9 approval are invoiced.

Restudy if required based on attrition

Terms & Conditions – Docket No. 2021-00277**

Phase 1 & Attrition Window

Within 15 business days of a cluster's closure, CMP will issue a Transmission System Impact Study Agreement to eligible Customer-Generators along with a data request if required. Each Customer-Generator shall have 10 business days from receipt to execute the Transmission System Impact Study Agreement, provide the study fee as indicated in Section 60.5, and return the completed data request. Completion of the requirements ensures participation in Phase 1 of the Transmission System Impact Study. Phase 1 includes the steady-state, dynamic stability, and short circuit analyses and these analyses may be performed on a variety of generation dispatches and load levels as needed. Failure to complete any of the Transmission System Impact Study requirements for eligibility will result in removal from participation in the Transmission System Impact Study. A Customer-Generator may elect to execute a Non-Disclosure Agreement to obtain study results which contain Critical Energy Infrastructure Information ("CEII"), not unduly withheld, to obtain Phase 1 or Phase 2 results.

Each Customer-Generator shall provide CMP via the Transmission System Impact Study Agreement with a single designated valid email address for all Transmission System Impact Study related data requests. After receipt of the completed agreements, CMP will hold a scoping meeting for the Cluster study within 5 business days. In this meeting CMP will discuss the preliminary assumptions and models that may be used for the study and will provide a high-level timeline for the cluster participants.

CMP will make best efforts to complete Phase 1 study within 140 business days of the scoping meeting and notify Customer-Generators of the results of the steady-state load flow, dynamic stability, and short circuit analyses as soon as those analyses are complete. CMP will coordinate data gathering, model building and verification for Phase 2 in parallel with conducting the Phase 1 analysis. Upon completion of Phase 1, CMP will release a Phase 1 system impact study report for review within 5 business days and will host a results meeting within 5 business days thereafter. The Phase 1 system impact study report will include the results of the analyses, identification of Network Upgrades, and identification of projects that do not contribute to the need for Network Upgrades. The Phase I results will include alternatives that have been considered, including alternatives to Network Upgrades, and an order of magnitude cost accuracy and construction time estimates of the proposed Network Upgrades required to mitigate identified reliability criteria violations as well as cost allocation of the Network Upgrades. Cost allocation shall be determined per Section 60.6.

Within 10 business days of the results meeting, Customer-Generators must signal their intent to be included in Phase 2 of the Transmission System Impact Study by submitting the second non-refundable Transmission System Impact Study fee per Section 60.5. Phase 2 of the Transmission System Impact Study will restudy the analyses in Phase 1 as required with the remaining Customer-Generators, will include the Power Systems – Computer Aided Design ("PSCAD") analysis, and will provide cost allocation of Network Upgrades if required based on the remaining Customer-Generators and results of the Phase 2 analyses.

Phase 2 & Data Requests

In parallel with Phase 2, CMP will perform additional study analyses to refine the scope, schedule and cost of the Network Upgrades identified by the Phase 1 analysis. CMP will make best efforts to complete the Phase 2 analysis within 100 business days, including any potential restudy, updates to mitigation and cost allocation, and the PSCAD analysis. CMP will conduct a customer meeting to inform Customer-Generators of the results of the re-study within Phase 2. The Phase 2 results will include the identification of projects that do not contribute to the need for Network Upgrades that can interconnect and operate prior to completion of Network Upgrades. CMP will provide the results and Transmission System Impact Study Report to Customer-Generators before submittal of PPAs to ISO-NE.

Customer-Generators participating in Phase 2 of the Transmission System Impact Study will have their PPA submitted to ISO-NE for Section I.3.9 approval. Additional study work to address Transmission System Impact Study attrition following receipt of Section I.3.9 approval will be addressed per Section 60.7. The Section I.3.9 approved Transmission System Impact Study will also be provided to the Office of the Public Advocate.

Data requests may be made by CMP throughout the course of a Transmission System Impact Study. CMP will make every reasonable effort to notify Customer-Generators of data requests as early as possible. Customer-Generators shall have 10 business days from receipt to respond to a CMP data request or the Customer-Generator will forfeit its participation in the current Transmission System Impact Studyincluding any study costs.

**T&Cs are being reviewed and updated to reflect the changes to the cluster study process

Terms & Conditions – Docket No. 2021-00277**

≥ 10 PRJs Study Fees/Costs

1) For Transmission System Impact Studies with 10 or more Customer-Generators, each Customer-Generator will be allocated a non-refundable Transmission System Impact Study fee for participation in the first phase ("Phase 1") of the Transmission System Impact Study This fee will be the Customer-Generator's pro-rata share of $175,000 based on the relative size (kW) of the facility as of the date of their Transmission System Impact Study Agreement.
2) For Transmission System Impact Studies with 10 or more Customer-Generators, each Customer-Generator will be allocated a non-refundable Transmission System Impact Study fee for participation in the second phase ("Phase 2") of the Transmission System Impact Study. This fee will be the Customer-Generator's pro-rata share of $50,000 based on the relative size (kW) of the facility as of the date of their Transmission System Impact Study Agreement. Customer-Generators that are identified as contributing to a Network Upgrade will be individually assessed an incremental $20,000 non-refundable deposit to perform additional study analysis.

< 10 PRJs Study Fees/Costs

3) For Transmission System Impact Studies with less than 10 Customer-Generators, each Customer-Generator will be allocated a non-refundable Transmission System Impact Study fee of $10,000 for participation in the first phase ("Phase 1") of the Transmission System Impact Study.
4) For Transmission System Impact Studies with less than 10 Customer Generators, each Customer-Generator will be allocated a non-refundable Transmission System Impact Study fee of $2,000 for participation in the second phase ("Phase 2") of the Transmission System Impact Study. Customer-Generators that are identified as contributing to a Network Upgrade will be individually assessed an incremental $50,000 non-refundable deposit to perform additional study analysis.

Study Invoicing

5) Final invoicing of all Phase 1 Transmission System Impact Study costs will occur at the conclusion of Phase 1 with the Customer-Generators participating in Phase 1 and they will beallocated their pro-rata share of the Phase 1 study costs based on the relative size (kW) of their facility as of the date of their Transmission System Impact Study Agreement.
6) Final invoicing of all Transmission System Impact Study costs will occur pursuant to the invoicing timelines in Chapter 324. Final Transmission System Impact Study costs will be reconciled with the Customer-Generators participating in Phase 2 and they will be allocatedtheir pro-rata share of the final study costs based on the relative size (kW) of their facility asof the date of their Transmission System Impact Study Agreement.

**T&Cs are being reviewed and updated to reflect the changes to the cluster study process

Terms & Conditions – Cost Allocation**

Example: Weighted Allocation Factor Analysis

Network Upgrades required to mitigate thermal violations shall be allocated using a weighted allocation factor analysis which will identify each Customer-Generator's contribution to the thermal violation. This means that the costs of those facilities are allocated proportionally to the amount of flow each generator contributes on the existing facility with the reliability criteria violation.

First, the outage and contingency scenarios that cause thermal overloads on an impacted facility are determined.

Each Customer-Generator's distribution factor ("DFAX") is calculated for each outage and contingency scenario.

A KW Impact is calculated for each Customer-Generator for each outage and contingency scenario as follows:

$$KW\ Impact = DFAX * Gen\ Output\ (kW)$$

An Allocation Factor is calculated for each Customer-Generator for each outage and contingency scenario as follows:

$$Allocation\ Factor = KW\ Impact / Sum\ of\ KW\ Impact\ for\ all\ Customer\text{-}Generators$$

An Overload Weighting Factor is calculated for each outage and contingency scenario as follows:

$$Overload\ Weighting\ Factor = (\%\ Loading - 100) / \Sigma\ (\%\ Loading - 100)$$

A Weighted Allocation Factor is calculated for each Customer-Generator for each outage and contingency scenario as follows:

$$Weighted\ Allocation = Allocation\ Factor * Overload\ Weighting\ Factor$$

Finally, a Total Weighted Allocation Factor for each Customer-Generator is calculated as follows:

$$Total\ Weighted\ Allocation\ Factor = \Sigma\ Weighted\ Allocation$$

The Total Weighted Allocation Factor determines each Customer-Generator's cost responsibility for the Network Upgrade which mitigates the thermal overload condition(s).

Example: Voltage Impact Analysis

Voltage support related Network Upgrades shall be allocated using a voltage impact analysis which will identify each Customer-Generator's contribution to the voltage violation. This means the Cluster Study identifies the worst-case voltage criteria violation at a transmission facility. Costs for this new voltage support resource are allocated by removing a Customer-Generator from the model (each in turn) and evaluating the impact of that generator on the voltage. For a low voltage violation, if the voltage stays constant or decreases when the generator is removed, it is considered a "Helper" generator. If the removal of a generator from the model elevates the contingent voltage and increases it, then such generator is called "Harmer." For those Customer-Generators labeled as "Harmers," cost of voltage mitigation is allocated in proportion to their voltage impact (the voltage delta between the contingent voltage and the contingent voltage with the removal of the Customer-Generator).

**T&Cs are being reviewed and updated to reflect the changes to the cluser study process

Conceptual Engineering Study – T&Cs

The level of improved cost & time estimates will be dependent on the amount of network upgrades and the amount of contributing DG

Substations

- Site visit to the existing site and potentially to the remote ends
- Complete surveys needed to develop the scope of work, depending on the project
  - Topographical Survey
  - Earthwork Quantities Report
  - Geotechnical Survey
- Improve scope definition by the performance or generation of some or all of the following:
  - Permitting, Real State and Outreach needs assessment
  - Storm Water Pollution Prevention Plan (SWPPP)
  - Site Plan (Install & Removal)
  - General Arrangement (Install & Removal)
  - Engineering notes
  - Preliminary bill of materials
  - Post fault current study - Aspen model
  - Fault Duty Analysis
  - CT Performance Calculations
  - Power One Line Diagram
  - Relay One Line (existing site and remote ends)
  - Integration One Line (existing site and remote ends)
  - Communication One Line (existing site and remote ends)
  - Ampacity Analysis of Underground Cables (When applicable)

Lines

- Develop a Conceptual Design Package by doing the following:
  - Gathering LiDAR topographic survey
  - Developing a design criteria document to summarize:
    - Project scope of work
    - Type of transmission structures, conductor and shield wire to be used
    - Compile electrical and structural standards to be used on the project
  - Creating a PLS-CADD model of the transmission line work
  - Developing a preliminary materials list and construction bid form
- Refine permitting and real estate scope

T&Cs: Schedule Comparison – With Attrition Window

- Per developers' request, proposed T&Cs enable developers to consider attrition before completion of the study
  - Inherently results in schedule extension following conclusion of Phase 1 (Pre-PSCAD Assessment)
    - 1 month: No attrition (hold period for developer consideration)
    - 4-5 months: Attrition

T&Cs: Milestone Summary

	Phase I						Phase II			
	Challenge Work*		Results Check-In*		Attrition Window*		Re-Study Cost Allocation*		I.3.9 Approval*	
Milestone	Previous Schedule	T&C Option #2 Implemented	Previous Schedule	T&C Option #2 Implemented	Previous Schedule	T&C Option #2 Implemented	Previous Schedule	T&C Option #2 Implemented	Previous Schedule	T&C Option #2 Implemented
Clusters 07, 08 & 10	22-Jun	22-Jun	22-Sep	22-Sep		22-Oct		23-Jan	22-Nov	23-Apr
Cluster 09	22-Jun	22-Jun	22-Sep	22-Sep		22-Oct		23-Jan	23-Jan	23-Mar
Clusters 11 & 12	22-Jul	22-Jul	22-Sep	22-Sep		22-Oct		23-Jan	22-Nov	23-Apr
Cluster 13	22-Nov	23-Jan	22-Dec	23-Apr		23-May		23-Aug	23-Apr	23-Jun
Clusters 14 & 15	22-Aug	22-Aug	22-Oct	22-Oct		22-Nov		23-Feb	22-Nov	23-May
Cluster 16	22-Jul	Complete	22-Sep	22-Aug		22-Aug		22-Sep	22-Nov	22-Nov

Will not transition these to T&Cs with exception of Cluster 13

*Dates shown are estimated completion dates
*Schedule includes re-study periods that could be reduced in a best-case scenario

PSCAD General Update

- Recent studies have shown that certain inverter technologies are vulnerable to tripping following bulk system events such as faults. The primary mechanism for tripping is an instantaneous overvoltage protection which is designed to disconnect the inverters when any individual phase exceeds some threshold (eg. 1.25-1.4 pu depending on inverter and manufacturer). This protection may exist to protect the inverter hardware, or (more likely) may exist to prevent the inverter from causing a voltage to exceed IEEE 1547 TOV standards in the case of a load rejection or island event. Transient voltages exceeding these levels are not frequent in the bulk grid, but are possible during extreme fault events, and bulk grid devices (not subject to IEEE 1547 standards) are typically able to withstand them.
- This problem is made worse by the nature of the fault conditions being analyzed. In particular, several critical events leave significant portions of DER connected to the grid very weakly through the distribution system. These weak conditions can result in the inverters being unable to maintain tight control over their currents during and immediately following severe faults, and in some cases they may inject enough current following the fault to create a voltage transient high enough to trip themselves off.
- It is possible in theory that the equipment protection may be relaxed to ride through higher voltages, although that would be subject to actual hardware limitations, and may also cause the plants to be unable to meet IEEE 1547 or regional requirements for islanding. It is also possible that the inverter controls could be tuned to provide better control over local current injections and avoid creating the over-voltages that result in tripping.
    - Inverter manufacturers/types that CMP has confirmed are vulnerable to this issue based on the results of the Sanford/Quaker Hill Cluster 04 study include: Sungrow SG125HV, SMA STP Core1 62-US, SMA SHP Peak 3 125-US or 150-US.

Winslow-Lakewood Cluster 02

Curtailment Solution Summary

The Winslow-Lakewood transmission system impact study identified N-1 and N-1-1 thermal overloads on the 34.5 kV which require mitigation.

N-1

- The study identified a need to upgrade a single 34.5 kV line to address a N-1 thermal overload. The Network Upgrade would be cost allocated to four (4) projects in the Winslow area.

N-1-1

- In order to address multiple N-1-1 thermal overloads, CMP developed two solution alternatives. The first alternative consisted of the upgrade/rebuild of approximately 42 miles of 34.5 kV transmission lines, estimated to cost $98.8M and allocated among 18 of the 20 cluster projects. Another alternative considered was a locally implemented DER Curtailment Solution that would prohibit the DERs from participating in the ISO New England markets. This curtailment solution would require local CMP operator action to curtail the DER within the Winslow and Lakewood Cluster to avoid potential thermal overloads for a subsequent contingency event. This curtailment solution was approved by the ISO-NE and was narrowly tailored for subtransmission contingencies that resulted in constraints on the subtransmission system. Due to the manual nature of this curtailment solution, CMP will evaluate the scalability of implementing similar solutions in other areas on a case-by-case basis.

- While the projects have saved significant time and upfront expense, the restriction that prevents the projects from being registered in ISO-NE Markets remains a financial concern to developers. CMP has been working with the ISO to identify and work towards a path to permit the Market registration (registration as settlement-only) for these impacted generators, where the contingency and the overloaded element are not on pool-transmission facilities (PTF). The ISO-NE will be bringing its proposal to this month's NEPOOL Reliability Committee for stakeholder discussion.

Projects in Cluster 02 received revised IAs around February 14th and will be required to meet project milestones such as making payments between now and resolution of ISO Market Registration

Cluster 02 - Winslow-County Rd-Lakewood -1

Cluster 02 Winslow-Lakewood Final report and PPAs were submitted to ISO-NE on November 30th

- RC meeting held December 14th, 2021 and received recommendation for approval
- The recommendation includes a locally implemented DER Curtailment Solution with the DERs being managed and dispatched locally instead of participating in the ISO New England markets
- Received ISO-NE I.3.9 approval on 12/17. This cluster is now considered complete.

LINK to Biweekly Report

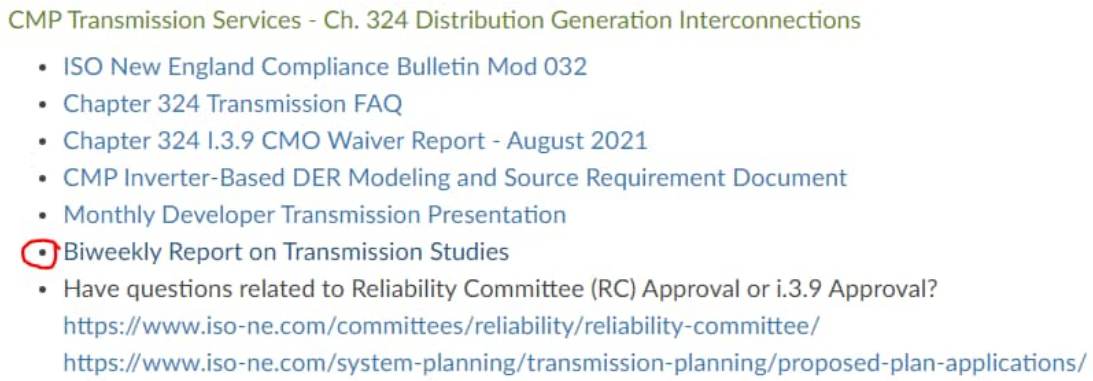
Other Transmission Items

- CMP has revised its model requirements and source requirements documentation and is expecting all projects to follow the latest revision which can be found on the CMP website.

- Power Factor Adjustments
  - If the Impact Study report calls for 99% power factor and the requirement to absorb VARs, even though the inverter may be capable of outputting the maximum requested MW while absorbing the requested VARS, the distribution analysis intended that the MWs would be reduced and the i.3.9 reflects this intended MW restriction.

General Information – Biweekly Reports

- CMP is posting reports biweekly every other Friday beginning October 8 containing individual cluster study schedules.


CMP Transmission Services - Ch. 324 Distribution Generation Interconnections

- ISO New England Compliance Bulletin Mod 032
- Chapter 324 Transmission FAQ
- Chapter 324 I.3.9 CMO Waiver Report - August 2021
- CMP Inverter-Based DER Modeling and Source Requirement Document
- Monthly Developer Transmission Presentation
- Biweekly Report on Transmission Studies
- Have questions related to Reliability Committee (RC) Approval or i.3.9 Approval?
  https://www.iso-ne.com/committees/reliability/reliability-committee/
  https://www.iso-ne.com/system-planning/transmission-planning/proposed-plan-applications/

- Biweekly Reports provide non-CEII details on the clusters, the cluster schedules, cluster dependencies, and preexisting conditions.

- Posting of the detailed Biweekly Report permits this presentation to focus on the highlights of each cluster.

General Information – CEII NDAs

- CMP is providing Critical Energy Infrastructure Information (CEII) non-disclosure agreements (NDA) to cluster participants.

- CEII results will be provided at five milestones throughout the cluster study process.
  - Preliminary steady-state study results prior to mitigation. These will be shared to provide an order of magnitude view of the potential network upgrades necessary.
  - Phase 1 study results at the conclusion of the Phase 1 study, which will include mitigation and cost allocations associated with steady-state, short circuit and stability analyses
  - Restudy results inclusive of revised cost allocations
  - PSCAD results if any adverse conditions have been identified
  - Final reports at the conclusion of Phase 2

Transmission Study Requirement

- CMP is required to ensure the reliability of the transmission system
- CMP performs a transmission assessment on all Level 4 interconnection requests, regardless of size
- I.3.9 review is a separate review process (ISO-NE PP5-1)
  - Applies to all projects greater than 1 MW and some projects less than 1 MW if included in an aggregate study
- ISO-NE is the final authority on what transmission study is required to receive the necessary i.3.9 approval
- Projects with completed studies are presented at the NEPOOL Reliability Committee (RC)
  - Meets on a monthly basis; recommends approval or disapproval to ISO-NE
- Process culminates in ISO-NE I.3.9 approval letter
- Permission to commercially operate with CMP will not be authorized until the project has received ISO-NE approval letter
- The i.3.9 process is independent of the Ch. 324 process. CMP sees each project to IA completion in accordance with the Ch. 324 timelines

Level 0 with Non-Comprehensive Study

Study Threshold

- < 5 MW individually and
- ≥ 5 MW and < 20 MW of DG in aggregate at 115 kV substation or electrically close 115 kV substations

Study Scope

- Steady state only
- Evaluated at Peak and Shoulder or Light Load with heavy N-S Transfers
- Report submitted to ISO-NE
- If no criteria violations, proceed to ISO notification form, PP-1 Attachment 3
- If criteria violations, project responsible for network upgrades
- Typically on RC Consent Agenda

Study Cost Estimate

- $3,000 - $10,000

Non-Comprehensive Study Update

- Due to large amount of DG already approved to interconnect through the ISO-NE I.3.9 process, projects with non-comprehensive designations are under evaluation at the ISO-NE to determine if they still can obtain their approval through the use of the ISO-NE Level 0 notification form (with a NC study) or if they will require the full Level III analysis.

- If the ISO-NE determines that the areas where these projects will interconnect is saturated (exceeds the 20 MW threshold), CMP will attempt to roll these into existing cluster studies where feasible.

- All new projects > 1 MW proposing to interconnect that have not been given a prior NC designation can expect to require an ISO-NE Level III study.

Level 3 (III)

Study Threshold

- ≥ 5 MW individually

Study Scope

- Steady state, short-circuit, stability
- Evaluated at variety of load levels and dispatches per ISO-NE recommendation
- If criteria violations, project responsible for network upgrades
- Report submitted to ISO-NE
- Requires ISO form, PP-1 Attachment 1
- Results presented at RC

Study Cost Estimate

- Approx. $20,000 - $65,000
  Approx. $25,000 - $35,000 adder for PSCAD

These Individual Level III projects must submit PSSE load flow and stability models for their projects that are specifically tailored to their project's characteristics. Standard library models are required. In addition, a project-specific short circuit model for use with ASPEN and a project-specific PSCAD model are required.

Level 3 (cont'd)

- Evaluate effect of proposed generation interconnections on the steady-state, stability, and short-circuit performance of the Pool Transmission Facilities (PTF) in central Maine. Develop system models to simulate the proposed interconnections under various operating conditions to evaluate if the interconnections have a Significant Adverse Impact on steady-state, stability, or short-circuit performance in accordance with ISO-NE Planning Procedures 5-3 and 5-6.

- Definition of Significant Adverse Impact from the ISO-NE Technical Planning Guide Section 5 - Appendices:

A change to the transmission system that increases the flow in an Element by at least two percent (2%) of the Element's rating and that causes that flow to exceed that Element's appropriate thermal rating by more than two percent (2%). The appropriate thermal rating is the normal rating with all lines in service and the long time emergency or short time emergency rating after a contingency.

A change to the transmission system that causes at least a one percent (1%) change in a voltage and causes a voltage level that is higher or lower than the appropriate rating by more than one percent.

A change to the transmission system that causes at least a one percent (1%) change in the short circuit current experienced by an Element and that causes a short circuit stress that is higher than an Element's interrupting or withstand capability.

With due regard for the maximum operating capability of the affected systems, one or more of the following conditions arising from faults or disturbances, shall be deemed as having significant adverse impact: A fault or a disturbance that cause:

Any loss of synchronism or tripping of a generator
Unacceptable system dynamic response as described in PP 3
Unacceptable equipment tripping: tripping of an un-faulted bulk power system element (element that has already been classified as Bulk Power System) under planned system configuration due to operation of a protection system in response to a stable power swing or operation of a Type I or Type II Special Protection System in response to a condition for which its operation is not required

Level 3 Aggregate Studies

Study Threshold

- ≥ 20 MW of DG in aggregate at 115 kV substation or electrically close 115 kV substations

Project Inclusion

- Must have an executed study agreement prior to cluster kick-off

Study Cost Estimate

- Approximately $500,000 for a cluster of 20 projects
- Study costs allocated on a per MW (under study) basis
- Midday Minimum scenarios could add up to $38k per cluster regardless of size

Restudies including QP additions/withdraws and PRJ addition/withdraws/reductions due to leapfrogging and complex mitigation all impact the timelines and study costs

Level 3 Aggregate Studies (cont'd)

Steady State Dispatch (Representative only)

- Peak Load D1 dispatch:
  - New Brunswick exporting 1050 MW to New England
  - Heavy north to south transfers across Maine and Northern New England
  - QP639 offline
- Peak Load D2 dispatch:
  - New Brunswick exporting 1050 MW to New England
  - Heavy north to south transfers across Maine and Northern New England
  - QP 639 online
- Peak Load D3 dispatch:
  - New England exporting 550 MW to New Brunswick
  - South to north transfers across Maine
- Shoulder Load D4 dispatch:
  - New Brunswick exporting 1050 MW to New England
  - Surowiec South Transfers Reduced
  - Heavy Southern Maine Generation
- Light Load D5 dispatch:
  - New Brunswick exporting 1050 MW to New England
  - Heavy north to south transfers across Maine and Northern New England
- Minimum Load D6 dispatch:
  - New Brunswick - New England, Orrington-South, Surowiec-South and ME-NH interface transfers all < 100 MW
  - No large synchronous generators on in Maine and New Hampshire
  - QP639 offline

Level 3 Aggregate Studies (cont'd)

Modeling

- 2019 or 2020 ISO-NE Model Administration and Support (MAS) Cases
- Study year 2021 or 2022
- Include relevant ISO "QP" Projects

Short Circuit

- ASPEN short-circuit analysis of all PTF circuit breakers in the vicinity of this interconnection. The case for the short circuit study will originate from the ISO-NE short circuit case library.

Stability

- Test the dynamic response of the proposed generators' PSSE models in accordance with ISO-NE's Generator Testing Procedure including testing the dynamic response of the power system for design contingencies near the interconnection. The case for the short circuit study will originate from the ISO-NE short circuit case library.
- < 5 MW aggregate on distribution buses using DER_A with NERC parameters adjusting ride-thru to ISO SRD requirements

Level 3 Aggregate Studies (cont'd)

PSCAD

- ISO-NE requires PSCAD studies for clusters over 20 MW
- Send in the PSCAD files to the CMP Interconnections Team (CMP-Interconnection.Services@cmpco.com)
- Identify the Project Number associated with each submittal
  - If one company is using the same inverters for all of its projects, submit multiple files
- Follow the ISO-NE Source Requirements Document (SRD). At this time, CMP does not have our own SRD. The models would be what you submit to Eversource as opposed to National Grid.
- Include documentation – CMP Transmission Planning does not have the internal capability of verifying the PSCAD submittals.
  - We can expedite review by using documentation to confirm the minimum requirements (consistent with ISO SRD).
  - Ensure the files are for the right inverter (ie SC2000 vs SC2500) and for the correct frequency (60 Hz)
  - Send in models for If a project has a plant controller, this should be included in the model.

- Additional Resource:
  - https://www.electranix.com/pscad-model-requirements/
  - Latest edition: PSCAD Model Requirements Rev. 10, February 3, 2021

Level 3 Aggregate Studies (cont'd)

Cluster Study – Mitigation Challenge Session

- Proposal to implement project-focused challenge session internal to the cluster study process is being implemented in the Winslow-Lakewood cluster study
- Specifically designated cluster study engineers will perform review of results and propose alternative mitigation strategies if available for consideration
- No study models, contingency files, etc. will be shared with individual Projects or developers or their engineering firms
- Challenge session alternatives will be included in the final CEII report

Level 3 Aggregate Studies (cont'd)

- Protective Trip Settings
  - Many projects' protective trip settings are not compliant with the ISO-NE's Inverter Source Requirement Document (SRD)
  - https://www.iso-ne.com/static-assets/documents/2018/02/a2_implementation_of_revised_ieee_standard_1547_iso_source_document.pdf

Table I: Inverters' Voltage Trip Settings

Shall Trip – IEEE Std 1547-2018 (2nd ed.) Category II					
Shall Trip Function	Required Settings		Comparison to IEEE Std 1547-2018 (2nd ed.) default settings and ranges of allowable settings for Category II		
	Voltage (p.u. of nominal voltage)	Clearing Time(s)	Voltage	Clearing Time(s)	Within ranges of allowable settings?
OV2	1.20	0.16	Identical	Identical	Yes
OV1	1.10	2.0	Identical	Identical	Yes
UV1	0.88	2.0	Higher (default is 0.70 p.u.)	Much shorter (default is 10 s)	Yes
UV2	0.50	1.1	Slightly higher (default is 0.45 p.u.)	Much longer (default is 0.16 s)	Yes

Table II: Inverters' Frequency Trip Settings

Shall Trip Function	Required Settings		Comparison to IEEE Std 1547-2018 (2nd ed.) default settings and ranges of allowable settings for Category I, Category II, and Category III		
	Frequency (Hz)	Clearing Time(s)	Frequency	Clearing Time(s)	Within ranges of allowable settings?
OF2	62.0	0.16	Identical	Identical	Yes
OF1	61.2	300.0	Identical	Identical	Yes
UF1	58.5	300.0	Identical	Identical	Yes
UF2	56.5	0.16	Identical	Identical	Yes

Important Links

CMP Interconnections Webpage: Interconnection (cmpco.com)

CMP Transmission Services - Ch. 324 Distribution Generation Interconnections

- ISO New England Compliance Bulletin Mod 032
- Chapter 324 Transmission FAQ
- Chapter 324 I.3.9 CMO Waiver Report - August 2021
- CMP Inverter-Based DER Modeling and Source Requirement Document
- Monthly Developer Transmission Presentation
- Biweekly Report on Transmission Studies
- Have questions related to Reliability Committee (RC) Approval or i.3.9 Approval?
  https://www.iso-ne.com/committees/reliability/reliability-committee/
  https://www.iso-ne.com/system-planning/transmission-planning/proposed-plan-applications/

Important Links (cont'd)

Central Maine Power MPUC Chapter 324 Interconnection Project List

CENTRAL MAINE POWER

CMP Chapter 324 Level 4 Interconnection Queue

											Feasibility Study		Impact Study		Facility Study							
Project #	Queue Position	Dependency (D)	Date App Rec'd	Town	Substation	Circuit	Type of Generation	Total Size (kW	Solar Size (kW	Battery Size (k	Start	Completion	Start	Completion	Start	Completion	Fully Executed Interconnection Agreement	Commercial Operation Date	Status	115 kV SS	T. Level 0=Screen NC=Non-Comp 3=Full	i39: RC Approval S = Submitted A = Approved
234	2 - LOV	D233	11/1/2019	Sweden	LOVELL	430D1	Solar/Battery	5,000	5,000	4,999			1/0/00	1/0/00			1/0/00	-	Active	Kimball Road/Lovell		
235			11/4/2019	West Paris	TRAP CORNER	453D1	Solar	2,500	2,500	-			5/1/20	7/6/20			7/13/20	Q4 2021	Fully Executed Interconnection Agreeme	Woodstock	NC	September
236	1 - Win		11/6/2019	Benton	WINSLOW	870D1	Solar/Battery	4,950	4,950	3,300			1/0/00	1/0/00			1/0/00	Q4 2020	Active	Winslow-County Rd		
237			11/7/2019	Denmark	DENMARK	413D1	Solar/Battery	2,500	2,500	2,340			12/16/19, 4/9/20	2/20/20, 5/20/20			5/27/20	Q4 2020	Fully Executed Interconnection Agreeme	Kimball Road/Lovell	3	
~~238~~			~~11/7/2019~~	~~Manchester~~	~~MANCHESTER~~	~~233D1~~	~~Solar/Battery~~												Withdrawn	~~Augusta E/Puddledock/Bowman St~~		
~~239~~			~~11/7/2019~~	~~Cornish~~	~~HIRAM TAP~~	~~692D1~~	~~Solar~~												Withdrawn	~~Kimball Road/Lovell~~		
240			11/7/2019	Searsport	SEARSPORT	850D2	Solar/Battery	4,000	4,000	2,000			3/24/20	5/28/20			6/16/20	Q4 2020	Fully Executed Interconnection Agreeme	Belfast	3	
241	2 - Win	D236	11/7/2019	Benton	WINSLOW	870D1	Solar	4,990	4,990	-			1/0/00	1/0/00			1/0/00	-	Active	Winslow-County Rd		
242	3 - Win	D241	11/7/2019	Benton	WINSLOW	870D1	0	-	-	-			1/0/00	1/0/00			1/0/00	-	Active	Winslow-County Rd		
243	4 - Win	D242	11/7/2019	Benton	WINSLOW	870D1	Solar/Battery	4,900	4,900	5,000			1/0/00	1/0/00			1/0/00	-	Active	Winslow-County Rd		
~~244~~			~~11/7/2019~~	~~Searsport~~	~~SEARSPORT~~	~~850D2~~	~~Solar/Battery~~												Withdrawn	~~Belfast~~		
245			11/7/2019	Starks	ANSON	801D1	Solar	1,800	1,800	-			1/27/20, 4/24/20	4/1/20, 6/4/20			7/6/20	Q4 2021	Fully Executed Interconnection Agreeme	Lakewood	3	
246	1 - Dex		11/7/2019	Dexter	DEXTER	813D1	Solar	4,000	4,000	-			5/1/20	7/6/20			1/0/00	Q4 2021	Active	Guilford	3	
247			11/7/2019	North Anson	NORTH ANSON	838D2	Solar	2,000	2,000	-			2/3/20	4/8/20			6/4/20	Q4 2021	Fully Executed Interconnection Agreeme	Lakewood	3	
~~248~~			~~11/7/2019~~	~~Westbrook~~	~~SPRING STREET~~	~~668U5~~	~~Solar~~												Withdrawn	~~Spring St~~		
249	3 - SNS	D229	11/7/2019	Skowhegan	SKOWHEGAN NORTH SIDE	853D2	Solar	2,500	2,500	-			1/0/00	1/0/00			1/0/00	Q4 2021	Active	Lakewood		
~~250~~			~~11/12/2019~~	~~Augusta~~	~~BOND BROOK~~	~~208D3~~	~~Solar~~												Withdrawn	~~Augusta E/Puddledock/Bowman St~~		
251			11/12/2019	Farmington	FARMINGTON FALLS	818D2	Solar	2,000	2,000	-			12/12/19	2/18/20			3/20/20	Q3 2021	Fully Executed Interconnection Agreeme	Sturtevant	NC	A
252			11/13/2019	Berwick	BERWICK	603D2	Solar	3,563	3,563	-			12/5/19	2/4/20			3/24/20	Q4 2020	Fully Executed Interconnection Agreeme	Quaker Hill	0	A
253	1 - R 115		11/13/2019	Naples	RAYMOND 115 KV	445D2	Solar	4,999	4,999	-			5/15/20	7/16/20			1/0/00	Q4 2021	Active	Raymond	3	
254			11/13/2019	Sidney	SOUTH WATERVILLE	855D2	Solar	1,950	1,950	-			1/27/20	4/1/20			5/20/20	Q4 2021	Fully Executed Interconnection Agreeme	Winslow-County Rd	3	
255	2 - FH	D76	11/13/2019	Gorham	FORT HILL	624D2	Solar	4,950	4,950	-			1/0/00	1/0/00			1/0/00	Q3 2021	Active	Raymond		
256			11/13/2019	Rockport	MEADOW ROAD	270D2	Solar	3,550	3,550	-			4/8/20	6/11/20			6/12/20	Q4 2020	Fully Executed Interconnection Agreeme	Meadow Road	NC	August
257	1 - Man		11/13/2019	Hallowell	MANCHESTER	233D2	Solar/Battery	4,975	4,975	2,340			5/15/20	7/20/20			1/0/00	-	Active	Augusta E/Puddledock/Bowman St	3	
258			11/13/2019	Sabattus	CROWLEYS	411D1	Solar	4,900	4,900	-			3/26/20	6/2/20			6/19/20	-	Fully Executed Interconnection Agreeme	tel Rd/Gulf/Middle St/Crowleys/Norw	3	
~~259~~			~~11/13/2019~~	~~St Albans~~	~~HARTLAND~~	~~824D2~~	~~Solar~~												Withdrawn	~~Hartland~~	~~NC~~	
260	1 - HT		11/14/2019	Parsonfield	HIRAM TAP	692D1	Solar	4,200	4,200	-			6/17/20	8/20/20			1/0/00	Q4 2021	Active	Kimball Road/Lovell	3	
~~261~~			~~11/14/2019~~	~~Eustis~~	~~STRATTON~~	~~877D1~~	~~Solar~~												Withdrawn	~~Bigelow~~	~~0~~	~~July~~
262	2 - LF	D133	11/18/2019	Jay	LIVERMORE FALLS	428D1	Solar	4,200	4,200	-			1/0/00	1/0/00			1/0/00	Q3 2020	Active	Livermore Falls		
263	6 - MO	D165	11/18/2019	Monmouth	MONMOUTH	457D3	Solar	3,250	3,250	-			1/0/00	1/0/00			1/0/00	-	Active	Monmouth		
264			11/18/2019	Strong	PHILLIPS/STRONG	841D1	Solar/Battery	4,990	4,990	4,990			2/25/20	4/29/20			5/6/20	Q3 2021	Fully Executed Interconnection Agreeme	Sturtevant	NC	August
265	1 - Oak		11/19/2019	Oakland	OAKLAND	839D1	Solar	4,000	4,000	-			1/0/00	1/0/00			1/0/00	Q4 2020	Active	Winslow-County Rd		
~~266~~			~~11/19/2019~~	~~Newcastle~~	~~DAMARISCOTTA-HILLS~~	~~219D2~~	~~Solar/Battery~~												Withdrawn	~~Newcastle~~	~~0~~	~~July~~
267	7 - MO	D263	11/19/2019	Wales	MONMOUTH	457D1	Solar	5,000	5,000	-			1/0/00	1/0/00			1/0/00	Q4 2020	Active	Monmouth		
268			11/19/2019	Corinna	CORINNA	811D1	Solar	4,950	4,950	-			4/2/20	6/8/20			7/23/20	Q4 2020	Fully Executed Interconnection Agreeme	Detroit	3	
~~269~~			~~11/20/2019~~	~~Paris~~	~~NORWAY~~	~~435D3~~	~~Solar/Battery~~												Withdrawn	~~Norway~~		
270			11/20/2019	Vassalboro	VASSALBORO	861D8	Solar	3,300	3,300	-			1/27/20	3/30/20			4/17/20	Q1 2022	Fully Executed Interconnection Agreeme	Winslow-County Rd	3	
271			11/21/2019	Sabattus	SABATTUS	450D1	Solar	900	900	-			1/7/20, 5/1/20	3/10/20, 6/12/20			6/16/20	-	Fully Executed Interconnection Agreeme	Hotel Rd/Gulf/Middle St/Crowleys	0	NA

Important Links (cont'd)

ISO-NE

https://www.iso-ne.com/participate/applications-status-changes/interconnection-process-guide/is-the-interconnection-process-right-for-you

https://www.iso-ne.com/system-planning/transmission-planning/proposed-plan-applications/

https://www.iso-ne.com/static-assets/documents/rules_proceds/isone_plan/pp05_1/pp5_1.pdf

https://www.iso-ne.com/static-assets/documents/rules_proceds/isone_plan/pp05_3/pp5_3_final.pdf

https://www.iso-ne.com/static-assets/documents/rules_proceds/isone_plan/pp05_6/pp5_6.pdf

https://www.iso-ne.com/static-assets/documents/2017/03/transmission_planning_techincal_guide_rev6.pdf

ISO-NE's Inverter Source Requirement Document (SRD)
https://www.iso-ne.com/static-assets/documents/2018/02/a2_implementation_of_revised_ieee_standard_1547_iso_source_document.pdf