2016/17 Maine Resource Integration Study – Additional Scenarios and Cluster Formation

Planning Advisory Committee

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SYSTEM PLANNING

Agenda

- Present the results for additional threshold sensitivities for the Maine Resource Integration Study (MRIS)
- Present updated approach to the cluster formation for Northern and Western resources

BACKGROUND

Brief Summary of the Maine Resource Integration Study

Study Objectives

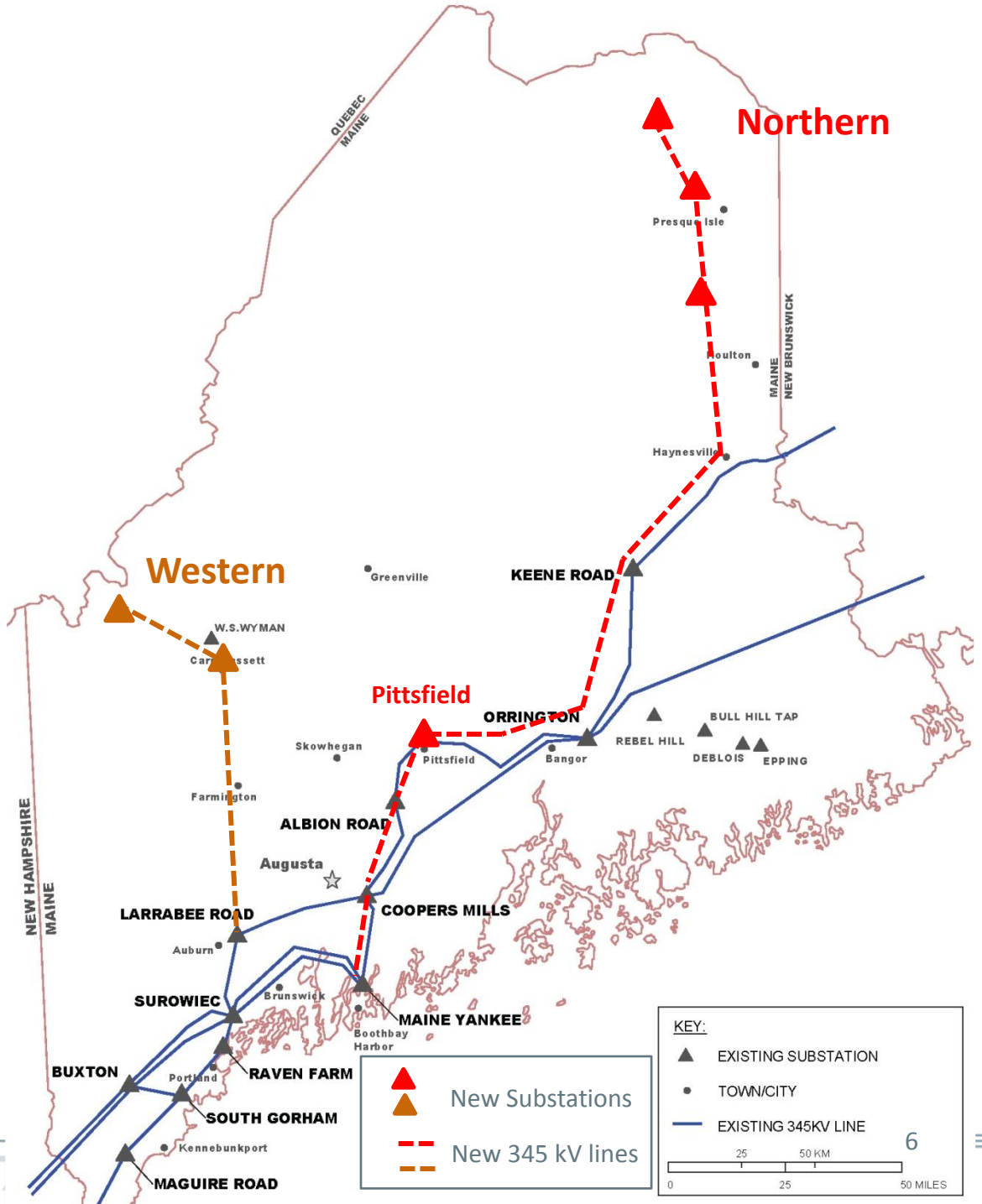
- Identify potential transmission infrastructure that could be used to interconnect queued generation in Maine
  - Quantify generation that could interconnect with new transmission
- The Maine Resource Integration Study is focused on the assessment of new 345 kV AC transmission circuits that could connect to the areas with the largest quantity of requested new generation interconnections
  - Scope presented to the March 2016 PAC meeting
  - Initial Steady State Results presented to the September 2016 PAC
  - Additional Steady State Results presented to the November 2016 PAC
  - Preliminary Stability Results presented to the February 2017 PAC
  - Study Results presented to May 2017 PAC
  - Scenarios and Cost Estimates presented to August 2017 PAC

Link to Interconnection Queue Clustering

- The Tariff changes for the proposed interconnection clustering methodology received the support of the NEPOOL Participants Committee at the February 2017 meeting
  - Filed at FERC on September 1, 2017
- The proposed methodology will be triggered when more than one Interconnection Request requires common new transmission line infrastructure to interconnect
- Clustering approach will have two phases
  - Phase 1 will be a Regional Planning Study that is presented to the PAC
    - It is proposed that this Maine Resource Integration Study will be used as the regional study for the first cluster(s)
  - Phase 2 will be a Cluster System Impact Study where more than one project will be studied together and will share the costs for certain upgrades

Transmission Upgrade Concepts

- Radial double circuit tower 345 kV line to a new 345 kV substation at Pittsfield with additional Parallel Pittsfield to Coopers Mills & Parallel 392 line (Coopers Mills – Maine Yankee 345 kV)
- Radial to Larrabee Road & Parallel 392 line



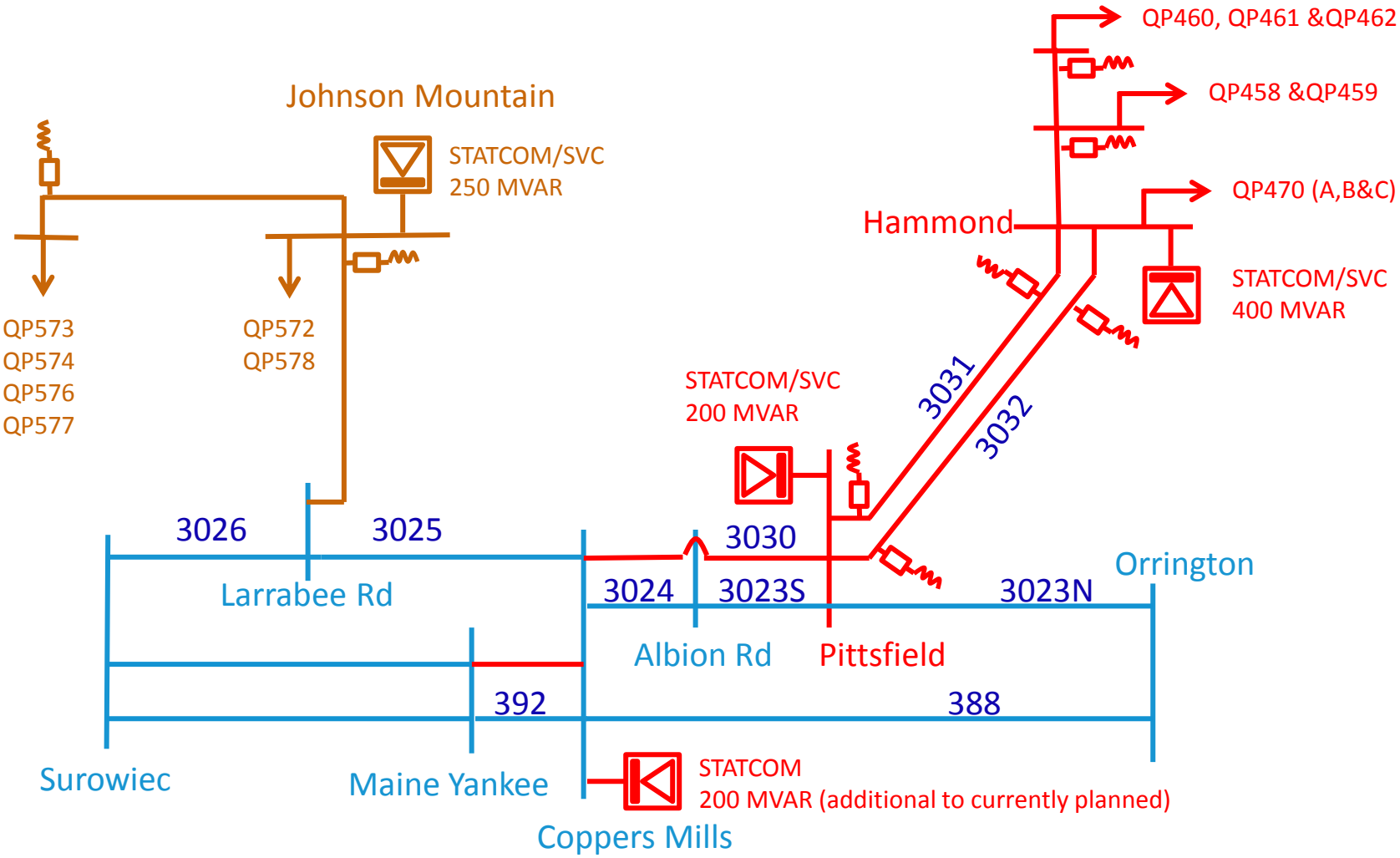
Queue Positions Included in Detailed Testing

- Northern Resources
  - QP458 & QP459
  - QP460, QP461 & QP462
  - QP470

  1118 MW
- Western Resources
  - QP572
  - QP573 & QP577
  - QP574 & QP576
  - QP578

  777 MW
- Note that the above list was selected as a representative set of actual Queue Positions that could participate in the cluster
  - Within the overall level of MW studied, any of the Queue Positions that are identified as eligible for the cluster could ultimately participate in the Cluster System Impact Study

Transmission Upgrades



ADDITIONAL THRESHOLD SENSITIVITIES

MW Threshold for Single Line to Pittsfield Only (no new lines south of Pittsfield)

- Identify the maximum amount of MW in Northern Cluster that can be interconnected to the New England system with the following upgrades:
  - Only one new Pittsfield-Hammond 345 kV line (no DCT)
  - No new 345 kV lines from Pittsfield–Coopers Mills or from Coopers Mills to Maine Yankee
  - Reactive upgrades as needed
- Approximately 325-350 MW
  - Limited by N-1 and N-1-1 violations on lines south from Orrington
  - Approximately 100 MVAR Statcom in addition to synchronous condenser(s) also required
  - Exact MW and MVAR values would be determined by the resources that proceed in this configuration
  - Surowiec-South remains at 1,600 MW

MW Threshold for Single Line to Pittsfield (no Double Circuit Tower)

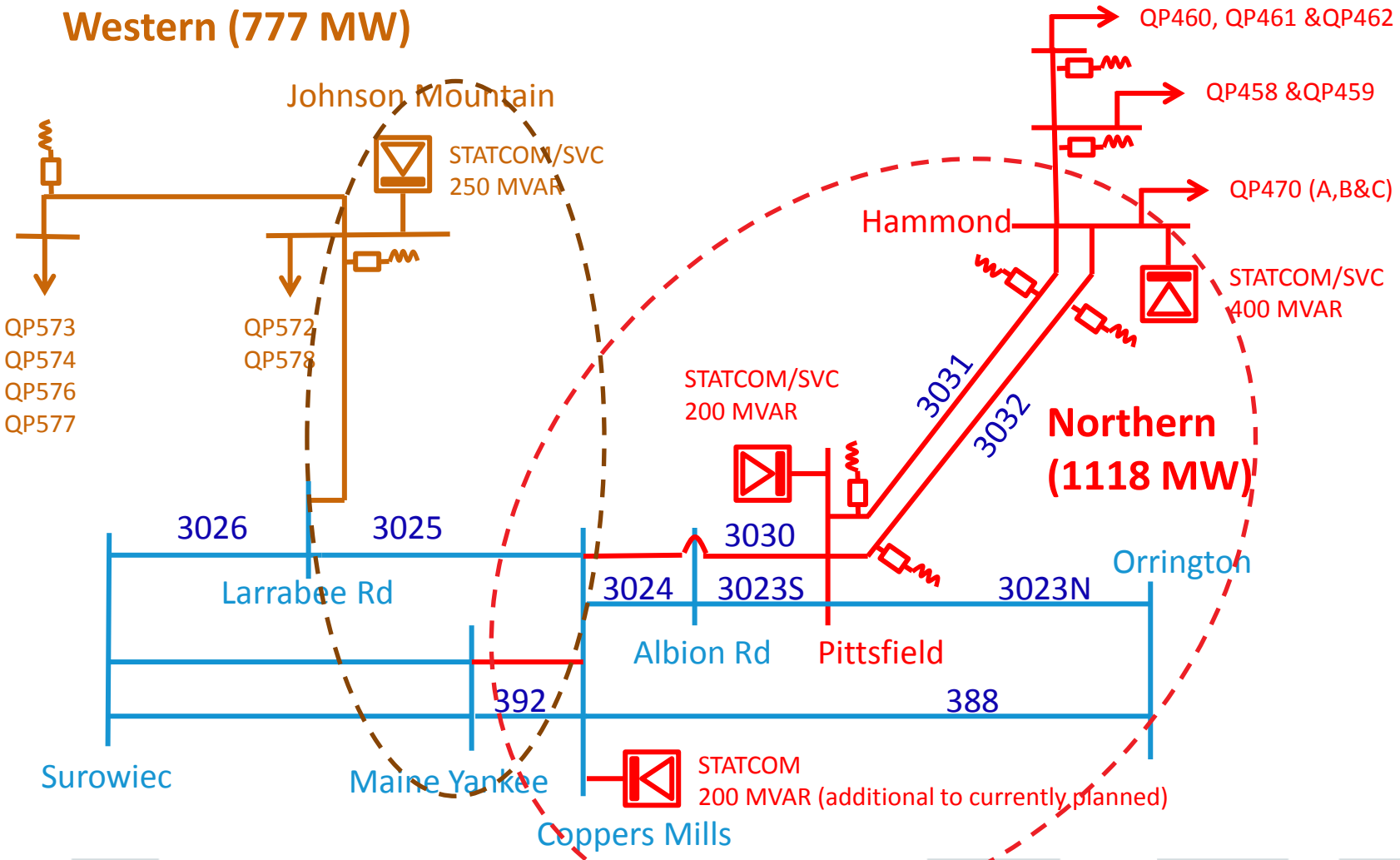
- Identify the maximum amount of MW in Northern Cluster that can be interconnected to the New England system with the following upgrades:
  - Only one new Pittsfield-Hammond 345 kV line (no DCT)
  - One new Pittsfield-Coopers Mills 345 kV line
  - One new Coopers Mills–Maine Yankee 345 kV line
  - Reactive upgrades as needed
- Approximately 675 MW
  - Limited by instability of wind farm facilities for local normal contingency faults
  - Approximately 650 MVAR total Statcom in addition to synchronous condenser(s) also required
  - Exact MW and MVAR values would be determined by the resources that proceed in this configuration
  - Surowiec-South increased to 2,200 MW

UPDATED CLUSTER FORMATION

Northern and Western Clusters

- The ISO presented Scenarios and Cost Estimates for the Maine Resource Integration Study at the August 2017 PAC
- Stakeholders observed that the sensitivity results appeared to identify that the dynamic reactive devices were attributable to either the Western or the Northern resources, but not to both sets of resources
- The ISO has reviewed the attribution of the dynamic reactive devices and is proposing to implement two clusters
  - Northern Maine Cluster
  - Western Maine Cluster

Northern and Western Cluster Upgrades



Northern Transmission Upgrades
Cost Estimates

	Transmission Facility Upgrades (1,118 MW Northern)	Miles/Size	Cost ($M)
Substation	New Hammond 345 kV Switching Station		35.3
Upgrades	New Pittsfield 345 kV Switching Station		44.4
Transmission	New 345 kV AC Transmission Line from Hammond S/S to Pittsfield (DCT)[5]	149	819.5
Upgrades[1]	New 345 kV AC Transmission Line from Pittsfield - Coopers Mills[5]	40	153.0
	New 345 kV AC Transmission Line from Coopers Mills to Maine Yankee[2]	27	108.1
Reactive	Statcom/SVC at the Hammond S/S	2 x 200	105.4
Upgrades	Statcom/SVC at the Pittsfield Switching Station	200	54.6
	Additional statcom at the Coopers Mills S/S	200	43.1
	Shunt reactors at Pittsfield	2 x 65	Note 3
	Shunt reactors at Hammond	2 x 65	Note 3
		Total	**1363.5**

Notes are on the following slide

Northern Transmission Upgrades
Cost Estimate Notes

1. Estimates assume bundled (2) 1590 ACSR conductor for all new 345 kV transmission lines
2. The second Coopers Mills – Maine Yankee line is common between both the northern and western Maine clusters and substation terminal upgrade costs are included in the provided estimate. Estimate assumes that work is required at Coopers Mills for both North and Western clusters. The $108.1 million cost to build the new line is duplicated in the Northern and Western cost estimate presentations, but if both clusters proceed, this cost would be shared by Northern and Western resources according to the distribution factor cost allocation methodology.
3. Hammond/Pittsfield shunt reactor costs included in substation costs
4. Assumed two 345kV generator terminals at Hammond, in the event more terminations are required this cost will increase
5. Substation terminal costs are included in the pricing above
6. Estimate provided above is a good faith non-binding order of magnitude estimate per ISO-NE PP4 Appendix D with an assumed accuracy of -50% to +200%
7. Assumed Contingency= 30%
8. Billing Adder= 16%
9. AFUDC= 0% (Assumed developers will supply capital for the project)
10. Escalation= 8.3% (Assumed 4 years of escalation and that construction will occur in year 2021)
11. In general MEPCO provided estimate based on breaker configuration identified in the ISO-NE MRIS results presentation. The next phase of planning process will finalize and agree on breaker configurations.

Western Transmission Upgrades
Cost Estimates

	Transmission Facility Upgrades (777 MW Western)	Miles/Size	Cost ($M)
Substation Upgrades	New Johnson Mtn 345 kV Switching Station[4]		44.5
	Larrabee Road 345 kV terminal upgrades		4.1
Transmission Upgrades[1]	New 345 kV AC Transmission Line from Johnson Mtn to Larrabee	100.8	353.2
	New 345 kV AC Transmission Line from Cooper Mills to Maine Yankee[2]	27	108.1
Reactive Upgrades	Statcom/SVC at Johnson Mtn	250	65.7
	Shunt reactor at Johnson Mtn	2 x 35	Note 3
		Total	**575.5**

Notes are on the following slide

Western Transmission Upgrades
Cost Estimates Notes

1. Estimates assume bundled (2) 1590 ACSR conductor for all new 345 kV transmission lines
2. The second Coopers Mills – Maine Yankee line is common between both the northern and western Maine clusters and substation terminal upgrade costs are included in the provided estimate. Estimate assumes that work is required at Coopers Mills for both North and Western clusters. The $108.1 million cost to build the new line is duplicated in the Northern and Western cost estimate presentations, but if both clusters proceed, this cost would be shared by Northern and Western resources according to the distribution factor cost allocation methodology.
3. Johnson Mountain shunt reactor costs included in substation costs
4. Assumed two 345kV generator terminals at Johnson Mountain as shown in the ISO-NE diagram, in the event more terminations are required this cost will increase
5. Estimate provided above is a good faith non-binding order of magnitude estimate per ISO-NE PP4 Appendix D with an assumed accuracy of -50% to +200%
6. Assumed Contingency= 30%
7. Billing Adder= 16%
8. AFUDC= 0% (Assumed developers will supply capital for the project)
9. Escalation= 8.3% (Assumed 4 years of escalation and that construction will occur in year 2021)
10. In general CMP provided estimate based on breaker configuration identified in the ISO-NE MRIS results presentation. The next phase of planning process will finalize and agree on breaker configurations.

Cluster Implementation

- The Maine Resource Integration Study supports the ability to conduct the Northern and Western Cluster System Impact Studies simultaneously
- The only cost that would be shared by the clusters is the new second Coopers Mills to Maine Yankee 345 kV line
  - Costs would be allocated using the same Distribution Factor methodology, in accordance with, or consistent with, the Late-Comer cost allocation provision, as applicable

Next Steps

- Issue Draft Report for 30 day comment period
  - Expected in September
  - Will include proposed cost allocations

Questions