



# 2016/17 Maine Resource Integration Study – Scenarios and Cost Estimates

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*Planning Advisory Committee*

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SYSTEM PLANNING



# Agenda

- Present the results for different megawatt scenarios for the Maine Resource Integration Study (MRIS)
- Present cost estimates for the Cluster Enabling Transmission Upgrades

# BACKGROUND

*Brief Summary of the Maine Resource Integration Study*

# Study Objectives

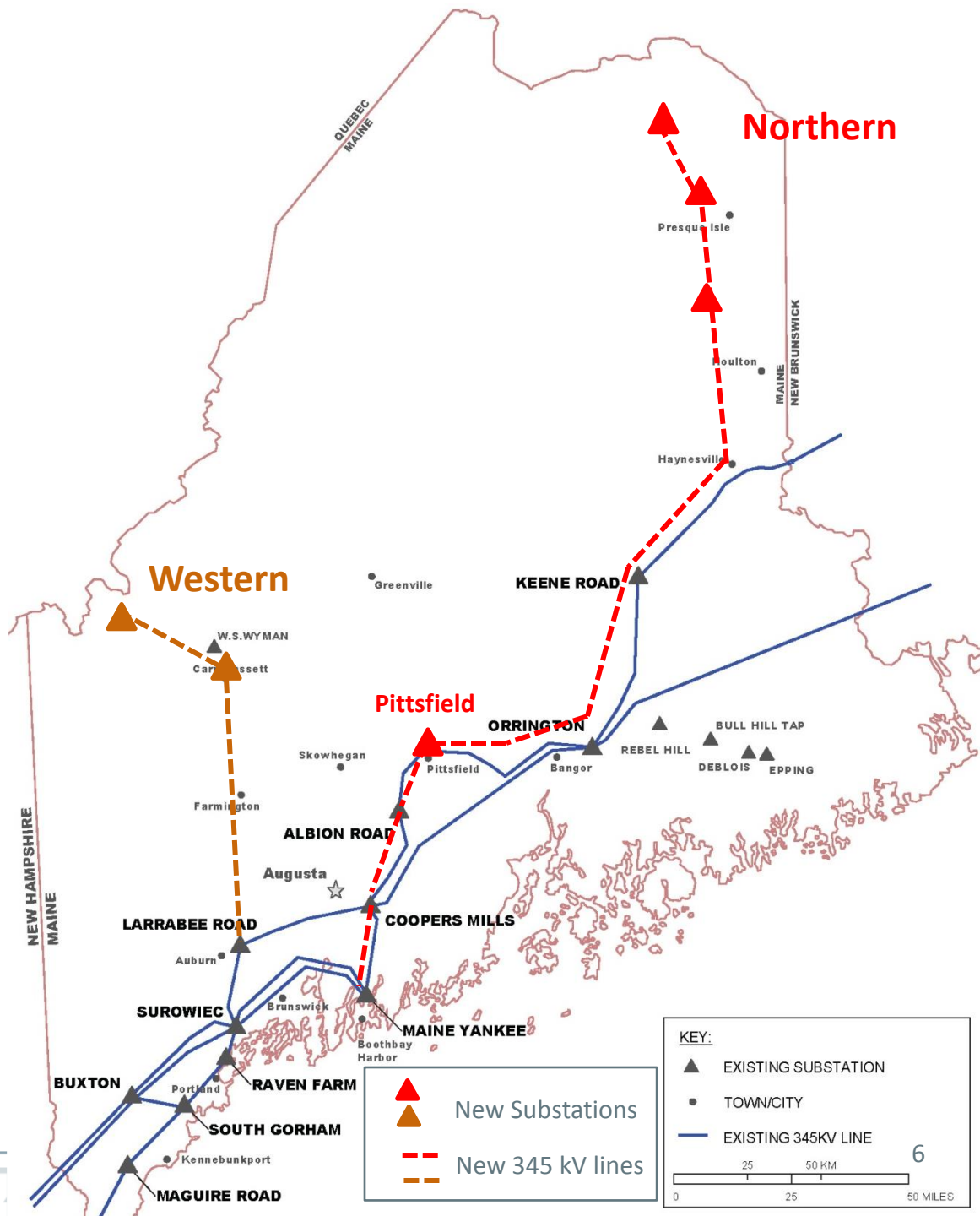
- Identify potential transmission infrastructure that could be used **to interconnect** queued generation in Maine
  - Quantify generation that could interconnect with new transmission
- The Maine Resource Integration Study is focused on the assessment of new 345 kV AC transmission circuits that could 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

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



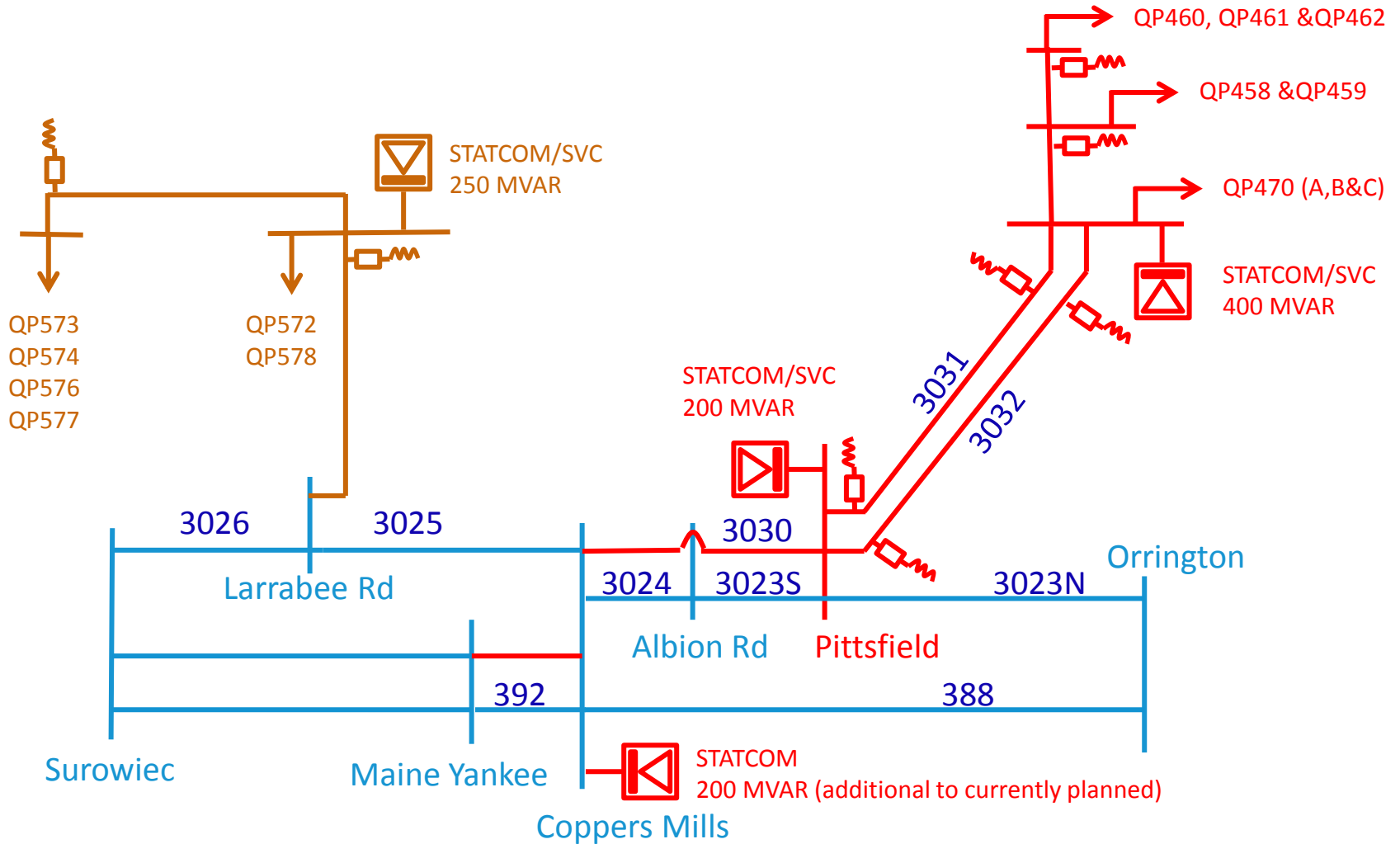
# Queue Positions Included in Detailed Testing

- 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





# RESULTS FOR DIFFERENT MEGAWATT SENSITIVITIES

# Sensitivities Studied

- Scenario 1 - Northern Only (1,118 MW)
- Scenario 2 - Half Northern Only (559 MW)
- Scenario 3 - Western Only (777 MW)

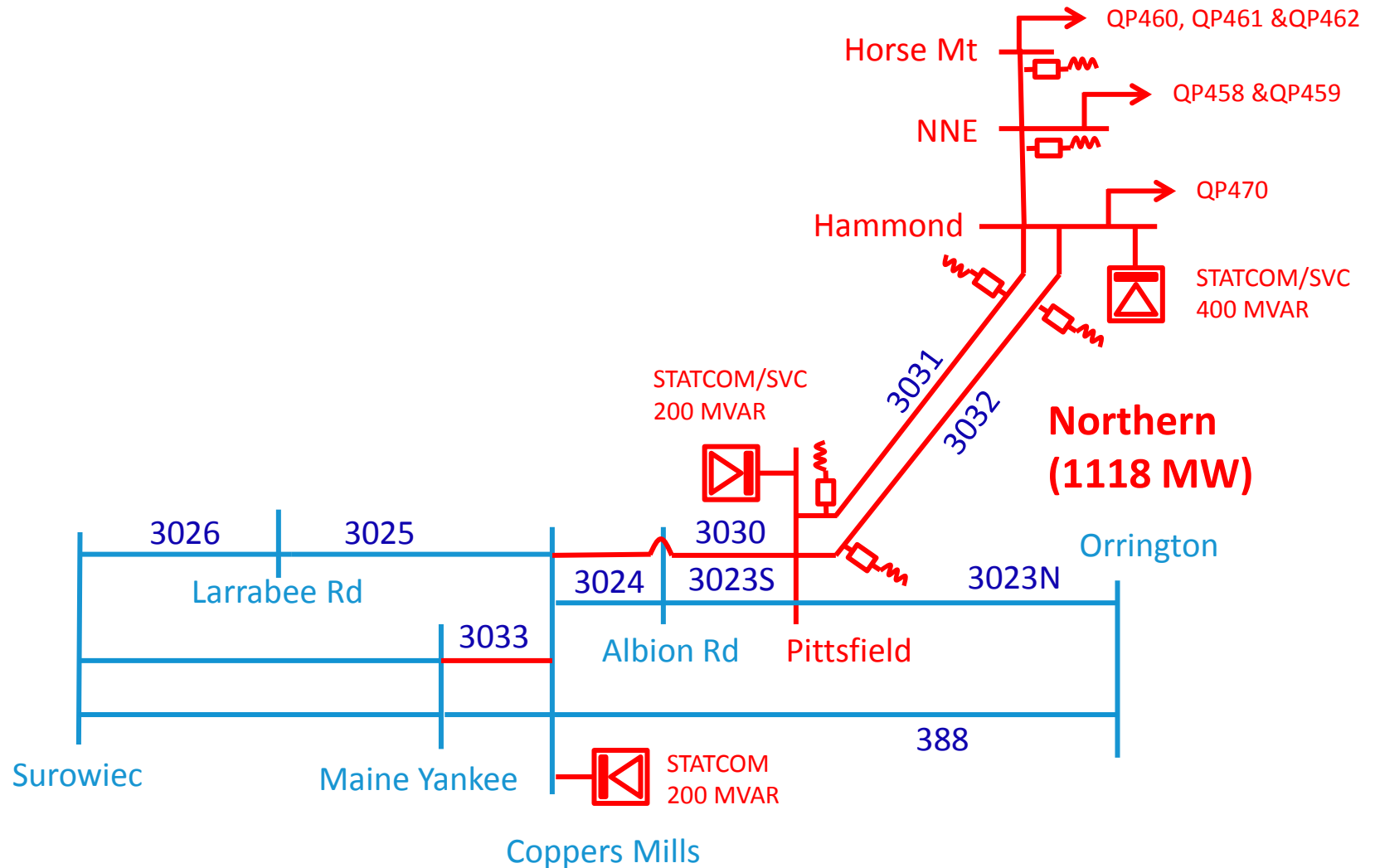


# Required Transmission Upgrades for Three Scenarios

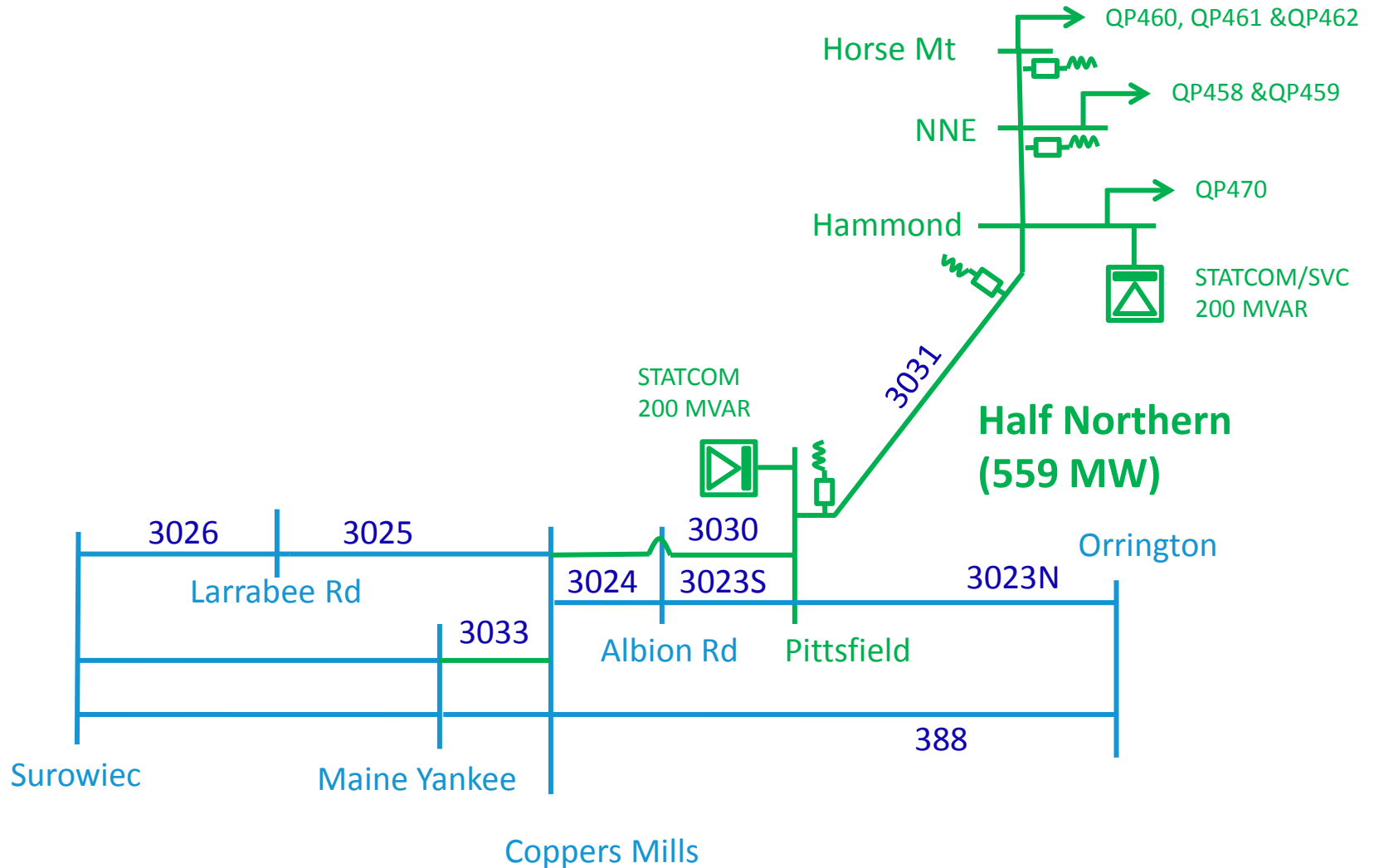
Facilities		Scenario 1	Scenario 2	Scenario 3	Northern & Western* (already studied)
New 345kV lines	Coopers Mills – Maine Yankee	X	X	X	X
	Pittsfield – Coopers Mills	X	X		X
	Pittsfield – Hammond 1	X	X		X
	Pittsfield – Hammond 2	X			X
	Hammond - NNE	X	X		X
	NNE – Horse Mt	X	X		X
	Larrabee Rd – Johnson Mt			X	X
	Johnson Mt – Jim Pond			X	X
STATCOMs (MVAR)	@Hammond	2X200	2X100		2X200
	@Pittsfield	1X200	1X200		1X200
	@Coopers Mills	1x200			1X200
	@Johnson Mt			1X250	1X250
Reactors (MVAR)	@Pittsfield	2X65	1X65		2X65
	@Hammond	2X65	1X65		2X65
	@NNE	1X30	1X30		1X30
	@Horse Mt	1X30	1X30		1X30
	@Johnson Mt			2X35	2X35
	@Jim Pond			2X35	2X35
Upgrades of Existing System	Larrabee Rd Autotransformer			X	X
	Bath – ME Yankee Tap (207-2)	X			X

\*--- upgrades for two clusters (northern & western) were listed here only for comparison purposes

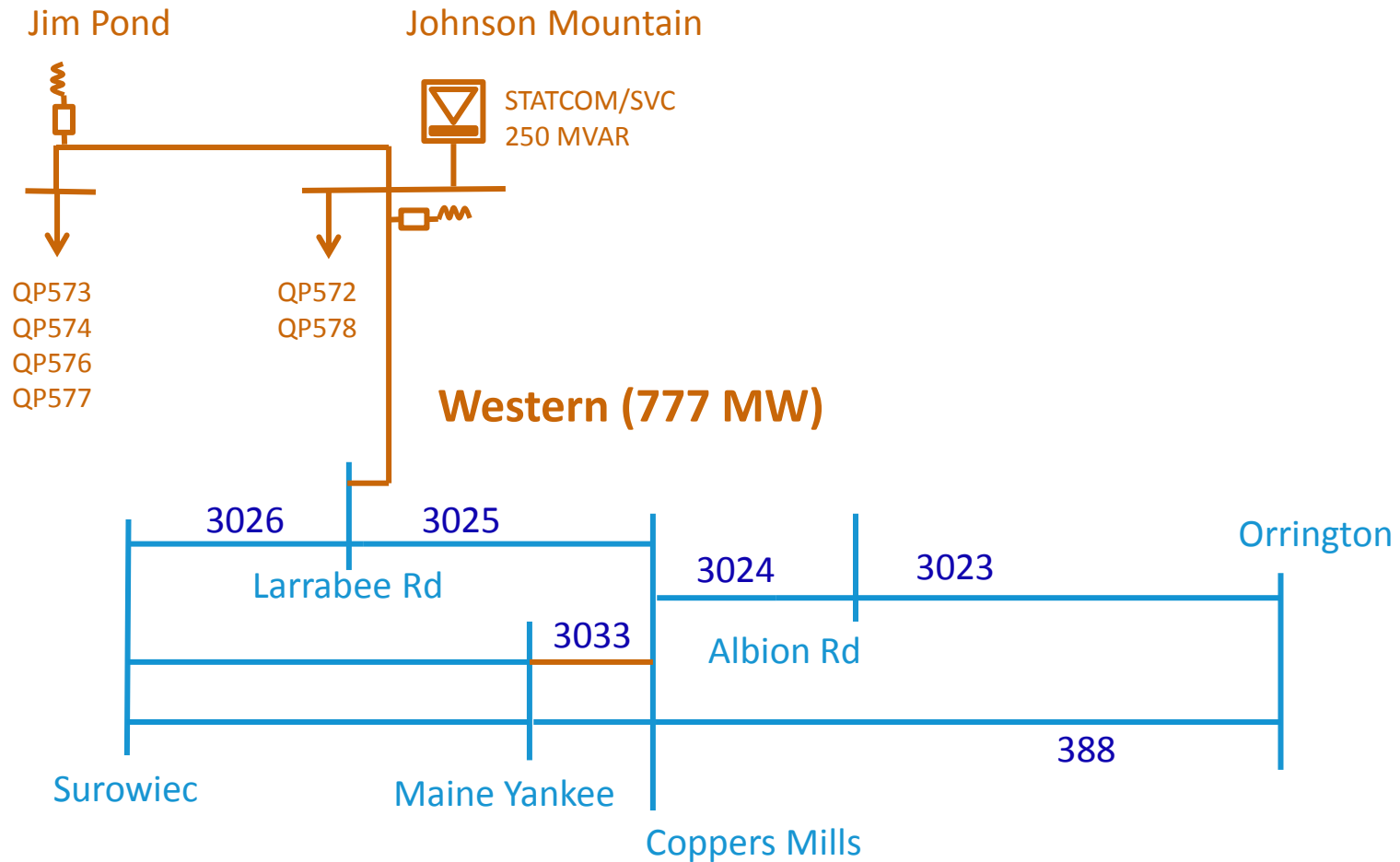
# Transmission Upgrades for Scenario 1



# Transmission Upgrades for Scenario 2

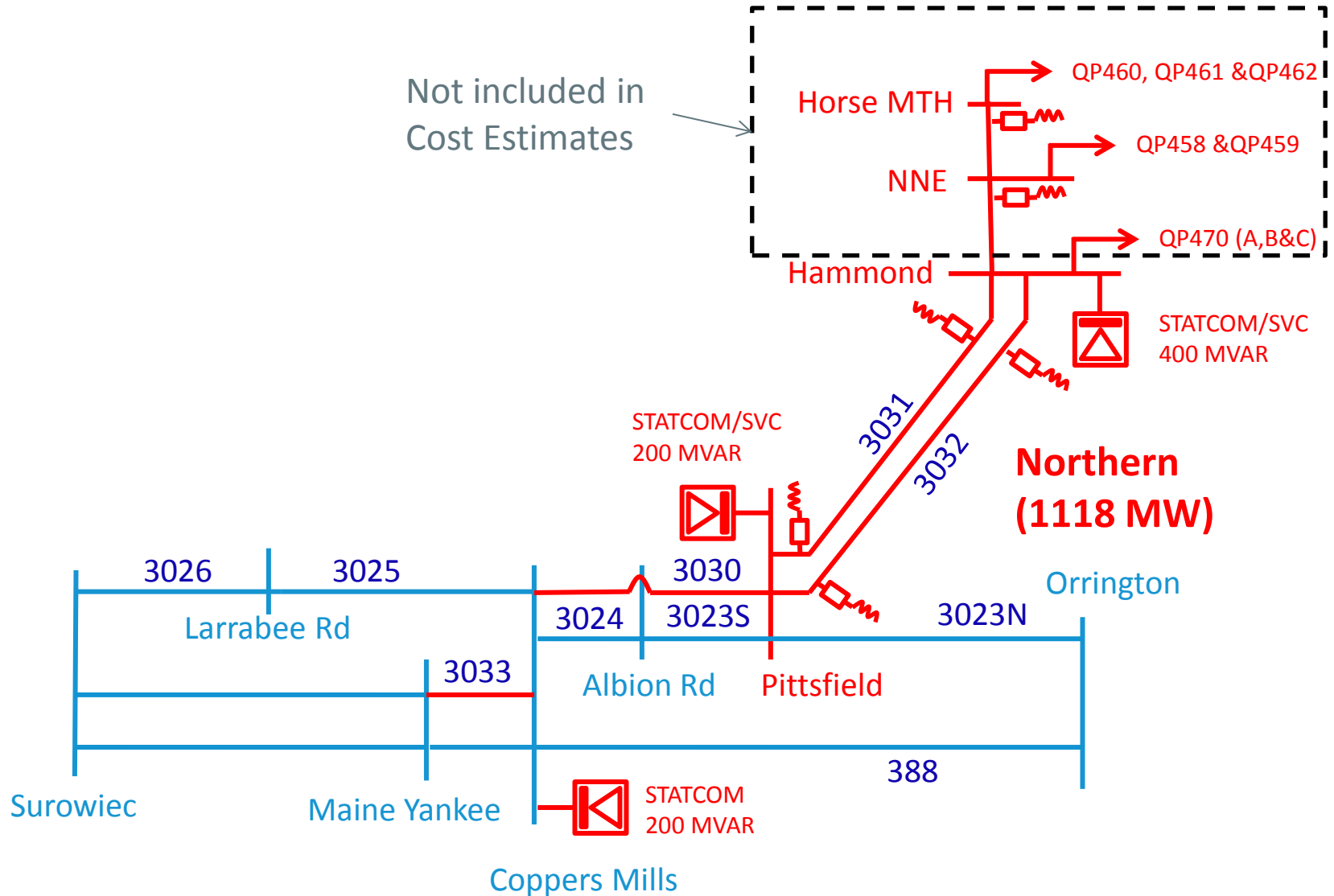


# Transmission Upgrades for Scenario 3



# COST ESTIMATES

# Northern Transmission 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) <sup>5</sup>	149	819.5
Upgrades <sup>1</sup>	New 345 kV AC Transmission Line from Pittsfield - Coopers Mills <sup>5</sup>	40	153.0
	New 345 kV AC Transmission Line from Coopers Mills to Maine Yankee <sup>2</sup>	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
		<b>Total</b>	<b>1363.5</b>

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 CETU's and substation terminal upgrade costs are included in the provided estimate
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.

# Single Circuit Hammond-Pittsfield 345 kV line

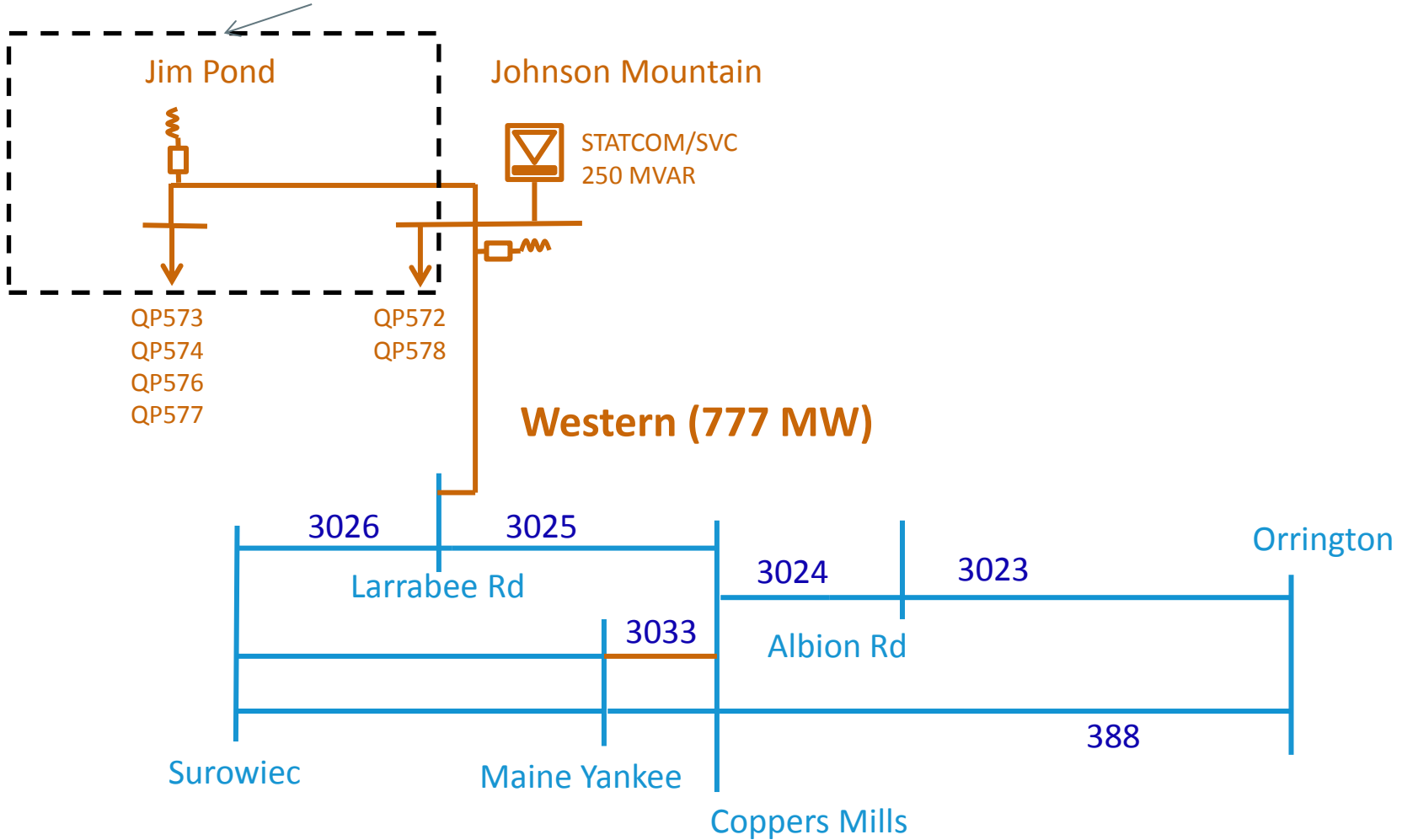
- The earlier described sensitivity analysis identified that a single circuit 345 kV line from Hammond-Pittsfield could be used for 559 MW of Northern generation
- The Transmission Owner provided a cost estimate for building the Hammond-Pittsfield 345 kV line as a single-circuit line
- Note that the additional upgrades identified on Slide 11 would also be required for this configuration for this level of MW

Transmission Facility Upgrades		Miles/Size	Cost (\$M)
Transmission	New 345 kV AC Transmission Line from Hammond S/S to Pittsfield	149	540.9
Upgrade <sup>1</sup>			

Notes are on the previous slide

# Western Transmission Upgrades

Not included in Cost Estimates



# Western Transmission Upgrades

## Cost Estimates

Transmission Facility Upgrades		Miles/Size	Cost (\$M)
Substation Upgrades	New Johnson Mtn 345 kV Switching Station <sup>4</sup>		44.5
	Larrabee Road 345 kV terminal upgrades		4.1
Transmission Upgrades <sup>1</sup>	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 <sup>2</sup>	27	107.8
Reactive Upgrades	Statcom/SVC at Johnson Mtn	250	65.7
	Shunt reactor at Johnson Mtn	2 x 35	Note 3
		<b>Total</b>	<b>575.2</b>

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 CETU's and substation terminal upgrade costs are included in the provided number
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.

# Other Upgrades

- Other upgrades were identified for certain combinations of Northern and Western resources
  - Larrabee Road T1 345/115 kV Transformer
  - 115 kV Section 207 (Maine Yankee – Bath)
  - Review of Orrington series capacitors
- Since these were not required in all cases, the need for these upgrades will be finalized in the Cluster System Impact Study
  - These upgrade costs will not be included in the cost estimate-based deposit that will be required to enter the cluster (the Cluster Participation Deposit)

# Next Steps

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



# Questions

