Feasibility Study for Improving New England Loss-of-Source Limits

Northeast Coordinated System Plan
IPSAC05
December 14, 2007

ISO new england

ISO NEW YORK INDEPENDENT SYSTEM OPERATOR℠
Building the Energy Markets of Tomorrow . . . Today

pjm

Background

- The loss-of-source limit is coordinated on an interregional basis
- NYISO and PJM economically dispatch their systems to observe transmission security limits considering
  - Contingency limits internal to their systems
  - A loss-of-source contingency in New England of 1,200 MW
- Operation of sources in New England above 1,200 MW is permissible provided that the contingency loss-of-source in New England is less severe than the internal contingencies
- Voltage constraints (as opposed to thermal or stability limits) are usually binding in New York and PJM
- The actual loss-of-source limits are dependent upon a number of system conditions

Previous Loss-of-Source Study Results

- Stakeholders requested the JIPC to
  - Confirm loss-of-source operating limits
  - Determine the short-term outlook
  - Examine system improvements that would increase the loss-of-source limit
- Operating and short-term planning outlooks were conducted and presented to the IPSAC March 2007
  - The New York Central-East (CE) Interface currently/will typically constrain the loss-of-source limit to 1,250 MW to 1,400 MW
  - PJM limitations are usually less restrictive at 1,400 MW to 1,500 MW

Feasibility Study for Improving New England Loss-of-Source Limits

- The relative severity of contingencies internal to the New York and PJM systems when compared to the impact of the loss-of-source contingencies in New England drives the loss-of-source limits
- Adding shunt reactive elements in New York or PJM would not increase the loss-of-source limit all the time
  - Economic dispatch would tend to utilize any increases in transfer limits
- However, a change in the overall network impedance could potentially increase the loss-of-source limit by reducing the power-flow pick-up on Central East for loss-of-source contingencies relative to contingencies internal to New York

Review of Pick-Up Factor

- Loss of Source Pick-up Factor for CE =

$$\frac{\text{(Post-contingency MW) – (Pre-contingency MW)}}{\text{Loss of Source MW}}$$

- Internal NY Transmission Line Pick-up Factor for CE =

$$\frac{\text{(Post-contingency MW) – (Pre-contingency MW)}}{\text{Pre-contingency MW flow in line(s)}}$$

Screening Analysis

- Goal – Identify feasibility of “quick-fixes” to increase the permissible loss-of-source limit for Central East
  - Study the 2009 system
- Method – Conduct pick-up analysis to quantify the impact of transmission improvements on constrained interfaces
  - Consider improvements that change the network impedance
  - Show the change in the relative severity of internal versus loss-of-source contingencies
  - Examine several loss-of-source contingencies in New England, including Sandy Pond at 1,200 MW and at 1,500 MW
  - Simulate key transmission contingencies within New York

System Improvements Considered

- Decreasing the relative impedance of the southern New England ties to New York compared to the northern New England ties would
  - Tend to reduce the pick-up across Central East for loss-of-source contingencies
  - However, it would increase the pick-up of the PJM Interfaces
- Similar results would be expected for increasing the impedance of the northern New England ties relative to the southern New England ties
- Considered short-term improvements alone and in combination
  - Planned transmission improvements in Southwest Connecticut
  - Adding 5% series reactors on both the Alps-Berkshire 345 kV tie and the Rotterdam-Bear Swamp 230 kV tie

Results

Table 1: Impact on Central-East Interface (Pick-up percentage)

	Phase II HVdc	Improvement		Contingency					
		SWCT Phase 2	5% Increase Impedance	Ph. II	Millstone	Mystic	Seabrook	MS-North	MS-South
Case 1	1200	No	No	34%	31%	34%	33%	67%	50%
Case 2	1200	No	Yes	32%	28%	33%	31%	66%	50%
Case 3	1200	Yes	No	32%	27%	34%	32%	61%	44%
Case 4	1200	Yes	Yes	31%	28%	32%	31%	61%	43%
Case 5	1500	No	No	33%	31%	34%	33%	67%	50%
Case 6	1500	No	Yes	32%	29%	33%	31%	67%	49%
Case 7	1500	Yes	No	32%	27%	34%	32%	61%	44%
Case 8	1500	Yes	Yes	31%	27%	32%	32%	61%	43%

Table 2: Decrease in pick-up factor with respect to existing system

	Phase II HVdc	Improvement		Contingency					
		SWCT Phase 2	5% Increase Impedance	Ph. II	Millstone	Mystic	Seabrook	MS-North	MS-South
Case 2	1200	No	Yes	-2%	-3%	-1%	-3%	-1%	-0%
Case 3	1200	Yes	No	-2%	-3%	-1%	-2%	-6%	-7%
Case 4	1200	Yes	Yes	-3%	-3%	-2%	-2%	-6%	-7%
Case 6	1500	No	Yes	-1%	-2%	-1%	-2%	-0%	-1%
Case 7	1500	Yes	No	-1%	-3%	-0%	-1%	-6%	-7%
Case 8	1500	Yes	Yes	-2%	-4%	-2%	-2%	-6%	-7%

Observations and Conclusions

- Across all cases, every loss-of-source contingency within New England (Phase II, Millstone, Mystic, and Seabrook) has about the same pick-up on the Central East Interface
  - The CE pick-up is approximately 31% +/- 3% across all cases
  - Some variation in the pick-up factors is the result of changes in the network impedance
  - Other differences are the result of changes in the voltage profiles and losses
- The completion of the Southwest Connecticut loop (Middletown – Norwalk Reliability Project)
  - Brings Connecticut electrically closer to PJM
  - Reduces the Central East pick-up factor by up to 0.5% for the contingency loss of imports over the Phase II HVdc Interconnection
  - Reduces the Central-East pick-up of Marcy-South contingencies by 5% to 7%

Observations and Conclusions (cont.)

- The addition of the series reactors reduces the pick-up on the Central East Interface about 1% to 2%

- Summary:

Improvement in New England Loss-of-Source Limits

Upgrades		Improvement in MW New England Loss-of-Source Limits from Existing System Limit of 1,200 MW
SWCT Phase 2	5% Increase Impedance	
No	Yes	31
Yes	No	8
Yes	Yes	72

Conclusions

- The addition of the series reactors could increase the acceptable loss-of-source contingency
  - By 30 MW without the Southwest Connecticut Loop
  - By 70 MW with the Southwest Connecticut Loop
- A complete evaluation of the series reactors would require detailed thermal, voltage, stability, transient, and short circuit analyses

Conclusions (cont.)

- The addition of the series reactors could provide very slight benefits, but would require extensive analysis and would likely degrade the overall performance of the system
  - The reactors would likely degrade thermal and stability performance
  - The operation of the system would be more complicated
  - Maintenance conditions would be problematic and losses would be higher

Conclusions (cont.)

- There do not appear to be quick-fix solutions that would change the relative severity of contingencies internal to New York and loss-of-source contingencies in New England
- Major transmission projects may have an impact on the permissible loss-of-source contingencies in New England
  - The scope of this further work will be discussed later today