January 28, 2019

LS Power and NYPA Comments on NYISO Board Draft Report on AC Project Selections

LS Power Grid New York, LLC (LS Power) and the New York Power Authority appreciate the opportunity to comment on the AC Transmission Public Policy Transmission Planning Report Addendum dated December 27, 2018 (Addendum) and intend to submit comments to the board prior to the March 1, 2019 deadline. In the meantime, this document summarizes the technical questions regarding the Addendum, most of which have been submitted to the Public Policy Planning Mailbox or presented verbally at the January 9, 2018 TPAS meeting.

Number	Document Reference	Question or Comment
1	Addendum, p. 7-8, Transfer Limits	Transfer Limits do not include the NUFs included in the System Impact Study (SIS), specifically a PAR at Alps to mitigate the NY/NE interface limitations. How would the PAR be operated once installed? The impact of the operation of the PAR should be reflected in the UPNY/SENY transfer results for each project. Note that a PAR at Alps would provide greater controllability than the series compensation included in Proposal T019, and could increase UPNY/SENY transfer for all projects.
2	Addendum p. 7, Transfer Limits	The UPNY/SENY N-1-1 Normal Thermal Transfer Capability results may have data inconsistency between the Draft Report and the Addendum. In the draft report, Table 3-18 for Roseton-East Fishkill 345kV line outage T027+T019 is 782MW, which is substantially lower than T027+T029 at 1331MW. In Addendum Table A-1 for the same line outage T027+T019 is 1350MW, which is close to the results of T027+T029. Please confirm these results.
3	Addendum p. 9, Cost per MW	The Segment B costs estimates do not reflect the estimated costs of the Segment B projects with Proposal T027. The estimated cost of Proposal T029 in combination with Proposal T027 is $401 million (see Table 3-10 of Draft Report). Further, since the Addendum assumes Proposal T027 is selected for all Segment B proposals, it would be appropriate to use the incremental cost of Proposal T027+Segment B proposal compared to the estimated cost of Proposal T027 alone. The incremental cost of Proposal T027+T029 is only $363 million relative to the estimated cost of Proposal T027 alone.
4	Addendum p. 9, Cost per MW	The NYISO did not incorporate the $4.875 million sub-synchronous resonance (SSR) mitigation cost in the Proposal T019 estimate in its calculation of various evaluation metrics such as $/MW. This known mitigation cost should be added to the Proposal T019 cost estimate.
5	Addendum p. 9, Cost per MW	The Addendum (p. 30) states that the Board concludes that visual impacts from structures will be addressed in the Article VII proceedings. However, this approach does not account for the many engineering measures identified in Proposals T029 and T030 taken to reduce structure heights that result in significant cost impacts, including matching existing structure locations, increasing conductor tension, adding in-line dead-ends, and adding structure weights to remediate uplift, estimated to be in the tens of millions of dollars. For an apples-to-apples comparison, mitigation costs must be included in Proposal T019, or a bare cost that removes mitigation measures that are currently included should be used for Proposals T029 and T030.

6	Addendum, p.9 Cost per MW, June Draft Report, p. 93	The Draft Report assumes that the impact on the NY/NE interface is equal for all projects, and that the installation of a PAR at Alps will mitigate the NY/NE interface limitations. However, the SIS studies for the projects identify that Proposal T019 has much greater impact on this interface. The SIS for Proposal T029 (in combination with Proposal T027 (double circuit)) identifies an impact of 140 MW on the interface. Proposal T018 (single circuit) +T019 had an impact of 236 MW on the interface. It is likely that the impact of Proposal T019 in combination with Proposal T027 will be even higher. Further, the worst case mitigation identified in the Proposal T019 SIS related to the NY/NE interface is estimated to cost $123 million, significantly higher than the worst case mitigation for other proposals. Please confirm whether the mitigation proposed for the NY/NE interface in Proposal T019 is correct and that the risk of higher cost NY/NE interface mitigations has been considered.
7	Addendum, p. 15-16, Impact on SENY 30-Minute Reserve Requirement	The SENY operating reserve requirement is 450MW higher with T027+T019 than T027+T029. Please provide the analysis that supports the conclusion, as made in the Addendum, that there should be no additional costs attributable to project T019 due to the higher operating reserve requirement. In particular, please perform this analysis using the system conditions that would exist under the NYISO's scenario that assumes achievement of the Clean Energy Standard goals, retirement of substantial generation in SENY and implementation of carbon pricing in the wholesale markets.
8	Addendum, p. 21, Production Cost	Please provide the Production Cost Savings by year for each of the Production Cost Savings NPVs identified in Table A-7 on page 21 of the Addendum.
9	Addendum, p. 21, Production Cost	In the January 9 meeting, the difference in Production Cost Savings between Proposals T027+T029 and Proposals T027+T030 was attributed to congestion on New Scotland to Knickerbocker. Please provide the annual congestion on the New Scotland to Knickerbocker transmission line in the production cost modeling results, CES+Retirement Scenario, for the following four cases: 1) base case, 2) T027+T019, 3) T027+T029, and 4) T027+T030.
10	Addendum, p. 11-12, Transmission Line Structural Design	The Addendum states that concrete foundations of Proposal T019 provide greater resilience to wind and ice loadings, which is not supported by engineering analysis and is not the case. The foundations of both Proposal T019 and Proposal T029 are designed for similar loadings and a concrete drilled pier foundation is not inherently stronger than a direct embed foundation. The Addendum also refers to benefits of the quantity of dead-end structures contributing to a resilient design. Please see the memorandum from Power Engineers Consulting, P.C., included as Attachment 1 for further information on these issues.
11	Addendum, p. 23, Revised Ranking	The production cost analysis assumes that the series compensation with Proposal T019 is in-service year round. Yet, the NYISO presentation of January 9 states "the NYISO expects operational benefits will be realized by the capability to control Segment B power flows by directing the operational status of the series compensation for T019." The Addendum attributed additional benefit to Proposal T019 for the "expected" benefits of switching the series compensation in and out of service. We believe that it is reasonable to assume that the series

		compensation, proposed with a bypass breaker to be capable of being removed from service, will not be in service year round. Therefore the production cost benefits – and the metrics driven by those benefits – are very likely overstated. We request that the NYISO account for the impact of removing the series compensation from service in the assessment of benefits of Proposal T019.
12	Draft Report, Property Rights Metric	The NYES Segment B – Transmission Project Interconnection Q543 System Impact Study for Proposal T019 (Proposal T019 SRIS, p. 3-5) notes that elements of Proposal T019 will be installed at Pleasant Valley on non-utility property. However the PSC Criteria include favoring projects that minimize the acquisition of property rights for substation expansions, considered in the Property Rights metric. The new information from the SIS, that Proposal T019 will require non-utility property, should be incorporated into Section 3.3.9 of the Draft Report, including Table 3-30, and Table 4-3 (Property Rights column).
13	Addendum, Appendix G, MMU Report	The MMU Report identifies the difference in transfer on UPNY-SENY of the recommended projects to be 2,000 MW for T027+T019 vs. 1,200 MW for T027+T029 and appears to calculate benefits based on a difference of 800 MW. However, the Addendum identifies the difference in transfer to be 2,100 MW for T027+T019 vs. 1,475 MW for T027+T029, or a difference of 625 MW. If this is the case then the MMU memo overstates the difference in benefits of the projects.
14	Addendum, Appendix H, ABB Study	The ABB study is highly qualified, for example, it states: "*Therefore, ABB recommends that a more appropriate screening study be performed before any mitigation option is selected, to ensure that the risk for SSR has been correctly identified.*" (p. ii) and does not consider potential impacts to future generators. ABB's analysis estimates that the cost of SSR mitigation could be approximately $4.875 million. There is no detail to this estimate to ensure that all costs, consistent with the estimates prepared by SECO for all of the proposals (including mark-up, contingency, etc.), have been captured. We request that the SSR mitigation estimate be prepared in the same format as developed by SECO to provide the necessary transparency and to enable market participants to verify all relevant costs have been reflected.
15	Addendum Appendix H, ABB Study	The ABB report was silent on the consideration of transient recovery voltages (TRV) and rate of rise transient recovery voltages (RRTRV). These phenomena are often encountered with series compensation applications and they were encountered with the Marcy South Series Compensation project. This phenomena results in circuit breakers (at the substation and in nearby substations) failing to interrupt fault current correctly. Additional costs would have to be incurred to mitigate these phenomena, which are absent from the Proposal T019 cost estimate. Please explain whether these phenomena were considered in the evaluation and why the additional mitigation costs were not included in the estimate.
16	T019 SRIS, p. 13-5	The SIS for Proposal T019 identifies the 40 kA circuit breaker at the Knickerbocker Series Compensation to be loaded at 203%, (Cricket Valley sensitivity) without the double circuit lines in Proposal T027. This implies that a circuit breaker with a rating of 90 kA or higher may be required, which is not commercially available. Please identify the resolution of this issue.

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MEMORANDUM

DATE: January 28, 2019

TO: Jim Andersen

C: Casey Carroll, Andy Scott, Marc Tavares, Simon Murley

FROM: Steve Walker
Sr. Project Manager

SUBJECT: 153160 NY AC Transmission NYISO PPTP Report Response on Resilience

MESSAGE

This memorandum addresses comments made by the NYISO in their AC Transmission Public Policy Transmission Planning Report Addendum, specifically the comments in Section 3.1 regarding the Resilience Benefits of the various project alternatives' Transmission Line Design characteristics.

Foundation Type

The NYISO report states (Section 3.1.1, page 11)

> *"National Grid/Transco T019 Segment B proposal includes heavier duty structures mounted on drilled-shaft concrete foundations where other proposals use direct embedded poles with crushed rock backfill foundations for tangent pole applications. The concrete foundations of T019 cost approximately two and a half times as much compared to the direct embedded rock foundations, but provide greater resilience to significantly heavier wind and ice loadings."*

The assertion that drilled-shaft concrete foundations are inherently more reliable than direct embedded poles is not correct. The applied loading, geotechnical parameters, the diameter and depth of the foundation determine the reliability of a foundation. Both types of foundations utilize similar mechanisms for resisting overturning moments from single pole structures. Industry standards such as the IEEE Guide for Transmission Structure Foundation Design and Testing[i] provide guidance on acceptable methods of design for these types of foundations to achieve the desired level of performance. Using these design methods, directly embedded foundations for transmission structures have been used with success, both from an overall performance standpoint as well as economics. By justifying an incremental cost delta without due consideration of the engineering mechanics and design basis of these two foundation types, the NYISO report inappropriately concludes that drilled shaft foundations provide more resilience than directly embedded pole foundations.

Longitudinal Cascade Event Containment

The NYISO report also states the following:

> *"In addition, T019 utilizes more dead-end structures compared to the other Segment B proposals, with an average distance of approximately one mile between dead-end structures. This more resilient design would mitigate cascading structure failures if they occur"*

Mitigation of longitudinal cascade events is an important element of a robust transmission line design basis. Left unchecked, longitudinal structure loads arising from broken conductors, broken hardware or unbalanced ice loading can result in longitudinal collapse of a transmission structure. In some cases progressive collapse of a large number of transmission structures can result. As the NYISO report notes, this was witnessed in the 1998 ice storm, as well as a number of other severe weather events[ii]. It is informative to note that most reported cases of longitudinal cascading failures involved unsymmetrical structure types, such as H-frame and rectangular lattice tower structures. This trend is related to the inherent lack of longitudinal strength in these types of structures, which are configured to primarily resist transverse wind loads. As will be discussed in more detail below, single pole structures do not suffer from this inherent weakness.

To address the potential for longitudinal cascading of transmission lines ASCE Manual 74[iii] recommends three mitigation strategies. These are: 1) Design all structures for longitudinal loads, 2) Install failure containment structures at specified intervals, or 3) Install release mechanisms. For a description of these mitigation strategies, refer to the ASCE Manual.

The NYISO assumes in their assessment that only option 2, installing failure containment structures at specified intervals, is available for mitigating longitudinal failure loads and makes no mention of the other options or the economics of these options relative to one another for this specific project. The ASCE manual in discussing option 1 in section 3.3.2.1 notes the following, "….single pole supports are capable of resisting longitudinal loads and providing failure containment at a relatively low cost", indicating that transmission lines using single pole structures are likely to find option 1 to be most economical in mitigating longitudinal cascade events. The reason for that is single pole structures are symmetrical, so the strength required to resist transverse wind loads is available to resist longitudinal loads. In addition, single pole structures are usually very flexible, which has the effect of reducing the longitudinal load resulting from broken conductors and balancing the load from any unbalanced ice loading. Therefore, it is generally much more economical to rely on the inherent longitudinal strength and flexibility of single pole structures than to add containment structures at specified intervals. This is highlighted in a 2008 study by Cigre[iv] which analyzed the impact on structure design of adding a longitudinal load case to tangent steel poles as a longitudinal cascade mitigation strategy. By designing a single pole structure first for transverse loads only, and then adding a longitudinal load case the study was able to identify the likely cost impacts of employing option 1 recommended by ASCE. The report concluded that "The steel pole structure was not noticeably affected by the unbalanced loads because of its geometrical properties and flexibility".

Given that the LS Power Grid New York/NYPA proposal includes a longitudinal broken wire and an unbalanced ice load case to be applied to all structures, the statements by the NYISO indicating that the proposals with more deadend structures are superior from a resilience point is unfounded. In addition, the LS Power Grid New York/NYPA proposal is designed using a 100 MPH extreme wind case versus at 90 MPH wind case used in T019. Given the square relationship between wind speed and wind pressure, this represents a 23.5% increase in transverse wind load over the T019 proposal.

In summary, the additional cost associated with the additional deadend structures in the T019 proposal, certainly at such a small interval as one mile, is not justified as there are more economical methods to address the issue of longitudinal cascading, as demonstrated by the LS Power Grid New York/NYPA proposal.

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[i] IEEE Standard 691, "Guide for Transmission Structure Foundation Design and Testing", 2007
[ii] Cigre, Working Group B2.22, "Mechanical Security of Overhead Lines Containing Cascading Failures and Mitigating Their Effects", October 2012
[iii] ASCE, Manuals and Reports on Engineering Practice No. 74, "Guidelines for Electrical Transmission Line Structural Loading", Third Edition, 2010
[iv] Cigre, Working Group B2-204, "Assessment of the Impacts of Increasing Structural Reliability and Security by Designing Lines for Longitudinal Broken Conductor and Unbalanced Icing Loads", Ghannoum, 2008