Frequently Asked Questions: AC Transmission Public Policy Transmission Planning Report

A Report by the
New York Independent System Operator

DRAFT
June 13, 2018

1. What is the expected Electromagnetic Field (EMF) Levels for the NAT/NYPA Double Circuit Proposal (T027)?

a. Background

Developers did not provide calculated results of anticipated EMF levels in their submitted proposals. The NYISO engineering contractor, SECo, identified this as a potential concern, and the NYISO issued a Request For Information requesting for EMF study reports. Developers provided calculations to the NYISO in October 2017 that SECo checked for their reasonableness within the context of the EMF standards promulgated by the New York State Public Service Commission (PSC). SECo determined that the calculations provided by all Developers have a reasonable correlation to one another for similar arrangements, such as the base project proposals consisting of a new single circuit between Edic and New Scotland, and appear to be a good preliminary indication of the potential EMF levels. All results indicated that the existing circuits between Princetown Junction and New Scotland Substation (this corridor has the existing 345 kV lines #14 Edic – New Scotland and #18 Marcy – New Scotland, and 115 kV line #13 Rotterdam – New Scotland) exceed the PSC's EMF standards, except for NAT/NYPA, which originally provided data indicating that project T027 met the EMF standards. The proposed designs improve the condition, but EMF levels are still reported to exceed the guidelines for all single circuit proposals. Proposal T027 claimed to reduce the EMF levels to just below the PSC's EMF standards. This was attributed to the electromagnetic fields from the new double circuit configuration interacting with the existing circuits to provide an EMF cancelling effect and reducing the EMF levels at the edge of the ROW. Transmission line design including the structure and conductor configurations, heights of conductor attachments to structures, conductor spacing, and phasing of the conductors have significant effects on EMF levels and with careful design can be used to mitigate EMF levels. Due to the good correlation of NAT/NYPA's results for the base single circuit design with the other Developers and consistency of their reports, it appeared that the results provided for the T027 double circuit design were likely within a reasonable degree of accuracy without performing a full-scale analysis. A full scale study, which will be required during detailed engineering and preparation of the Part B application for a certificate of environmental compatibility and public need under Public Service Law Article VII, and is therefore outside the scope of the NYISO evaluation process.

b. Study Results

After reviewing the study results with the Developers and the stakeholders at meetings of the ESPWG/TPAS and receiving updated EMF studies from NAT/NYPA on May 23, 2018, the NYISO

requested SECo to complete an independent EMF study of T027. SECo completed a study utilizing PLSCadd software. Additionally, SECo's subcontractor, HMV Engineering, conducted a separate study using the EPRI EMF software. This study focused on the T027 proposal for the line segment between Princetown and New Scotland and calculated EMF levels at the three sections of the corridor where the ROW widths varied. The results of the independent studies indicated that the EMF levels for 13.4 miles of the line corridor is anticipated to exceed the PSC's EMF standards. Additionally, NAT/NYPA submitted revised results on June 7, 2018, recognizing an error in previous calculations. The updated EMF results indicate that T027 requires the least easement to mitigate EMF impacts among the Segment A proposals due to the proposed replacement of 6.3 miles of Line #14 Edit – New Scotland. Therefore, the results from the independent studies conducted by HMV Engineering do not change the report's project ranking and selection recommendation.

2. Segment B Structure Heights

a. Why are pole heights for Segment B projects important?

In its December 17, 2015 Order, the PSC makes several references to the importance of minimizing structure heights and specifically noted on page 43 "As to structure heights, the Commission will not mandate criteria to be applied by the NYISO, but all proposers of transmission solutions should be aware as they prepare their submissions that minimization of structure heights will be an important issue in the siting review process so applicants should be careful to not lock themselves into designs that could not later be approved. All applicants are encouraged to minimize the heights of the proposed structures while keeping them within the context of their 2015 proposals." Therefore, the PSC identified minimizing structure height as an important consideration in evaluating the transmission proposals.

b. How were pole heights for Segment B projects evaluated?

NYISO engineering contractor, SECo, obtained PLSCadd models of each Developer's proposed design and compared the proposed structure heights to the existing structures that would be replaced to determine the relative height increases and decreases. The comparison of each Developer's design was based on the absolute difference between a proposed structure and the structure it would replace. While SECo checked to ensure Developers' designs met ground clearance standards, the designs were evaluated as proposed.

For projects T022 and T023 proposed by NextEra, the concrete pole section is 90 feet, and there is a steel section with the crossarms on top of the concrete poles. The structures total height above the ground is 92.5 feet. The review team does not believe that most of NextEra's structures can be shortened from the proposed design and still maintain NESC required ground clearance.

c. Why didn't the ISO and its contractor SECo perform viewshed analysis?

A viewshed analysis is considered detailed engineering that will be required for the Developer to complete in preparation of the Part B application for a certificate of environmental compatibility and public need under Public Service Law Article VII and is therefore outside the scope of the NYISO evaluation process. The PSC stated in its December 17, 2015 Order on page 42, "*The Commission is sympathetic to the suggestion of the NYTOs that projects have a positive impact on the community by reducing the total number of structures in a community from the number that exists today. At this stage, however, the NYISO would not have sufficient information to determine such impacts and the Commission does not want to convert the NYISO process into a siting process. Those matters will be further addressed by the Commission in the Article VII siting cases after the Part B construction information is filed. Similarly, structure heights are often dependent on specific decisions as to structure location and span length which are often influenced by the consideration of site-specific impacts to natural resources.*"

Therefore, the PSC also did not intend that the NYISO conduct detailed siting-type studies such as a viewshed analysis.

d. Why is structure height increase used as a distinguishing factor if the heights can be modified during the Article VII process?

The Article VII process does provide the mechanism by which the PSC identifies and mitigates unacceptable visual impacts. While the December 17, 2015 PSC Order stated on page 35 that structure height increases of less than 25 feet "*will not create an adverse impact of a regional nature that would significantly impair the physical visual character of the Hudson Valley and its communities.*" visual impact is subjective and open to debate before the PSC in an Article VII proceeding. The PSC order continues on to state that "*[a] change in structure types and structure heights of the types contemplated may have local, site specific visual impacts."* The =PSC stated in its December 17, 2015 Order on page 42, "*The Commission is sympathetic to the suggestion of the NYTOs that projects have a positive impact on the community by reducing the total number of*

structures in a community from the number that exists today. At this stage, however, the NYISO would not have sufficient information to determine such impacts and the Commission does not want to convert the NYISO process into a siting process. Those matters will be further addressed by the Commission in the Article VII siting cases after the Part B construction information is filed. Similarly, structure heights are often dependent on specific decisions as to structure location and span length which are often influenced by the consideration of site-specific impacts to natural resources." Therefore, the NYISO cannot speculate on the outcome of the identification and mitigation of each projects' potential adverse visual impacts in a PSC Article VII proceeding. Nevertheless, in its December 17, 2015 Order, the PSC makes several references to the importance of minimizing structure heights and specifically noted, on page 43, "*As to structure heights, the Commission will not mandate criteria to be applied by the NYISO, but all proposers of transmission solutions should be aware as they prepare their submissions that minimization of structure heights will be an important issue in the siting review process so applicants should be careful to not lock themselves into designs that could not later be approved. All applicants are encouraged to minimize the heights of the proposed structures while keeping them within the context of their 2015 proposals*."

The NYISO reasonably effectuated the PSC's intent by evaluating projects, in part, based upon their relative tower height increase and decreases.

3. How is the cost estimated for installation of concrete monopoles?

SECo's subcontractor, Kenny Construction, has applied this unit cost methodology for many years and believes it to be a widespread industry practice. The unit pricing rate is based on Kenny's experience.

There is significantly more incremental work involved in the installation of full length concrete poles as opposed to multi-piece steel poles. The costs for matting, access roads, traffic control, and QA/QC were estimated based on typical construction activities for steel pole construction and was applied consistently for all projects (steel and concrete) considering normal operations. The unit cost used for the installation cost of concrete poles includes the following incremental work not usually required on steel pole installations:

- A 75-ton crane to off load the concrete pole from the Valmont delivery truck at the entrance to the right of way to a heavy duty truck capable of navigating the right of way. Based on Kenny's experience, an additional crane would be needed to off load the concrete pole at the

structure location though the means and methods vary to be as efficient as possible during construction.

  - Typically, steel poles are delivered from the lay down area directly to the site, off loaded with a front end loader, and erected with a 40-ton crane.
  - Typically, one concrete pole is delivered at a time and off loaded by the crane. Whereas, two steel poles are delivered to the right of way then off loaded by a front end loader or derrick truck.

- Additional traffic control for off-loading areas along the right of way and public thoroughfares.
- An 80 to 100 ton crawler crane is required for use in the right of way to set the poles.
  - This is a much more expensive crane than the DOT example used in NextEra's comments.
  - The crane costs referenced by NextEra are for roadway work. SECo's experience indicates that crane rentals for this type of transmission line work costs $335.00/hour for a 100-ton crane.
- The size of the crane and the typical weight of the concrete poles require additional and thicker matting and heavier duty construction roads with wider turning radius capable of supporting the heavier loads. An average cost for matting and access roads was included in each estimate line item for matting and was applied consistently for all projects (steel and concrete) considering normal operations including framing and stringing. Incremental matting cost is included in the installation cost for the heavier equipment loadings and larger work pad areas required for the concrete pole.
  - Normal construction will require 200 three ply mats whereas the heavier concrete poles installation will require 340 timber type mats.
  - NextEra states that matting is required in wetlands whereas matting required on Article VII projects are estimated to be much more extensive.
  - Normal work pads for steel construction are estimated to average 100 feet in length and the pads for full length concrete poles will be approximately 150 feet long. The steel poles have three sections. The base section can be set in place and the top section framed on the ground and then the two remaining sections are set in place

on the base section. Kenny has found this method of setting the steel pole in sections the most efficient method.

- QA/QC inspections for each of the concrete poles will need to be done at the off-loading area or along the right-of-way.
    - Typically the steel poles are inspected several at a time at the lay down area.
- There would be additional labor required to rig and set poles. Rigging and maneuvering poles ranging to a length up to 135 feet and weighing up to 62,000 pounds versus steel pole segments (steel poles typically include three segments no longer than 50 feet) up to 50 feet long and 16,000 pounds. The terrain and off road locations of these transmission corridors and congestion of the ROW with existing energized circuits adds complexity to maneuvering poles of this weight. A minimum of six workers is required for each concrete pole as opposed to three workers for each steel pole.
- More time consuming construction. A three-person crew can typically to install four steel structures in one day as opposed to a six-person crew installing two similar concrete structures in a day.

4. How did the NYISO evaluate NAT/NYPA proposals for Rotterdam Substation with potential interference of existing gas pipelines?

During the field review of the Rotterdam substation, NYISO engineering contractor, SECo, identified that the preferred proposed substation layout in the NAT/NYPA and ITC proposals would interfere with existing gas pipelines. Thereafter, the NYISO issued a Request for Information on how the Developers were proposing to address this issue. NAT/NYPA's response provided amplifying information on options to relocate the gas pipelines or move the substation location to the northeast to avoid the pipelines.

NAT/NYPA's original proposal as submitted to the NYISO provided the alternative designs, indicated that the designs were preliminary in nature, and expressed willingness to work with the incumbent utility to complete an acceptable design. NAT/NYPA stated in the proposal:

> *Rotterdam - the proposal assumes the new 345 kV substation yard will be built in an area to the southwest of the existing 230 kV yard in an area that requires minimal relocation of existing lower voltage transmission lines. The cost of relocation has been included in the estimate. Another alternative considered is building a 345 kV yard on a portion of the existing 230 kV yard. Bidders propose a new location for the Rotterdam 345 yard due to the lower estimated cost, and with the expectation that expanding the*

230 kV yard to 345 kV would be much more difficult and require a longer schedule. However, Bidders will be willing to have the incumbent transmission owners build and own the Rotterdam 345 kV substation if necessary to implement the proposal in the most effective and cost efficient manner. Similarly, Gas Insulated Substation (GIS) equipment could be used to greatly reduce the footprint of the Rotterdam 345 kV substation and allow for construction on a smaller footprint on the Rotterdam site, but at a higher cost.

NAT/NYPA's response to the NYISO's Request For Information did not alter its original proposal by providing alternative routes for the first time. Instead, the response provided additional detail on the routing alternatives noted in its original proposal. Section 31.4.8.1.6 of Attachment Y of the OATT contemplates a scenario where a Developer can supply the NYISO will routing alternatives such as those provided to the NYISO here. Specifically, "[t]he ISO will consider whether the Developer: (i) already possesses the rights of way necessary to implement the project; (ii) has completed a transmission routing study, which (a) identifies a specific routing plan with alternatives."

Here, NAT/NYPA presented viable routing options to mitigate the concern with the gas pipeline interference and indicated in the proposal a willingness to adapt the design of the Rotterdam Substation to the incumbent utility's needs. Accordingly, the NYISO reasonably evaluated the alternative routes and included mitigation costs in the independent cost estimates used in its ranking and selection. Specifically, SECo and the NYISO factored this issue into its evaluation and ranking by imputing a cost to address the pipeline relocation issue. Only a small section (length of approximately 1,500 feet) of the gas pipelines is affected, and the affected section can be relocated within existing National Grid property—*i.e.*, to the western edge of National Grids property or to the east side of the proposed substation location internal to National Grid's property. Thus, the NYISO determined that the risk associated with the relocation of the gas pipelines was low.

Kenny Construction had another Granite subsidiary with expertise in gas pipeline construction review the proposed relocation. Kenny and its affiliate provided budgetary pricing and did not identify any significant issues in completing this work. The affected pipeline was constructed under an Article VII certificate and would be subject to an Article VII modification. Considering the line can be relocated within the National Grid substation site, SECo did not consider it to be a major obstacle.

Alternatively, the substation can be moved to the northeast of the proposed location to avoid the gas lines or a GIS station can be constructed in the northern 230 kV yard, which is proposed to

be abandoned in this project. These proposed alternatives would be analyzed in more detail during detailed engineering and licensing in conjunction with the NYSPSC and the incumbent utility. The PSC will have the ultimate decision in the Article VII process for the gas pipeline and new station location.

5. How is the Middletown Transformer replacement analyzed?

As a component of NAT/NYPA's Segment B projects, NAT/NYPA propose to replace an existing transformer at the Middletown Tap, which is owned by Orange and Rockland Utilities, Inc. The NYISO studied the replacement of this transformer, among other elements, in a System Impact Study and determined that there would be no adverse system impacts.

While no detailed engineering has been completed, NYISO's engineering contractor, SECo, believes the replacement transformer can be installed in the existing substation. SECo relied on Google Earth images to determine the dimensions of the substation and existing equipment. The substation comprises of a 345 kV structure to terminate the incoming 345 kV transmission line tap, a 345 kV breaker and a disconnect switch, a 138 kV breaker and a disconnect switch, 345 kV/138 kV transformer, 138 kV line terminal structure, and associated instrument transformers.

The existing transformer has a top continuous rating of 562 MVA (652 LTE and 746 STE). The replacement transformer will have a top continuous rating of 720MVA (836 LTE and 956 STE). There is approximately 60 feet of space between the 345 kV breaker and the 138 kV breaker terminals. There are also a set of 345 kV bus supports between the 345 kV breaker and transformer, and a set of 138 kV instrument transformers between the 138 kV breaker and transformer. The existing transformer dimension is approximately 29 feet wide by 22 feet deep. Conservatively, the replacement transformer is estimated to be 50 feet wide by 33 feet deep. SECo assumed the existing transformer and oil containment will be replaced and the 345 kV bus supports and instrument transformer will be relocated to new foundations integrated with the transformer foundation. Based on the foregoing review, SECo determined that there is more than adequate room to install the larger transformer. SECo further noted that during detailed engineering, the specification for the transformer can be developed to optimize the arrangement of coolers and ancillary equipment to minimize the depth of the transformer to ensure that the transformer would fit within the existing substation.

6. What is the potential subsynchronus resonance (SSR) risk for the National Grid/Transco New York Energy Solution Segment B Proposal (T019)?

T019 may pose a potential SSR risk to the operation of its facilities caused by interactions between the proposed 50% series compensation and nearby synchronous generators. The topology screening that was provided by National Grid/Transco is not sufficient to conclude that there is no SSR issue due to the following reasons

a. Frequency scanning and electrical damping torque that are widely used to analyze SSR, was not provided.

b. The topology screening was based on the Summer Peak load flow model. However, the worst case for SSR could occur during light load system conditions.

c. If there is any negative electrical damping for any unit, the interaction between torsional mode and resonant frequency should be further studied.

d. The power flow cases used by National Grid/Transco to perform the SSR screening are outdated, and do not include certain generators that have made significant efforts to interconnect and become in-service in the next few years.

e. SSR could impact future generation proposing to interconnect near the series compensation and that could be impacted by SSR.

Transient torque may be induced on the generators in the vicinity by system disturbances, and could lead to a catastrophic event that could damage the generator-turbine shaft. Diagnosing such events requires highly specialized expert knowledge and technology. To prevent catastrophic events that damage the generator shaft, special protection schemes can be designed and installed on the generators in the vicinity, if necessary. Such significant SSR risk can be assessed by screening and performing a frequency scan analysis; however, it is difficult to fully anticipate other potential impacts to generator operation and maintenance.

In addition, over voltage could occur at nearby buses due to series compensation. Transient recovery voltages (TRV) and the rate of rise of transient recovery voltages (RRTRV) needs to be studied for circuit breakers. The circuit breakers should be capable of building sufficient dielectric capability fast enough to extinguish the arc during fault current interruption. The installation of series compensation would require extensive protection coordination.