The Long-Range Transmission Plan 2013 – 2023

Transmission Planning Department
Consolidated Edison Company of New York, Inc.

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1.0 EXECUTIVE SUMMARY

The Long-Range Transmission Plan is focused on achieving the objective of reliably serving forecasted loads over a 10-year planning horizon under certain conservative assumptions on the interconnection of new generating projects. The Plan meets this objective and adheres to Con Edison's Transmission Planning Criteria. The Plan may change over time in order to adapt to changing future conditions which include: variations in load forecast, variations in load distribution across the service area, evolving new generation development projects, transmission projects, demand side management programs, evolution in the regulatory and/or power market rules, and advancements in transmission technology.

Compared to the Plan issued in 2012, the major changes or items of note are:

1. Revised forecasts utilized early versions of the 2013 (year 0), 2018 (year 5) and 2023 (year 10) FERC 715 models from the NYISO, combined with more recent internal corporate forecasts of Con Edison loads anticipated for 2013, 2018, and 2023.
2. The completion of the Hudson Transmission Partners (HTP) 345 KV tie feeder from Ridgefield Substation in New Jersey to West 49th Street Substation in Manhattan. Initially, it will only provide emergency assistance until certain transmission upgrades on the PJM system are completed. The analysis for 2018 (Year 5) assumes that HTP will provide 320 MW of firm transfer into New York.
3. The anticipated establishment of Goethals 345 KV Station as a single ring bus, assumed to be completed in the year 2014.
4. The anticipated establishment of a new 138 kV transmission line in the year 2018, connecting the Rainey and Corona Transmission Stations, with associated 345/183 kV Transformer and Phase Angle Regulator at Rainey.

The Transmission Load Areas[1] (TLAs) evaluated in the development of the Plan were: New York City - 345 kV, West 49th Street - 345 kV, New York City - 138 kV, Astoria - 138 kV, Greenwood / Staten Island - 138 kV, East 13th Street - 138 kV, Corona / Jamaica - 138 kV, Bronx - 138 kV, Astoria East / Corona - 138 kV, Astoria West / Queensbridge - 138 kV, Vernon - 138 kV, Staten Island 138 kV - 138 kV, East River - 138 kV, Eastview - 138 kV, Dunwoodie North / Sherman Creek- 138 kV , Dunwoodie South- 138 kV , and Millwood / Buchanan - 138 kV.

Of the 17 Transmission Load Areas evaluated in this report, the Plan identifies three load areas – Greenwood / Staten Island, Astoria East / Corona – 138 kV, and Jamaica / Corona - 138 kV, as having a deficiency condition relative to planning criteria over the planning horizon. The Plan identifies a single recommended solution that addresses the deficiencies in Astoria East / Corona and Corona / Jamaica, specifically the establishment of a phase angle regulated transmission feeder connecting Rainey and Corona substations. The Plan further identifies a solution for the Greenwood / Staten Island area, specifically the establishment of an additional breaker at Greenwood to mitigate the impact of the worst contingency. Over the ten-year study period, no other deficiencies have been identified in the remaining transmission load areas.

The Plan also discusses the prospects for new transmission and generation in the Con Edison system over the study period based on an analysis of the overall capacity of projects in the NYISO interconnection queue. The uncertainty of proposed developer projects reaching commercial operation would make planning the future system topology a challenging and evolving task. For this reason, only projects currently under construction or that have accepted cost allocation in the NYISO interconnection process are considered in the development of the Plan.

The Governor's Energy Highway initiative resulted in a Blueprint with at least two specific PSC proceedings that will affect the grid within the timeframe studied. They are the proceeding on *Alternating Current Transmission Upgrades* and on an *Indian Point Contingency Plan*. New AC transmission will make additional resources available to meet New York City reliability requirements. A decision on new generation, transmission and demand side resources implemented to address the potential shutdown of the

[1] Transmission Load Areas are specified portions of the transmission system designated for convenience in studying the reliability of the system.

Indian Point nuclear units 2 and 3, is expected in the fall of 2013, . When final decisions are made in both of these proceedings they will be incorporated into the following Plan. Therefore, the current Plan considers that Indian Point units remain in service for the entire period of analysis. Con Edison also participated in a transmission study[2] with other NY Transmission Owners (TOs), which was the basis for proposals submitted regarding both PSC proceedings.

The NYISO 2012 RNA identified system adequacy deficiencies starting in 2021. Con Edison is one of the designated Responsible TOs that was called upon to submit backstop solutions for this deficiency. In addition, the RNA identified a criteria thermal deficiency in 2022 for the Leeds to Pleasant Valley interface. The causes for the LOLE and thermal deficiencies are considered in the RNA to be the same, increased load forecast and generation retirements. Thus, addressing the 2021 deficiency will also address the 2022 deficiency. Since the issues identified by the RNA are not local in nature, they are not identified as deficiencies under this Con Edison Long Range Plan.

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[2] Con Edison, together with all other TOs in the State participated in a separate planning program called the New York State Transmission Assessment and Reliability Study, or STARS. Information on this initiative can be found on the NYISO website at: http://www.nyiso.com/public/markets_operations/services/planning/documents/index.jsp

2.0 OVERVIEW

This document lays out Con Edison's plan ("the Plan") for the transmission system over a 10-year planning horizon[3]. Recognizing future uncertainties, the Plan should be viewed as a robust yet flexible framework or roadmap for direction rather than a well-defined series of projects to be implemented on a set schedule. Decisions on the implementation of specific projects are made based on reliability needs that are affected by numerous factors, including the economy, customer usage behavior, demand side management efforts and developer projects. As factors change so must the Plan.

This is the fifth edition of the Plan. The first edition was published on the Con Edison Web Site (www.coned.com) on September 22, 2009, and presented at the NYISO TPAS meeting on October 14, 2009 for stakeholder review and comments. The second edition of the plan was submitted to the NYISO and published on the Con Edison Web Site on August 27, 2010. The third edition of the plan was submitted to the NYISO and published on the Con Edison Web Site on September 15, 2011. The third edition was updated on February 17, 2012, in response to a major change in the system, the notice of mothballing of generators at Astoria and Gowanus. The fourth edition was published on October 3, 2012.

2.1. Factors Affecting the Long-Range Transmission Plan

Factors that affect the Plan include:

i. Changes in reliability requirements;
ii. Changes in econometric load forecasts;
iii. Impact of demand side management programs (DSM);
iv. Impacts from the State's Energy Efficiency Portfolio Standard (EEPS) and Renewable Portfolio Standard (RPS) programs;
v. Other state and national policy programs such as the Regional Greenhouse Gas Initiative (RGGI);
vi. New merchant generation and transmission;

[3] The posting and discussion of this document satisfies the requirements of Order 890 for openness and transparency in local transmission planning. The document itself constitutes the Local Transmission Plan (LTP) referred to the in the NYISO tariff.

vii. Decisions under the New York Independent System Operator's (NYISO's) Comprehensive Reliability Planning Process (CRPP) and FERC Order 890;
viii. Potential new legislation on the interconnection-wide planning process; and
ix. Potential changes in the NYISO's Locational Capacity Requirement for New York City (NYISO Zone J).

The studies that support the Plan reflect current assumptions regarding these factors. Conversely, the Plan needs to be updated periodically to capture, among other issues, updated assumptions.

Of particular importance are Con Edison's on-going and proposed DSM programs. These programs have been embedded in the Plan and in particularly in the load forecast and load projections for Transmission Load Areas. Con Edison's proposed DSM program results in the deferral of significant transmission investments. For this reason, this Plan contains no recommendations for new transmission substations.

2.2. Con Edison Transmission Planning Criteria

System expansion and the incorporation of new facilities must follow the established and published Con Edison Transmission Planning Criteria, EP-7100[4]. The criteria document describes Con Edison's transmission planning criteria for assessing the adequacy of its transmission system to withstand design contingency conditions while providing reliable supply to all its customers throughout the planning horizon. The document includes a description of the Company's transmission system design principles, performance criteria, and voltage, thermal and stability assessments and is updated when there are changes to existing criteria or when new criteria items are added. The latest version of the Transmission Planning Criteria includes three items covering the topics of Black Start capability for new or re-powered generation, Reactive Power (Lead / Lag), and Dual Fuel requirements for units supplied with natural gas from the Con Edison gas transmission system. The latest version of EP-7100 is publicly available and posted on the Con Edison website.[5]

[4] The Con Edison Transmission Planning Criteria; EP-7100 dated November 22, 2011, was adhered to in developing this Plan.
[5] http://www.coned.com/documents/Transmission Planning Criteria.pdf

All system expansions, whether by Con Edison or by other parties, must be made in accordance and in compliance with NERC Standards, NPCC Criteria, NYSRC rules and NYISO procedures. As a member of the Northeast Power Coordinating Council (NPCC), Con Edison's planning process adheres to NPCC Criteria. The NPCC Criteria documents are designated as "Directories" and describe the minimum criteria applicable to NPCC members functioning as part of the coordinated interconnected network. Given their importance, the Criteria and Directory documents require the approval of two thirds of the NPCC membership. NPCC Guideline documents serve as the guides through which implementation of the criteria and acceptable system performance is achieved. As a member of the New York State Reliability Council (NYSRC), Con Edison must also adhere to the "NYSRC Reliability Rules for Planning and Operating the New York State Power System". NYSRC reliability rules may be more specific or stringent than NERC Standards and NPCC Criteria. Given the importance of NYSRC reliability rules, adoption or modification requires an affirmative vote of at least 9 out of the 13 members of NYSCR's Executive Committee.

2.3. Relationship with FERC Orders 2003, 890 and 1000

FERC Order 2003 *Standardization of Generator Interconnection Agreements and Procedures* established rules and procedures that govern large generation interconnections. In New York, parts of Order 2003 are addressed by tariff provisions in the NYISO OATT, Attachment X. Merchant generation can follow a defined process to interconnect at the location of its choice, and the TO's Long-Range Transmission Plan must consider this. Further, TOs are required to meet load for a given year[6] with generic generation placed at feasible locations. Recently the NYISO has adopted a deliverability requirement, embedded in Attachments X of the NYISO OATT, in addition to the prior minimum interconnection standard. As a result of the application of this tariff, new generation may require changes and additions to the transmission system that must be also be reflected in all studies performed.

FERC Order 890 "*Preventing Undue Discrimination and Preference in Transmission Service*" requires reliability and economic processes for new transmission. In New

[6] Attachment S of the NYISO OATT includes the concept of Class Year in which Generator Owners can place themselves so that the reliability of the system can be studied with the collective presence of all generators in the Class Year.

York, the reliability planning process is the first step of the Comprehensive System Planning Process under the NYISO OATT, which places primary emphasis on implementing new market-based merchant resources to meet a reliability need if there is a system capacity Loss of Load Expectation (LOLE) greater than 0.1 over a 10-year period. The Comprehensive Reliability Plan issued by the NYISO then identifies regulated backstop solutions to be developed by the appropriate TOs that would be triggered by the NYISO if the market does produce a merchant solution in a timely manner.

Further, Order 890 contains certain principles to achieve the non-discriminatory, open and transparent goals of the planning process that must be followed by both the NYISO and the local TOs. The posting of this document and its discussion with interested parties are intended to satisfy these requirements. The NYISO sets a schedule for meeting these requirements in advance of the Load and Capacity Data Report (aka Gold Book) used at the start of next RNA cycle.

Since there are many reasons that may affect decisions on future generation, DSM and transmission, it is necessary to make reasonable assumptions on such changes in the development of the Plan. However, in all circumstances, the driver for the local Long-Range Transmission Term is maintaining reliability.

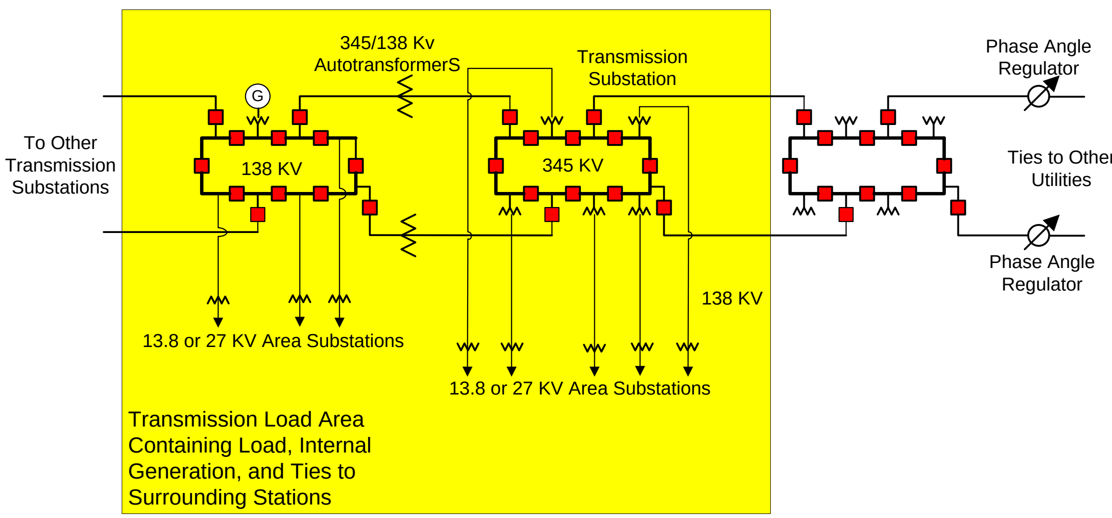
On July 21, 2011, FERC issued Order 1000 on Transmission Planning and Cost Allocation, which affirms certain Order 890 requirements and establishes some new ones. Order No. 1000's transmission planning reforms require that each public utility transmission provider: (1) participate in a regional transmission planning process that produces a regional transmission plan and (2) amend its OATT to describe procedures for the consideration of transmission needs driven by public policy requirements established by local, state, or federal laws or regulations in the local and regional transmission planning processes. On October 11, 2012 the NYISO and the NY TOs filed a compliance filing with the FERC. On April 18, 2013 the FERC accepted this compliance filing subject to some further revisions which are due in October 2013. The chronology of compliance with Order 1000 did not permit Order 1000 related requirements to be factored into the present Plan.

2.4. Objectives

The driver of the Long-Range Transmission Plan is maintaining reliability. Con Edison has developed a set of objectives for the development of its Long-Range Transmission Plan in accordance with all applicable reliability criteria. The ability of the transmission system to perform in accordance with the Transmission Planning Criteria is periodically assessed as new load forecast information becomes available. This assessment can result in recommendations for specific upgrades, as discussed in more detail in Chapter 6 of this Plan.

2.4.1. Objective 1: Transmission Load Area (TLA) Assessment

Planning for the Con Edison transmission system includes the detailed evaluation of Transmission Load Areas over a ten-year period. Transmission Load Areas are specified portions of the transmission system for studying the reliability of the system. The following diagram is a generic representation of a TLA:



As load forecasts are considered, it is possible that projections indicate that one or more reliability criteria would not be met at some date in the future. In such cases, remedial actions are developed and planned to assure the system continues to comply with reliability criteria. There are a number of possible actions that can address Transmission Load Area reliability criteria deficiencies:

1. Additional transmission expansion into the Transmission Load Area, which may require other transmission support farther out from the Transmission Load Area;
2. Demand side management programs targeting load within the Transmission Load Area;
3. Increasing the capacity of existing transmission components;
4. Transferring load from one Transmission Load Area to another Transmission Load Area by transferring a portion of one network within the load area to a network in another load area that has spare capacity;
5. New generation within the Transmission Load Area; and
6. Combinations of the above.

Analysis is performed on a case-by-case basis to determine the most cost-effective remedial action. All are designed to bring the Transmission Load Area into compliance with reliability criteria. Chapter 6 presents the current status of the Con Edison system Transmission Load Area assessment.

2.4.2. Objective 2: Transmission Substation Assessment

As load grows within a Transmission Load Area, more feeders are required to reliably supply network load. At some point, an area station may reach its expansion limit due to transformer capacity, subtransmission feeder capacity, bus current capacity, circuit breaker interrupting capability, or other reasons. In these situations, a new area station may be needed with support from an existing Transmission station with sufficient capacity. As the Transmission station's capacity is reached, a new transmission station, along with appropriate connections to the surrounding transmission system, may be required to for the reliable integration of a new area station and its load. All of this may have an impact on the defining characteristics of the associated Transmission Load Areas. Chapter 7 is reserved for discussing the need for new transmission stations. None were found to be required for the 10-year period studied in this Plan.

2.4.3. Objective 3: Interconnection of New Generation Resources

Reliability criteria can be met in some cases by the interconnection of new generation resources within the system or by interconnections to new or existing generation resources outside the system. New generation resources are not only a source of additional real power but are also a source of reactive power, all of which help to meet reliability criteria. Other considerations include the provision of black start capabilities by units directly on the Con Edison system as well as well as the provision of dual fuel capability, both of which contribute to maintaining reliability. At some point, the interconnection of new generation resources may be needed to meet reliability and supply requirements.

New transmission may be needed to integrate new internal or external resources. The current outlook of interconnection projects in the Con Edison system is discussed in Chapter 8.

2.5. Organization of the Report

Chapter 3 presents the analysis tools and methodologies followed in developing the Plan to meet its three main objectives. Chapter 4 contains the information posted on the Con Edison website regarding the origin of the base cases and major assumptions used in developing the Plan. The methodologies used in the development of the Plan are discussed in Chapter 5. In turn, Chapter 6 presents the results of studies performed on all 17 TLAs. Chapter 7 is reserved for studies regarding the need for new transmission stations. The prospects for new generation during the study period are discussed in Chapter 8.

3.0 LONG-RANGE TRANSMISSION PLAN ANALYSIS TOOLS AND METHODOLOGIES

Con Edison's transmission system is assessed using a variety of system modeling and simulation tools to measure the transmission system's capabilities against design criteria[7]. This is done for present and planned configurations at present and future load levels, respectively. The simulations are validated using real-time measurements made under normal and contingency conditions whenever possible. Assessments are performed as needed in the following areas using standardized software packages to study the system's performance:

- Thermal;
- Voltage;
- Short Circuit;
- Stability;
- Critical Clearing Time;
- Underfrequency Load Shedding;
- Transient Switching Surge and Lightning Withstand Capabilities; and
- Extreme Contingencies.

3.1. Thermal

Load flow studies are the primary method used by Transmission Planning to assess the performance of the transmission system under normal and contingency conditions. The software used for these studies is provided by Power Technologies International, a division of Siemens AG, and is referred to as PSS/E, the acronym for Power System Simulator / Engineering. This is the leading software package for bulk transmission system load flow studies.

The load flow levels established by the studies are measured against the thermal ratings of transmission facilities. Con Edison's Central Engineering Department assigns facilities thermal ratings for normal operation, long-time emergency operation (LTE), and short-time emergency operation (STE).

[7] In accordance with the requirements of Order 890, the contents of this chapter were posted on the Con Edison website in December, 2009. The latest version can be found at: http://www.coned.com/tp/Long Range Plan Analysis Tools and Methodology.pdf

Load flow studies are conducted to simulate normal operation under peak forecast loads, followed by various contingency conditions defined the Northeast Power Coordinating Council (NPCC), the New York State Reliability Council (NYSRC) and Con Edison Transmission Planning Criteria. In order to comply with the more stringent Con Edison Transmission Planning Criteria, the transmission system must exhibit the capability to be returned to operation within normal thermal limits following the worst case contingencies.

3.1.1. FERC Form 715

While load flow studies are conducted year-round by Transmission Planning for a wide variety of analyses, including planned expansions and real-time contingencies, overall system-wide assessments are required once a year to support the NYISO's requirement to file FERC Form 715, the Annual Transmission Planning and Evaluation Report. This is a comprehensive effort that includes updating the system model in terms of configuration and impedances, and adjusting the transmission system. A battery of load flow base cases are developed for the FERC 715 filing that include present summer and winter seasonal cases, as well as five and ten year look-ahead cases. The future cases incorporate all planned changes such as additions, expansions, and retirements according to the scheduled timelines for these changes.

Load flow base cases developed for the FERC 715 filing are used for annual reviews of Installed Reserve Margin (IRM), a NYSRC requirement. Transfer limits for the local area are calculated by Transmission Planning using load flow studies, and these are used as inputs in Multi Area Reliability Simulations (MARS) conducted by Con Edison's Energy Management organization.

Load flow base cases developed for the FERC 715 filing are also used in the NYISO's Comprehensive Reliability Planning Process (CRPP) which is conducted annually looking out over a ten-year horizon, one year at a time. The first task in the CRPP is to conduct a Reliability Needs Assessment (RNA). If a reliability need or needs are identified in any or all of the ten years studied, a Comprehensive Reliability Plan (CRP) must be formulated to meet that need or those needs.

3.2. Voltage

Voltages throughout the transmission system are checked using the same load flow studies that are used to make the thermal assessments described in the section above. The focus, however, shifts from the delivery of real power, measured in MW, to voltage support and control provided by reactive power, measured in Mvar[8].

3.3. Short Circuit

Short circuit studies are conducted using the ASPEN program. These are done to assess the ability of the transmission system, specifically circuit breakers, to withstand and interrupt fault currents. The NYISO conducts semi-annual updates of its short circuit base case models. Significant data for these studies include system configuration, i.e., network topology, impedances of all connected equipment, and circuit breaker interrupting ratings. All short circuit base cases use all available generation to ensure that the maximum possible current levels are simulated.

3.4. Stability

Stability studies are performed as needed, using the dynamic simulation capability of the PSS/E software. The studies encompass the full range of stability considerations on the power system, namely, steady-state stability, transient stability, and dynamic stability. These studies are very dependent on the detailed modeling of generator characteristics including excitation systems, control systems, inertia, and governor response.

Stability is assessed in accordance with NPCC Regional Reliability Reference Directory #1 "Design and Operation of the Bulk Power System". Directory #1 specifies a variety of faults and other contingencies, including stuck breaker conditions, through which the power system must remain stable. Provision is included for automatic reclosing which can be very effective in maintaining system stability following transient faults such as those induced by lightning.

Within NPCC Directory #1, Appendix B – "Guidelines and Procedures for NPCC Area Transmission Reviews" states that stability assessment is to be part of the

[8] Voltages must remain within a prescribed range of 0.95 to 1.05 per unit throughout all contingencies.

Comprehensive Review conducted once every five years in each of the NPCC Areas. The NYISO conducts the Comprehensive Review for the New York Control Area. Beyond this requirement, Con Edison undertakes stability studies when planned system changes have potential stability implications. In some cases, the studies are quite specific, targeted on a particular vicinity of the system. In other cases, the studies are broad in nature, encompassing a widespread territory. Transmission planners must use their experience and engineering judgment in determining the boundaries for such studies. Otherwise the studies become unwieldy and the results can be difficult to interpret.

3.5. Critical Clearing Time

Critical clearing time studies, like stability studies, are performed as needed using the dynamic simulation capability of the PSS/E software. These are subsets of stability studies done with the intent of determining the allowable time intervals for protective relays and circuit breakers to sense and isolate faults without causing generator instability or unstable oscillations (power swings) on the system. Worst case fault clearing scenarios are investigated, including, among other things, stuck breaker conditions. The results of critical clearing time studies are often used to set the time delays on breaker failure relaying schemes to determine if existing settings are adequate.

Critical clearing time studies are by their very nature voluminous given the number of combinations and permutations to be considered in a typical complex transmission system. New studies are undertaken for significant planned changes to the system.

3.6. Underfrequency Load Shedding

The adequacy of the underfrequency load shedding program is also assessed using the dynamic simulation capability of the PSS/E software. Simulations for the Con Edison service territory are conducted. The Company participates in NPCC Study Group SS-38, which conducts simulations that encompass all areas in the NPCC region. Underfrequency load shedding has been implemented throughout the NPCC to address imbalances between generation and load when electrical islands are formed due to major disturbances. Adequacy is affected by the extent of the imbalances, as well as by the dynamic response of the generators. The nature of the load modeling can also impact the study results.

While the NPCC keeps a close eye on the adequacy of its underfrequency load shedding program through its SS-38 Study Group, there is no prescribed interval for periodic studies. Studies are undertaken when engineering judgment dictates that system conditions have changed sufficiently to warrant a review of the existing program.

3.7. Transient Switching Surge and Lightning Withstand Capabilities

The ability of the transmission system to withstand transient switching surges and surges due to lightning is assessed as needed using the Electromagnetic Transients Program, known throughout the industry as EMTP. These types of studies, while not explicitly required by any of the various industry oversight entities, are conducted by electric utilities to ensure that planned expansions are designed in a manner that will not impose transient stresses beyond the capability of equipment on their system, either existing or new. Scenarios studied include energizing and de-energizing, fault clearing under normal and stuck breaker conditions, backfeed conditions, and potential resonance conditions. Occasionally, studies are conducted to address unusual or unexpected electrical phenomena observed on the transmission system in real time operation. From a technical perspective, these are very sophisticated studies that require detailed modeling of system parameters and even the specific electrical characteristics of equipment.

EMTP studies can identify a need for surge arrestors, and determine the required capability thereof. They can also identify a need for shunt reactors to mitigate transient overvoltages, even in cases where they would not be required for normal voltage control.

3.8. Extreme Contingencies

Extreme contingency scenarios that stress the transmission system beyond its design criteria are assessed in accordance with NPCC Directory #1, Appendix B – “Guidelines and Procedures for NPCC Area Transmission Reviews”. Appendix B states that extreme contingency assessment, similar to stability assessment, is to be part of the Comprehensive Review conducted once every five years in each of the NPCC areas. The NYISO conducts the Comprehensive Review for the New York Control Area. Beyond this requirement, Con Edison also conducts extreme contingency assessments for its own transmission system. The intent is to gauge the extent of customer and overall system impact that could be incurred under selected worst case scenarios involving multiple contingencies, and to identify potential mitigating actions that could be taken to minimize the adverse impact.

4.0 ORIGIN OF BASE CASES AND MAJOR ASSUMPTIONS

The analysis presented in this document is performed on a yearly cycle and takes close to eighteen months to carry out and review. The studies are based on assumptions that were posted in the Con Edison website.[9]

4.1. Long-Range Transmission Plan Assumptions

Study Year	**Assumptions**[10] [11]
2013	• Con Edison Load (Coincident Peak) = 13,200 MW • Mothballed Generators: Astoria Steam units 2 and 4 Astoria Gas Turbines 5, 7, 8, 12 and 13 • 138 kV Transmission tie 38M72, with associated Phase Angle Regulator R1, connecting Vernon to West 49th Street Substations, is a steady state resource • 345 kV Transmission tie Y56, with associated Hudson Transmission Partners (HTP) DC Back-to-Back converter station is in service, connecting West 49th Street to the Bergen Substation at PSE&G.
2018	• Con Edison Load (Coincident Peak) = 14,100 MW • Mothballed Generators: Astoria Steam units 2 and 4 Astoria Gas Turbines 5, 7, 8, 12 and 13 • Goethals established as a 345 kV ring bus (in 2014) • 138 kV Transmission tie 38M72, with associated Phase Angle Regulator R1, connecting Vernon to West 49th Street Substations, is a steady state resource • 345 kV Transmission tie Y56, with associated Hudson Transmission Partners (HTP) DC Back-to-Back converter station is in service, connecting West 49th Street to the Bergen Substation at PSE&G.
2023	• Con Edison Load (Coincident Peak) = 14,850 MW • Mothballed Generators: Astoria Steam units 2 and 4 Astoria Gas Turbines 5, 7, 8, 12 and 13 • Goethals established as a 345 kV ring bus (in 2014) • 138 kV Transmission tie 38M72, with associated Phase Angle Regulator R1, connecting Vernon to West 49th Street Substations, is a steady state resource • 345 kV Transmission tie Y56, with associated Hudson Transmission Partners (HTP) DC Back-to-Back converter station is in service, connecting West 49th Street to the Bergen Substation at PSE&G.

[9] The revised Long-Range Transmission Plan Assumptions were posted on July 11, 2011, on the Con Edison website http://www.coned.com/tp/transmission_planning_process.asp in accordance with the requirements of Order 890

[10] These assumptions supplement or replace the comparable assumptions in the FERC 715 Annual Transmission Planning and Evaluation Report filed by the NYISO in April, 2013. Also, the load quantities quoted are net of transmission system losses.

[11] Mothballing of Astoria Gas Turbines 5,7,8,12 and 13 are conditional upon NRG Berrians I, II, III and East (IV) in service status.

5.0 DEVELOPMENT OF THE LONG-RANGE TRANSMISSION PLAN

This chapter presents the requirements, procedures, and scheduling that are necessary for the development of the Long-Range Transmission Plan. The process is designed to be completed on an annual basis, and to dovetail with the scheduling requirements of FERC Order 890, which requires a local transmission plan to be posted for public review in the September - October timeframe, in sufficient time for meaningful review and comments prior to the inputs that need to be provided for the NYISO's Comprehensive System Planning Process (CSPP).

5.1. General Description of the Contingency Evaluation Process

Con Edison is required by NERC, NPCC and NYSRC rules to maintain its transmission system so that the worst contingency during the highest load period will not result in equipment loading that exceeds the designated emergency rating of that equipment, will not result in the loss of any customer service, and following "criteria corrective action"[12], will not result in equipment loading that exceeds the designated normal rating of that equipment.

Single contingency design is defined in the Con Edison Criteria as "the most severe of design criteria contingencies of type "a" through "g", per Table A of the NYSRC Reliability Rules". The definition includes the loss of associated infrastructure that would also be lost as a result of the contingency. Generally, this may be the loss of a single transmission line or generator. Sometimes the failure of a circuit breaker, switch, or "common mode" failures such as transmission tower, double circuit configuration, or relay may also cause the outage of multiple transmission lines and or generators.

Con Edison also considers some load areas to be designed for second contingency, which is defined in the Criteria as the more severe of independent Scenarios A and B, as described below:

[12] The term "criteria corrective action" is used to signify actions permissible under the Con Edison Transmission Planning Criteria, EP-7100.

A. The most severe of design criteria contingencies of type “a” through “g”, per Table A of the NYSRC Reliability Rules.
B. The most severe combination of two non-simultaneous design criteria contingencies of type “a” and “d”, per Table A of the NYSRC Reliability Rules.

In this definition, a common mode failure (such as a tower) or breaker failure is not included. Criteria corrective actions following first or second contingency events are different in scope and extent. Any area which has been designated as second contingency must also satisfy first contingency requirements. The worst first contingency may be different from the first of the worst second contingency pair.

5.2. Long-Range Transmission Plan Process Milestones and Schedule

For every annual cycle, the Long-Range Transmission Plan process begins with the development of the annual FERC715 load flow models, describing the summer conditions for the following snapshot years:

1. Summer peak load period for year 1 of the study;
2. Summer peak load for year 5 of the study; and
3. Summer peak load for year 10 of the study.

The NYISO, with input from the TOs on changes to their transmission system and their load forecasts, develops a summer model for each of the 3 snapshot years for the entire New York system. However, these models are usually not finalized until late in the second quarter of the year. In order to complete the long range studies in a timely manner, the earlier versions of the load models are adjusted to accurately represent the internal Con Edison coincident loads that are determined and made available by the Company’s Area Station Planning group in the first quarter of the year. Once these internal loads are incorporated into the model, appropriate voltages, interface flows, and generation dispatch are established for the three cases. At this point, all appropriate contingencies are evaluated, with a focus on 17 different TLAs associated with the Con Edison transmission system. Short circuit analysis is also performed. Any areas in which deficiencies have been identified undergo further evaluation for the development and verification of potential solutions. The solutions are reviewed and vetted with engineering and operating organizations, up to their executive levels. After the solution strategies have been selected, the overall plan is thoroughly reviewed and the report is drafted.

These steps are described in detail below:

1. Obtain Independent Peaks by Station for Years 1, 5 and 10 (2013, 2018, 2023)

   Con Edison determines area station load forecasts after the summer of each year, based on the most current summer load information for each area station. The independent peaks to be used in the TLA tabulations are available by the start of the fourth quarter;

2. Evaluation of Tabulations for 17 TLAs for Years 1, 5 and 10 (2013, 2018, 2023)

   The TLA tabulations utilize independent area station peaks combined with a diversity factor in order to provide a rough estimate of the MW margin or deficiency within each TLA. These results are generally optimistic by design. An indication of a TLA with marginal or deficit conditions would signal the need for a more accurate study in the subsequent load flow evaluations;

3. NYISO cases provided to Con Edison for Years 1, 5 and 10 (2013, 2018, 2023)

   The NYISO collects all of the component models of each contributing Transmission Owner and generation entity within the state and surrounding areas, and combines them into a single model (FERC 715) which is then distributed to all utilities. Generators that are in the NYISO interconnection process for future establishment are not included in the model unless they meet certain NYISO criteria, including initiation of construction;

4. Obtain Coincident Peaks for Years 1, 5 and 10 (2013, 2018, 2023)

   The latest forecast of coincident peaks for all area stations are obtained from the Company's Area Station Planning group, and incorporated into the Con Edison portion of the NYISO load flow models. The models are adjusted so that the load stations are regulated to the appropriate voltage level. Generation is re-dispatched, and tie line flows are modified as necessary.

   In some cases, a TLA experiences its peak load at a significantly different time than the system. Potential impacts from contingencies may not be observed because the coincident peak loads are smaller than independent peak loads for these stations. For these cases, additional load models would be created and evaluated, in which the localized area station load values are modified to reflect independent localized TLA peak loads;

5. Load flow studies for each of the 17 TLAs, for each of the 3 snapshot years

   The load models are evaluated for each of the 3 years in question. Each TLA is categorized according to a first or second contingency level of reliability, and evaluated accordingly.

   If significant changes in the transmission system are scheduled between two snapshot years, then additional studies will be performed to identify the impact.

6. Problems Identified

   Thermal overloads and voltage violations may require pre-contingency adjustments to the system (such as pre-loading transmission lines, generator re-dispatch, or reactive compensation, etc.) in order to resolve post-contingency violations.

   Thermal overloads and voltage violations that cannot be corrected using acceptable methods will be identified according to the year of appearance, extent of violation, growth of the problem over time, and potential of remediation through scheduled or anticipated infrastructure improvements;

7. Solutions Proposed and Evaluated

   For all thermal overloads and voltage violations that cannot be corrected using actions permissible within the transmission planning criteria, the impact of various system enhancements are evaluated according to their feasibility, timely establishment, extent of impact, and cost, and the one that most optimally satisfies the reliability, economic and operational requirements of the Transmission System is selected. Temporary operational remedial measures are identified to satisfy the TLA deficit until such time as the permanent solution is in place;

8. Report and Presentation

   The results of the analysis performed for each TLA are included in the annual Long-Range Transmission Plan; and

9. FERC Orders 890 and 1000 - Presentations and Responses

In accordance with the requirements set forth in FERC Order 890 and Order 1000, the Plan is posted and presented to interested parties. The intent is to provide information on the local transmission plan early in the planning cycle so as to provide a meaningful opportunity for comments.

5.3. Design Criteria Requirements

1. Thermal Overloads and Voltage Violations

Thermal overloads occur when the complex power, or MVA, on a transmission path exceed the normal rating of that path. These overloads can be caused by excessive real power flow, reactive power flow, or a combination of both. Voltage violations occur when bus voltages exceed their limits either above or below their nominal ratings.

For Overhead lines and inter-utility ties, Con Edison transmission planning design criteria for every “loss of transmission path” contingency is evaluated such that:

a. Immediately following the contingency and prior to any criteria corrective action, the flow on any path does not exceed the Long Term Emergency rating of that path; and
b. Following criteria corrective action (steady state), the flow on the path may not exceed the normal rating of that path.

For underground lines, Con Edison transmission planning design criteria is evaluated such that:

a. Immediately following the contingency and prior to any criteria corrective action, the flow on any path does not exceed the Short Term Emergency rating of that path, and bus voltages do not violate their 0.95 – 1.05 per unit limits; and
b. For the Loss of Generation - provided ten (10) minute operating reserve and/or phase angle regulation is available to reduce the loading to its LTE rating within fifteen (15) minutes and not cause any other facility to be loaded beyond its LTE rating.

c. For the loss of Transmission Facilities - provided phase angle regulation is available to reduce the loading to its LTE rating within fifteen (15) minutes and not cause any other facility to be loaded beyond its LTE rating.

d. Once the overload(s) are reduced to a level below the Long Term Emergency ratings, generation redispatch, within prescribed limits and additional PAR action may be used to reduce the overload(s) to a level below normal rating. Following criteria corrective action (steady state), the flow on the all paths may not exceed the normal rating of that path, and bus voltages may not exceed their steady-state operating limits.

If criteria corrective actions are sufficient to meet design criteria requirements, the analysis will conclude that there are no reliability deficits.

2. Short-Circuit Violations

Short-Circuit Violations occur when a 3 phase, 2 phase to ground or single line to ground faults create a short-circuit flow on a transmission path which exceeds the appropriate short-circuit rating of any of the breakers that are necessary for the isolation of that transmission path. In addition, all equipment on the transmission system, including but not limited to circuit breakers, bus work, disconnect switches, and structural supports, shall be evaluated for their ability to withstand the mechanical forces associated with fault currents.

5.4. Corrective Actions within the Modeling Environment

The sets of corrective actions allowed by criteria are different according to the stage and type of contingency encountered. In the results of the analysis of TLAs presented in Chapter 5 a finding of “no deficit” after a first or second contingency already may assume that the following acceptable corrective actions have been taken:

Criteria corrective actions include:

a. Adjustment of power flow using Phase Angle Regulators and Transformers;

b. Adjustment of generation power output up to their maximum capability;
c. Adjustment of generation voltage and reactive power;
d. Initiation of any and all Gas Turbines; and
e. Switching of shunt devices.

5.5. Methods for Deficit Resolution through System Enhancements

When criteria corrective actions are deemed insufficient or inappropriate for resolving post-contingency problems, strategies for the resolution of deficits through system enhancements are identified. Various solutions are modeled and evaluated for every problem, based on extent of impact, reliability improvement, scheduling, and cost. The following solution concepts are considered:

1. Load Transfers

   Area Station load transfers that reduce load within a TLA may be sufficient to reduce or eliminate deficits found within a TLA.

   Advantages: Economical, faster implementation

   Disadvantages: May limit future growth for impacted area stations, Requires extensive Distribution system re-configuration

2. Upgrades to Infrastructure

   Enhancements to transmission lines, circuit breakers, transformers, or phase angle regulators can increase the ability to import power into a TLA. Upgrades include increased circulation for underground circuits, cooling, re-conductoring, or replacement of equipment.

   Advantages: Permanent improvement in capacity, more economical than building new infrastructure.

   Disadvantages: May require significant outage time, improvement may be limited by upstream or downstream facilities.

3. New Generation or Upgrades

The timely establishment of new generation or the upgrade of existing generation within a TLA can have a major impact on reducing TLA deficits. Generally, anticipated generation is not considered unless construction has begun. Con Edison closely tracks the status of all generation projects in the NYISO queue that can have an impact within the Con Edison service territory.

Advantages: Permanent improvement in capacity and voltage support

Disadvantages: Merchant generation not under the control of Con Edison, long period from concept to operation, may need short circuit mitigation.

4. New or Reconfigured Transmission Lines

New transmission lines increase the ability to import power into a TLA by providing an alternative path for support following a contingency. Sometimes, it can be sufficient to reconfigure a line to improve reliability, either by relocating a termination point to another station, or by relocating the termination point within a station. Consideration must be taken for any increase in short-circuit magnitudes.

Advantages: Permanent improvement in capacity, reliability.

Disadvantages: Cost, long lead times, may need short-circuit mitigation

5. New Transmission Stations with New or Reconfigured Transmission Lines

Transmission stations can be established according to the need for load relief in support of area stations that have reached their capacity. In most cases, these new transmission stations will also provide new transmission line connections or pathways that improve capacity and deliverability.

Advantages: Permanent improvement in capacity, future flexibility

Disadvantages: High Cost, long lead time, up to 3 years, may need short-circuit mitigation.

6. Transmission Station Configuration Upgrades

Transmission stations can be reconfigured or expanded to provide reliability improvements. Isolated bus configurations can be effectively upgraded to ring bus or breaker-and-a-half configurations. Consideration must be taken for any increase in short-circuit magnitudes.

Advantages: Permanent improvement in capacity, reliability, cost.

Disadvantages: Cost, long lead times, may need short-circuit mitigation, size of property may be limiting. Most transmission stations are at their physical size and utilization limits.

7. Reactive Power Compensation (Capacitors or Shunt Reactors)

The need for reactive power compensation varies according to the structure and function of various transmission and sub-transmission components:

Overhead transmission lines usually carry a large volume of power and may be limited by low voltage constraints. The most efficient and economical support for deliverability is the installation of shunt capacitor banks to provide reactive compensation for the transmission path, and maintain high voltage along the transmission corridor.

Underground cables have significant capacitive reactance, providing reactive support for the system that can be essential during peak load periods but may be detrimental at light load periods.

The most efficient and economical resolution is the utilization of switched shunt reactors at the terminal points of these lines to absorb the reactive component flow at light load periods.

Advantages: Permanent improvement in compensation, lower cost, short lead time

Disadvantages: Shunt devices are subject to fluctuation as a function of voltage. Capacitor banks must be evaluated for contribution to transients during switching

8. Power Flow Control (Phase Angle Regulators, Variable Frequency Transformers)

Phase angle regulators (PAR's) and Variable Frequency Transformers (VFT's) are used when control of the real power flow on a transmission path needs to be regulated.

Advantages: Permanent improvement in reliability

Disadvantages: Cost, long lead time, relatively large equipment

9. Short Circuit Remediation

As generators are added to the system and as new transmission ties create more connections between stations, the overall level of short-circuit current magnitudes will increase. To reduce short-circuit currents higher impedance devices such as series reactors or phase angle regulators can be added to the system.

Advantages: Allows for more interconnections between stations, more economical than other alternatives such as DC back-to-back links

Disadvantages: Absorb reactive power, reduces voltages

10. Demand Side Management (DSM), Demand Response, and/or Distributed Generation

Advantages: Permanent reduction in load, most cost-effective strategy

Disadvantages: Requires massive customer participation to achieve impact at the transmission level

All of these strategies, when allocated appropriately, can delay or replace the costly implementation of alternative infrastructure improvements.

6.0 TRANSMISSION LOAD AREA ASSESSMENT

The following table lists all 17 Transmission Load Areas in the Con Edison system. This is followed by individual tables for each TLA containing the results of first contingency or second contingency analysis together with other analysis and considerations.

	Transmission Load Area	Design Contingency
1	New York City - 345 kV	Second
2	West 49th Street - 345 kV	Second
3	New York City - 138 kV	Second
4	Astoria - 138 kV	Second
5	East 13th Street - 138 kV	Second
6	Astoria East / Corona - 138 kV	Second
7	Astoria West / Queensbridge - 138 kV	Second
8	Vernon - 138 kV	Second
9	East River - 138 kV	Second
10	Greenwood / Staten Island - 138 kV	First
11	Corona / Jamaica - 138 kV	First
12	Bronx- 138 kV	First
13	Eastview - 138 kV	First
14	Staten Island - 138 kV	First
15	Dunwoodie North / Sherman Creek - 138 kV	First
16	Dunwoodie South - 138 kV	First
17	Millwood / Buchanan - 138 kV	First

6.1. New York City - 345 kV

<table>
<tr><td>Geographic Coverage</td><td colspan="4">Manhattan, Bronx, Brooklyn, Queens and Staten Island.</td></tr>
<tr><td>Design Criteria</td><td colspan="4">Second Contingency.</td></tr>
<tr><td rowspan="4">Planned Changes In Load Area</td><td>2013</td><td colspan="3">Reconfigure 34091 to dedicated bus section at Astoria Annex</td></tr>
<tr><td>2013</td><td colspan="3">Establish HTP (PSNJ to W 49th St) 320 MW Firm, 660 MW Emergency</td></tr>
<tr><td>2013</td><td colspan="3">138 kV Transmission tie 38M72, with associated Phase Angle Regulator R1, connecting Vernon to West 49th Street Substations, is a steady state resource</td></tr>
<tr><td>2014</td><td colspan="3">Goethals established as a 345 kV ring bus</td></tr>
<tr><td rowspan="6">Assessment</td><td rowspan="2">2013</td><td>First Contingency</td><td>Loss of feeder 71 or feeder 72</td><td>No deficit</td></tr>
<tr><td>Second Contingency</td><td>Loss of feeder 71 or feeder 72 followed by the loss of Ravenswood 3</td><td>No deficit</td></tr>
<tr><td rowspan="2">2018</td><td>First Contingency</td><td>Loss of feeder 71 or feeder 72</td><td>No deficit</td></tr>
<tr><td>Second Contingency</td><td>Loss of feeder 71 or feeder 72 followed by the loss of Ravenswood 3</td><td>No deficit</td></tr>
<tr><td rowspan="2">2023</td><td>First Contingency</td><td>Loss of feeder 71 or feeder 72</td><td>No deficit</td></tr>
<tr><td>Second Contingency</td><td>Loss of feeder 71 or feeder 72 followed by the loss of Ravenswood 3</td><td>No deficit</td></tr>
<tr><td rowspan="3">Operational Remediation</td><td>2013</td><td colspan="3">None required</td></tr>
<tr><td>2018</td><td colspan="3">None required</td></tr>
<tr><td>2023</td><td colspan="3">None required</td></tr>
<tr><td rowspan="3">Planning Solution</td><td>2013</td><td colspan="3">None required</td></tr>
<tr><td>2018</td><td colspan="3">None required</td></tr>
<tr><td>2023</td><td colspan="3">None required</td></tr>
<tr><td>Short Circuit Considerations</td><td colspan="4">None</td></tr>
</table>

6.2. West 49th Street - 345 kV

Geographic Coverage	Midtown and Lower Manhattan.			
Design Criteria	Second Contingency.			
Planned Changes In Load Area	2013	Reconfigure 34091 to dedicated bus section at Astoria Annex		
	2013	East Establish HTP (PSNJ to W 49th St) 320 MW Firm, 660 MW Emergency		
	2013	138 kV Transmission tie 38M72, with associated Phase Angle Regulator R1, connecting Vernon to West 49th Street Substations, is a steady state resource		
Assessment	2013	First Contingency	Loss of M51	No deficit
		Second Contingency	Loss of M51 followed by the loss of M52	No deficit
	2018	First Contingency	Loss of M51	No deficit
		Second Contingency	Loss of M51 followed by the loss of M52	No deficit
	2023	First Contingency	Loss of M51	No deficit
		Second Contingency	Loss of M51 followed by the loss of M52.	No deficit
Operational Remediation	2013	None required.		
	2018	None required.		
	2023	None required.		
Planning Solution	2013	None required.		
	2018	None required.		
	2023	None required.		
Short Circuit Considerations	None			

6.3. New York City - 138 kV

Geographic Coverage	Bronx, Brooklyn, Queens and Manhattan.			
Design Criteria	Second Contingency			
Planned Changes In Load Area	2013	Reconfigure 34091 to dedicated bus section at Astoria Annex		
	2013	138 kV Transmission tie 38M72, with associated Phase Angle Regulator R1, connecting Vernon to West 49th Street Substations, is a steady state resource		
Assessment	2013	First Contingency	Loss of Astoria Energy I 500 MW Plant at Astoria East.	No deficit
		Second Contingency	Loss of Astoria Energy I 500 MW Plant at Astoria East, followed by NYPA CC1/CC2 500 MW plant at Astoria West.	No deficit
	2018	First Contingency	Loss of Astoria Energy I 500 MW Plant at Astoria East.	No deficit
		Second Contingency	Loss of Astoria Energy I 500 MW Plant at Astoria East, followed by NYPA CC1/CC2 500 MW plant at Astoria West.	No deficit
	2023	First Contingency	Loss of Astoria Energy I 500 MW Plant at Astoria East.	No deficit
		Second Contingency	Loss of Astoria Energy I 500 MW Plant at Astoria East, followed by NYPA CC1/CC2 500 MW plant at Astoria West.	No deficit
Operational Remediation	2013	None required		
	2018	None required		
	2023	None required		
Planning Solution	2013	None required		
	2018	None required		
	2023	None required		
Short Circuit Considerations	None			

6.5. Astoria - 138 kV

Geographic Coverage	Bronx, Queens and Manhattan			
Design Criteria	Second Contingency			
Planned Changes In Load Area	2013	Reconfigure 34091 to dedicated bus section at Astoria Annex		
Assessment	2013	First Contingency	Loss of Astoria Energy I 500 MW Plant at Astoria East.	No deficit
		Second Contingency	Loss of Astoria Energy I 500 MW Plant at Astoria East, followed by NYPA CC1/CC2 500 MW plant at Astoria West.	No deficit
	2018	First Contingency	Loss of Astoria Energy I 500 MW Plant at Astoria East.	No deficit
		Second Contingency	Loss of Astoria Energy I 500 MW Plant at Astoria East, followed by NYPA CC1/CC2 500 MW plant at Astoria West.	No deficit
	2023	First Contingency	Loss of Astoria Energy I 500 MW Plant at Astoria East.	No deficit
		Second Contingency	Loss of Astoria Energy I 500 MW Plant at Astoria East, followed by NYPA CC1/CC2 500 MW plant at Astoria West.	No deficit
Operational Remediation	2013	None required		
	2018	None required		
	2023	None required		
Planning Solution	2013	None required		
	2018	None required		
	2023	None required		
Short Circuit Considerations	None			

6.6. East 13th Street - 138 kV

<table>
<tr><td>Geographic Coverage</td><td colspan="4">Midtown and lower Manhattan</td></tr>
<tr><td>Design Criteria</td><td colspan="4">Second Contingency</td></tr>
<tr><td rowspan="2">Planned Changes In Load Area</td><td>2013</td><td colspan="3">Reconfigure 34091 to dedicated bus section at Astoria Annex</td></tr>
<tr><td>2013</td><td colspan="3">Establish HTP (PSNJ to W 49th St) 320 MW Firm, 660 MW Emergency</td></tr>
<tr><td colspan="5"></td></tr>
<tr><td rowspan="6">Assessment</td><td rowspan="2">2013</td><td>First Contingency</td><td>Loss of Feeder B47, Q35L, 37378, 44371 L/M, Transformers 16 & 17 at E13th Street. Switch to restore Q35L, 44371 & Transformer 17.</td><td>No deficit</td></tr>
<tr><td>Second Contingency</td><td>Followed by loss of Feeder 48, Q35M, 34091, 37376, 37377, Transformers 10 & 11 at E13th Street.</td><td>No deficit</td></tr>
<tr><td rowspan="2">2018</td><td>First Contingency</td><td>Loss of Feeder B47, Q35L, 37378, 44371 L/M, Transformers 16 & 17 at E13th Street. Switch to restore Q35L, 44371 & Transformer 17.</td><td>No deficit</td></tr>
<tr><td>Second Contingency</td><td>Followed by loss of Feeder 48, Q35M, 37376, 37377, Transformers 10 & 11 at E13th Street.</td><td>No deficit</td></tr>
<tr><td rowspan="2">2023</td><td>First Contingency</td><td>Loss of Feeder B47, Q35L, 37378, 44371 L/M, Transformers 16 & 17 at E13th Street. Switch to restore Q35L, 44371 & Transformer 17.</td><td>No deficit</td></tr>
<tr><td>Second Contingency</td><td>Followed by loss of Feeder 48, Q35M, 37376, 37377, Transformers 10 & 11 at E13th Street.</td><td>No deficit</td></tr>
<tr><td colspan="5"></td></tr>
<tr><td rowspan="3">Operational Remediation</td><td>2013</td><td colspan="3">None required</td></tr>
<tr><td>2018</td><td colspan="3">None required</td></tr>
<tr><td>2023</td><td colspan="3">None required</td></tr>
<tr><td colspan="5"></td></tr>
<tr><td rowspan="3">Planning Solution</td><td>2013</td><td colspan="3">None required</td></tr>
<tr><td>2018</td><td colspan="3">None required</td></tr>
<tr><td>2023</td><td colspan="3">None required</td></tr>
<tr><td colspan="5"></td></tr>
<tr><td>Short Circuit Considerations</td><td colspan="4">None</td></tr>
</table>

6.7. Astoria East / Corona - 138 kV

Geographic Coverage	Queens			
Design Criteria	Second Contingency			
Planned Changes In Load Area	2013	Reconfigure 34091 to dedicated bus section at Astoria Annex		
	2018	Establish new 138 kV transmission line with transformer and Phase Angle Regulator connecting Rainey and Corona Substations		
Assessment	2013	First Contingency	Loss of Astoria Energy I	No deficit
		Second Contingency	Loss of Astoria Energy I, followed by loss of feeder 34091	~20 MVA deficit
	2018	First Contingency	Loss of Astoria Energy I	No deficit
		Second Contingency	Loss of Astoria Energy I, followed by loss of feeder 34091	~90 MVA deficit
	2023	First Contingency	Loss of Astoria Energy I	No deficit
		Second Contingency	Loss of Astoria Energy I, followed by loss of feeder 34091	No deficit
Operational Remediation	2013	Utilize 300 hr ratings for feeders 34051/52 and 701/702 until new transmission line established in 2018		
	2018	Utilize 300 hr ratings for feeders 34051/52 and 701/702 until new transmission line established in 2018		
	2023	None required		
Planning Solution	2013	None required – See Operational Remediation		
	2018	None required – See Planned Changes in Load Area		
	2023	None required		
Short Circuit Considerations	None			

6.8. Astoria West / Queensbridge - 138 kV

Geographic Coverage	Queens and Manhattan			
Design Criteria	Second Contingency			
Planned Changes In Load Area	2013	Reconfigure 34091 to dedicated bus section at Astoria Annex		
Assessment	2013	First Contingency	Loss of NYPA CC1/CC2	No deficit
		Second Contingency	Loss of NYPA CC1/CC2 followed by loss of Astoria Unit 5	No deficit
	2018	First Contingency	Loss of NYPA CC1/CC2	No deficit
		Second Contingency	Loss of NYPA CC1/CC2 followed by loss of Astoria Unit 5	No deficit
	2023	First Contingency	Loss of NYPA CC1/CC2	No deficit
		Second Contingency	Loss of NYPA CC1/CC2 followed by loss of Astoria Unit 5	No deficit
Operational Remediation	2013	None required		
	2018	None required		
	2023	None required		
Planning Solution	2013	None required		
	2018	None required		
	2023	None required		
Short Circuit Considerations	None			

6.9. Vernon - 138 kV

<table>
<tr><td>Geographic Coverage</td><td colspan="4">Queens and Manhattan</td></tr>
<tr><td>Design Criteria</td><td colspan="4">Second Contingency</td></tr>
<tr><td>Planned Changes In Load Area</td><td>2013</td><td colspan="3">Vernon Fault Duty Upgrades Completed</td></tr>
<tr><td colspan="5"></td></tr>
<tr><td rowspan="6">Assessment</td><td rowspan="2">2013</td><td>First Contingency</td><td>Loss of Ravenswood 1</td><td>No deficit</td></tr>
<tr><td>Second Contingency</td><td>Loss of Ravenswood 1, Followed by loss of Ravenswood 2</td><td>No deficit</td></tr>
<tr><td rowspan="2">2018</td><td>First Contingency</td><td>Loss of Ravenswood 1</td><td>No deficit</td></tr>
<tr><td>Second Contingency</td><td>Loss of Ravenswood 1, Followed by loss of Ravenswood 2</td><td>No deficit</td></tr>
<tr><td rowspan="2">2023</td><td>First Contingency</td><td>Loss of Ravenswood 1</td><td>No deficit</td></tr>
<tr><td>Second Contingency</td><td>Loss of Ravenswood 1, Followed by loss of Ravenswood 2</td><td>No deficit</td></tr>
<tr><td colspan="5"></td></tr>
<tr><td rowspan="3">Operational Remediation</td><td>2013</td><td colspan="3">None required</td></tr>
<tr><td>2018</td><td colspan="3">None required</td></tr>
<tr><td>2023</td><td colspan="3">None required</td></tr>
<tr><td colspan="5"></td></tr>
<tr><td rowspan="3">Planning Solution</td><td>2013</td><td colspan="3">None required</td></tr>
<tr><td>2018</td><td colspan="3">None required</td></tr>
<tr><td>2023</td><td colspan="3">None required</td></tr>
<tr><td colspan="5"></td></tr>
<tr><td>Short Circuit Considerations</td><td colspan="4">None</td></tr>
</table>

6.10. East River - 138 kV

Geographic Coverage	Manhattan			
Design Criteria	Second Contingency			
Planned Changes In Load Area	None			
Assessment	2013	First Contingency	Failed Breaker BT 6-7 resulting in Loss of ER6 & ER7 at East River	No deficit
		Second Contingency	Loss of ER2 at East River followed by Transformer 17	No deficit
	2018	First Contingency	Failed Breaker BT 6-7 resulting in Loss of ER6 & ER7 at East River	No deficit
		Second Contingency	Loss of ER2 at East River followed by Transformer 17	No deficit
	2023	First Contingency	Failed Breaker BT 6-7 resulting in Loss of ER6 & ER7 at East River	No deficit
		Second Contingency	Loss of ER2 at East River followed by Transformer 17	No deficit
Operational Remediation	2013	None required		
	2018	None required		
	2023	None required		
Planning Solution	2013	None required		
	2018	None required		
	2023	None required		
Short Circuit Considerations	None			

6.11. Greenwood / Staten Island - 138 kV

Geographic Coverage	Brooklyn and Staten Island			
Design Criteria	First Contingency			
Planned Changes In Load Area	None			
Assessment	2013	First Contingency	Bus Fault with Stuck Breaker #4N results in loss of Gowanus GTs 1&3, Narrows GT2, Feeder 42232.	No Deficit
	2018	First Contingency	Bus Fault with Stuck Breaker #4N results in loss of Gowanus GTs 1&3, Narrows GT2, Feeder 42232.	At limit
	2023	First Contingency	Bus Fault with Stuck Breaker #4N results in loss of Gowanus GTs 1&3, Narrows GT2, Feeder 42232.	No Deficit
Operational Remediation	2013	None required		
	2018	None required		
	2023	None required		
Planning Solution	2013	None required		
	2018	Establish Breaker 3N, to separate feeder 42232 from feeder 42G13		
	2023	None required		
Short Circuit Considerations	None			

6.12. Corona / Jamaica - 138 kV

Geographic Coverage	Queens			
Design Criteria	First Contingency			
Planned Changes In Load Area	2013	Reconfigure 34091 to dedicated bus section at Astoria Annex		
	2018	Establish new 138 kV transmission line with transformer and Phase Angle Regulator connecting Rainey and Corona Substations		
Assessment	2013	First Contingency	Failed breakers 1, 2, 9, or 18 resulting in the loss of feeder 901, 702 and transformer bank 4 at Jamaica 138 kV	None required.
	2018	First Contingency	Failed breakers 1, 2, 9, or 18 resulting in the loss of feeder 901, 702 and transformer bank 4 at Jamaica 138 kV	10 MVA Deficit
	2023	First Contingency	Failed breakers 1, 2, 9, or 18 resulting in the loss of feeder 901, 702 and transformer bank 4 at Jamaica 138 kV	None required.
Operational Remediation	2013	None required		
	2018	None required		
	2023	None required		
Planning Solution	2013	None required		
	2018	None required – See Planned Changes in Load Area		
	2023	None required		
Short Circuit Considerations	None			

6.13. Bronx - 138KV

Geographic Coverage	The Bronx and Manhattan			
Design Criteria	This 138 kV load area has a first contingency design serving load in the Bronx and supports second contingency load in Manhattan supplied by Sherman Creek.			
Planned Changes In Load Area	None			
Assessment	2013	First Contingency	Loss of X28 or M29	No Deficit
	2018	First Contingency	Loss of X28 or M29	No Deficit
	2023	First Contingency	Loss of X28 or M29	No Deficit
Operational Remediation	2013	None required		
	2018	None required		
	2023	None required		
Planning Solution	2013	None required		
	2018	None required		
	2023	None required		
Short Circuit Considerations	None			

6.14. Eastview - 138 kV

Geographic Coverage	Westchester			
Design Criteria	First Contingency			
Planned Changes In Load Area	None			
Assessment	2013	First Contingency	Loss of 1 Common Tower – Transformers 1S & 1N at Eastview, W78, W85, W64 and W99	No deficit
	2018	First Contingency	Loss of 1 Common Tower – Transformers 1S & 1N at Eastview, W78, W85, W64 and W99	No deficit
	2023	First Contingency	Loss of 1 Common Tower – Transformers 1S & 1N at Eastview, W78, W85, W64 and W99	No deficit
Operational Remediation	2013	None required		
	2018	None required		
	2023	None required		
Planning Solution	2013	None required		
	2018	None required		
	2023	None required		
Short Circuit Considerations	None.			

6.15. Staten Island - 138 kV

Geographic Coverage	Staten Island			
Design Criteria	First Contingency			
Planned Changes In Load Area	2020	Transfer 6 MW from Wainwright to Woodrow		
	2021	Transfer 6 MW from Willowbrook to Woodrow		
Assessment	2013	First Contingency	Loss of Arthur Kill 2	No deficit
	2018	First Contingency	Loss of Arthur Kill 2	No deficit
	2023	First Contingency	Loss of Arthur Kill 2	No deficit
Operational Remediation	2013	None required		
	2018	None required		
	2023	None required		
Planning Solution	2013	None required		
	2018	None required		
	2023	None required		
Short Circuit Considerations	None			

6.16. Dunwoodie North / Sherman Creek - 138 kV

Geographic Coverage	Westchester, the Bronx and Manhattan			
Design Criteria	First Contingency design, supporting second contingency load in Manhattan			
Planned Changes In Load Area	None			
Assessment	2013	First Contingency	Loss of M29	No Deficit
	2018	First Contingency	Loss of M29	No Deficit
	2023	First Contingency	Loss of M29	No Deficit
Operational Remediation	2013	None required		
	2018	None required		
	2023	None required		
Planning Solution	2013	None required		
	2018	None required		
	2023	None required		
Short Circuit Considerations	None			

6.17. Dunwoodie South - 138 kV

Geographic Coverage	Westchester and the Bronx			
Design Criteria	First Contingency			
Planned Changes In Load Area	No Changes			
Assessment	2013	First Contingency	Loss of W73	No deficit
	2018	First Contingency	Loss of W73	No deficit
	2023	First Contingency	Loss of W73	No deficit
Operational Remediation	2013	None required		
	2018	None required		
	2023	None required		
Planning Solution	2013	None required		
	2018	None required		
	2023	None required		
Short Circuit Considerations	None			

6.18. Millwood / Buchanan - 138 kV

Geographic Coverage	Westchester and the Bronx			
Design Criteria	First Contingency			
Planned Changes In Load Area	No Changes			
Assessment	2013	First Contingency	Loss of Transformer TA-2 at Millwood	No Deficit
	2018	First Contingency	Loss of Transformer TA-2 at Millwood	No Deficit
	2023	First Contingency	Loss of Transformer TA-2 at Millwood	No Deficit
Operational Remediation	2013	None required		
	2018	None required		
	2023	None required		
Planning Solution	2013	None required		
	2018	None required		
	2023	None required		
Short Circuit Considerations	None			

7.0 LOAD GROWTH SUPPORT: NEW TRANSMISSION STATIONS

There are no new transmission stations required for the period 2013-2023.

8.0 INTERCONNECTION PROCESS AND OUTLOOK

Con Edison has issued a Developer Welcome Kit (posted on the Con Edison website[13]) with the intent to provide developers of merchant generator or merchant transmission projects with general guidelines for connecting proposed facilities to Con Edison's electric transmission and distribution systems. This Welcome Kit contains a general schedule and technical requirement to guide developers in their project development process.

8.1. Regulations Governing the Interconnection Process

As Con Edison is a member of the New York Independent System Operator (NYISO), all proposed connections to the transmission system are governed by the NYISO Open Access Transmission Tariff (OATT) – Attachment X – Large Generator Interconnection Procedure. Connection of proposed developer projects to the Con Edison electric transmission system must meet established reliability, environmental and safety standards. Attachment X to the NYISO OATT prescribes a number of technical system studies. These system studies are performed to ensure that the proposed project does not have an adverse impact on the performance of the New York State Transmission System. The performance of these studies is the responsibility of the NYISO. Studies performed for previous projects can be obtained from the NYISO website. While Attachment X of the OATT outlines the general requirements of each study, a detailed scope must be presented to and approved by the NYISO's Operating Committee.

8.2. Con Edison Transmission Planning Criteria

Developers must also adhere to the local TO planning criteria and practices to assure a reliable interconnection. In general, new generating facilities must not contribute to a deterioration of system reliability such as by burdening it with flows that exceed criteria under normal and contingency conditions, fault currents that exceed

[13] See http://www.coned.com/tp/developer_welcome_kit.asp

criteria, or by not supplying the reactive power required by their interconnection agreement.

8.3. The NYISO Interconnection Process

Below is a simplified flow chart of the Interconnection Process. This is only to serve as a general guide to the Interconnection Process with notes that pertain to Con Edison. Developer should adhere to the most updated NYISO Open Access Transmission Tariff.

1. Interconnection Request	• Developer submits Interconnection Request to NYISO
2. Scoping Meeting	• Discuss Project particulars with NYISO and connecting Transmission Owner • The Developer must submit a one-line diagram of the proposed Interconnection Point within 5 days of the Scoping Meeting
3. Feasibility Study	• Preliminary assessment of the physical constructability of the proposed project and location proposed by the Developer
4. System Impact Reliability Study	• Evaluates thermal, stability, short circuit and transfer limit impacts
5. Facilities Study	• Two part study conducted by NYISO to determine the necessary system upgrades and cost allocation among a Class Year of developers based on minimum interconnection and deliverability standards
6. Interconnection Agreement	• Culmination of the Interconnection Process and study evaluations • Includes terms and conditions agreed by involved parties
7. Construction	
8. Backfeed and Developer Activities	

Developer Projects Proposing to Interconnect to Con Edison

The table below lists the merchant generation and transmission projects that currently propose to interconnect to Con Edison. This information was extracted from the latest version of the NYISO's interconnection queue listing, dated August 31, 2013, and is subject to periodic revision by the NYISO to reflect the status updates of the various projects currently in the queue, as well as the addition of new or deletion of existing projects. Some of the projects are relatively new, and their anticipated MW capabilities are listed as TBD (To Be Determined), because these values have not yet been defined by the developers.

The list of proposed developer projects that seek interconnection to the Con Edison transmission system reveals that 2646 MW of new generation projects and 3420 MW of new transmission projects.

None of the projects in the queue have been included in the Long Range Plan, because their actual construction (and in-service dates) may be delayed or cancelled due to a variety of factors that impact a developer's decision to proceed or exit from the project. These include:

- Future load growth and existing available capacity;
- Development of DSM programs;
- Fuel diversity of the load area served to access a competitive advantage;
- Local reliability rules that would prescribe a specific need not met by existing facilities;
- Capacity market pricing;
- Retirements of existing generation;
- Financing costs and calculated payback period for the technology utilized; and
- Forecasted needs for resources as communicated by the NYISO through the Comprehensive System Planning Process.

Appendix: NYISO Queue Entries for the Con Edison Service Territory

Con Edison - The Long-Range Transmission Plan, 2013 – 2023

Based on NYISO Interconnection Queue as of 2013

Pos.	Owner/Developer	Project Name	G/T	Date of IR	(MW)	Zone	Interconnection Point	Availability of Studies	Interconnect Request	Scoping Meeting	Feasibility Study	System Reliability Impact Study	Facilities Study	Original In-Svc Date	Current In-Svc Date
201	NRG Energy	Berrians GT I	G	8/17/05	200	J	Astoria West Substation 138kV	FES, SRIS	X	X	X	X	b*	3/2014	6/2014
224	NRG Energy, Inc.	Berrians GT II	G	8/23/06	50	J	Astoria West Substation 138kV	FES, SRIS	X	X	X	X	b*	3/2014	6/2014
266	NRG Energy, Inc.	Berrians GT III	G	11/28/07	250	J	Astoria 345kV	FES, SRIS	X	X	X	X	x, c*	3/2016	6/2016
294	Orange & Rockland	Ramapo-Sugarloaf	T	4/29/08	N/A	G	Ramapo - Sugarloaf 138kV	SIS	X	X		X		2014/Q2	
305	Transmission Developers Inc.	Champlain Hudson Power Express	T	7/18/08	1000	J	Astoria Substation 345kV	FES, SRIS	X	X	X	X		12/2017	12/2017
310	Cricket Valley Energy Center, LLC	Cricket Valley Energy Center	T	9/22/08	1020	G	Pleasant Valley - Long Mt. 345kV	FES, SRIS	X	X	X	X	a*	7/2016	7/2016
358	West Point Partners, LLC	West Point Transmission	T	9/13/10	1000	F, H	Leeds - Buchanan North 345kV	FES	X	X	X			7/2017	7/2017
361	US PowerGen Co.	Luyster Creek Energy	G	2/15/11	401	J	Astoria West Substation 138kV	FES	X	X	X			6/2015	6/2015
367	Orange & Rockland	North Rockland Transformer	T	9/14/11	TBD	G	Line Y94 345kV	SIS	X	X				6/2015	
368	Consolidated Edison Co. of NY	Feeder 76 Ramapo to Rock Tavern	T	10/13/11	TBD	G	Ramapo to Rock Tavern 345 kV	SIS	X	X				8/2016	
369	Clover Leaf Power, LLC	Clover Leaf Hollers Ave	G	10/24/11	174	J	E 179th St. Subsation 138kV	FES	X	X	X			12/2016	12/2016
382	Astoria Generating Co.	South Pier Improvement	G	5/30/12	88	J	Gowanus Substation 138kV	SRIS	X	X		X		7/2015	7/2015
383	GenOn Energy, Inc.	Bowline Gen. Station Unit #3	G	5/30/12	775	G	Ladentown Subsation 345kV	None	X	X				1/2016	6/2016
384	National Grid	Knickerbocker Pleasant Valley	T	6/15/12	TBD	F, G	Knickerbocker - P. Valley 345kV	SIS	X	X		X		2018	
385	National Grid	Hudson Valley Reinforcement	T	6/15/12	TBD	F, G	N. Scotland-Leeds-P. Valley 345kV	SIS	X	X		X		2018	
393	NRG Energy, Inc.	Berrians East Repower	G	10/16/12	500	J	Astoria East Substation 138kV	FES	X	X	X			6/2018	6/2018
396A	New York State Electric & Gas	Wood Street Transformer	T	12/14/12	TBD	G	Wood St. 345/115kV	None	X	X				12/2017	
400	East Coast Power LLC	Linden Cogen Uprate	G	3/4/13	208	J	Linden Cogen 345kV	None	X	X				2016/Q2	2016/Q2
402	NextEra Energy Transmission	Marcy - PV 345	T	5/17/13	TBD	E-G	Marcy - P. Valley 345kV	None	X	X				7/2017	8/2017
406	NextEra Energy Transmission	Marcy - KB - PV 345	T	6/21/13	TBD	E-G	Marcy - P. Valley 345kV	None	X	X				7/2017	8/2017
407	National Grid	Edic - New Scotland #1	T	7/1/13	TBD	E, F	Edic - New Scotland 345kV	None	X					12/2018	12/2018
408	National Grid	Edic-Princetown-NScotland #2	T	7/1/13	TBD	E, F	Edic - New Scotland 345kV	None	X					12/2018	12/2018
411	BCDC Transmission LLC	BCDC Transmission	T	7/1/13	400	J	NJ - Farragut Substation 345kV	None	X	X				7/2017	10/2017

Total Generation - MW's	**2,646**
Total Transmission - MW's	**3,420**
Total Proposed Project MW's that have a completed Facility Study and have accepted Cost Responsibility	**250**
At the time of publication, the Class Year 2011 Facilities Study has not yet been finalized	

Notes:
a* = Has completed 2011 Facility Study but rejected its cost responsibility
b* = Has completed 2011 Facility Study and accepted cost responsibility
c* = Has completed 2010 Facility Study, rejected cost responsibility in CY2010. Not a participant in 2011 Facility Study

G = Generation Project
T = Transmission Project
FES = Feasibility Study
SRIS = System Reliability Impact Study
FS = Facilities Study
NA = Not Applicable