New York ISO
Independent System Operator

# Manual 35

# Economic Planning Process Manual- ~~Congestion Assessment and Resource Integration Studies (CARIS)~~

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# Revision History

| Version | Date | Revisions |
|---|---|---|
| 1.0 | 12/06/2012 | Initial Release |
| 2.0 | 05/28/2014 | Global<br>➢ Performed a reorganization of content<br>➢ Implemented minor stylistic changes<br>➢ Added additional language clarifying the CARIS process |
| 2.1 | 02/26/2016 | Section 3.2<br>➢ New section inserted for Developer Qualifications<br>Appendix H<br>➢ New appendix incorporating by reference, the "NYISO Qualification Form" in Attachment A of the Reliability Planning Manual |
| 2.2 | 05/30/2019 | Global<br>➢ Updated description of historic congestion data reporting<br>➢ Inclusion of a reference to Generation Deactivation process in the Introductory section<br>➢ Correction to NYISO web links<br>➢ Ministerial changes such as standardization of tariff references, inappropriate capitalizations, and use of defined terms<br>➢ Minor language edits for user readability |
| 2.3 | 11/11/2020 | Section 3.1<br>➢ Removed methodology for maintaining a representative system<br>➢ Included generic resource addition process for resource adequacy and transmission security needs identified in the latest Reliability Planning Process |
| 2.4 | MM/DD/YYYY | Global<br>➢ Updated introductory section to ~~to~~ align with new tariff<br>➢ Replaced CARIS Phase 1 process with System & Resource Outlook process<br>➢ Replaced CARIS Phase 2 process with Economic Transmission Project Evaluation process<br>➢ Replaced Additional CARIS Study process with Requested Economic Planning Study process<br>➢ Updated forms and appendices to align with new tariff |

# 1. Overview

## 1.1. The Comprehensive System Planning Process

This Economic Planning Process Manual (Manual) describes the NYISO's ~~e~~Economic ~~p~~Planning ~~p~~Process (EPP) component of the Comprehensive System Planning Process (CSPP). The CSPP was approved by the Federal Energy Regulatory Commission (FERC) and its requirements are contained in Attachment Y of the NYISO's Open Access Transmission Tariff (OATT). One of the NYISO's responsibilities is to prepare for the impact of expected changes in supply and demand of power on the reliable operation of the New York transmission system. The analyses, evaluations and forecasts produced by the NYISO's system and resource planning activities assist Market Participants, regulators and policy makers as they plan for the future. One way the NYISO accomplishes this responsibility is through the Economic Planning Process component of the CSPP.~~Unless otherwise defined in this document, capitalized terms used herein shall have the meanings ascribed to them in the NYISO OATT.~~

The CSPP is comprised of four components:

1. Local Transmission Planning Process (LTPP),
2. Reliability Planning Process (RPP) along with parts of the Short--Term Reliability Process (STRP).~~,~~
3. ~~Congestion Assessment and Resource Integration Study (CARIS),~~Economic Planning Process (EPP), and
4. Public Policy Transmission Planning Process

~~One of the NYISO's responsibilities is to prepare for the impact of expected changes in supply and demand of power on the reliable operation of the New York transmission system over a ten-year period. The analyses, evaluations and forecasts produced by the NYISO's system and resource planning activities assist Market Participants, regulators and policy makers as they plan for the future. One way the NYISO accomplishes this responsibility is through its CSPP.~~

The first component in the CSPP cycle is the LTPP. Under this process, the local Transmission Owners (TOs) perform transmission studies for their transmission areas according to all applicable criteria. This process produces the Local Transmission Owner Plan (LTP), which feeds into the NYISO's determination of system needs through the ~~reliability planning process component of the~~ CSPP. Details of the LTPP are

included ~~captured~~ in the ~~r~~Reliability ~~p~~Planning ~~p~~Process ("RPP") Manual[1].

The ~~RPP, which is the~~ second component in the CSPP cycle is the RPP, covering year 4 through year 10 following the year of starting the study, along with STRP, covering year 1 through year 5 following the STAR Start Date of the study. The RPP and STRP requirements are ~~, is~~ described in detail in the RPP Manual and Attachments Y and FF to the OATT, respectively. Under the biennial process for conducting the RPP, the reliability of the New York ~~b~~Bulk ~~p~~Power Transmission Facilities (BPTF)~~system~~ is assessed, any Reliability Needs ~~(if any)~~ are identified, solutions to identified needs are proposed and evaluated for their viability and sufficiency to satisfy the identified needs, and the more efficient or cost-effective transmission solution to the identified needs ~~if any~~ is selected by the NYISO. The RPP~~is process~~ was originally developed and implemented in conjunction with stakeholders, was approved by FERC in December 2004 and was revised in 2014 to conform to FERC Order No. 1000.

The RPP consists of two studies:

1. The Reliability Needs Assessment (RNA). The NYISO performs a biennial study in which it evaluates the resource and transmission adequacy and transmission system security of the New York ~~bulk power system~~ BPTF over ~~a ten year~~ its Study Period, encompassing years 4 through 10 following the year in which the RNA is conducted. Through this evaluation, the NYISO identifies Reliability Needs in accordance with applicable Reliability Criteria. This report is reviewed by NYISO stakeholders and approved by the Board of Directors.

2. The Comprehensive Reliability Plan (CRP). After the RNA is complete, the NYISO requests the submission of market-based solutions to satisfy the Reliability Needs. The NYISO also identifies a Responsible TO and requests that the TO submit a regulated backstop solution and that any interested entities submit alternative regulated solutions to address the identified Reliability Needs. The NYISO evaluates the viability and sufficiency of the proposed solutions to satisfy the identified Reliability Needs and evaluates and selects the more efficient or cost-effective transmission solution to the identified need. In the event that market-based solutions do not materialize to meet a Reliability Need in a timely manner, the NYISO triggers regulated solution(s) to satisfy the need. The NYISO develops the CRP for

[1] See the *Reliability Planning Process Manual*, which is located in the Manuals>Planning folder on the NYISO Manuals, Technical Bulletins & Guides Web site: https://www.nyiso.com/manuals-tech-bulletins-user-guides.

itsthe ten-year Study Period that sets forth its findings regarding the proposed solutions. The CRP is reviewed by NYISO stakeholders and approved by the Board of Directors.

The Short-Term Reliability Process (STRP) uses quarterly Short-Term Assessment of Reliability (STAR) studies to assess the reliability impacts of Generator deactivations on both Bulk Power Transmission Facilities (BPTF) and non-BPTF (local) transmission facilities, in coordination with the Responsible Transmission Owner(s). The STAR is also used by the NYISO, in coordination with the Responsible Transmission Owner(s), to assess the reliability impacts on the BPTF of system changes that are not related to a Generator deactivation. These changes may include adjustments to load forecasts, delays in completion of planned upgrades, long duration transmission facility outages and other system topology changes. Section 38 of the NYISO OATT describes the process by which the NYISO, Transmission Owners, Market Participants, Generator Owners, Developers and other interested parties follow to plan to meet Generator Deactivation Reliability Needs affecting the New York State Transmission System and other Reliability Needs affecting the BPTF (collectively, Short-Term Reliability Needs).

Each STAR will assess a five-year period, with a particular focus on Short-Term Reliability Process Needs ("needs") that are expected to arise in the first three years of the study period. The STRP is the sole venue for addressing Generator Deactivation Reliability Needs on the non-BPTF, and for BPTF needs that arise in the first three years of the assessment period. With one exception[2], needs that arise in years four or five of the assessment period may be addressed in either the STRP or longer-term Reliability Planning Process (RPP).

Each STAR looks out five years from its STAR Start Date. The STRP concludes if a STAR does not identify a need or if the NYISO determines that all identified needs will be addressed in the RPP. Should a STAR identify a need to be addressed in the STRP, the NYISO would request the submission of market-based solutions to satisfy the need along with a Responsible Transmission Owner STRP solution. The NYISO evaluates the viability and sufficiency of the proposed solutions to satisfy the identified needs and selects a solution to address the need. The NYISO reviews the results of the solution or combination of solutions (including an explanation regarding the solution that is selected) with stakeholders and posts a Short-Term Reliability Process Report detailing the determination with stakeholders.

[2] Generator Deactivation Reliability Needs that arise on local facilities, not on the BPTF, must always be addressed in the STRP.

The third component of the CSPP is ~~CARIS,~~ the ~~e~~Economic ~~p~~Planning ~~p~~Process, which consists of three study processes:

1. The System & Resource Outlook ("The Outlook") is a biennial report by which the NYISO summarizes the current assessments, evaluations, and plans in the biennial Comprehensive System Planning Process; produces a twenty-year projection of congestion on the New York State Transmission System; identifies, ranks, and groups congested elements; and assesses the potential benefits of addressing the identified congestion. This report is reviewed by NYISO stakeholders and approved by the Board of Directors.

2. If a Developer proposes a Regulated Economic Transmission Project to address constraints on the BPTFs identified in the Economic Planning Process, the NYISO will perform an Economic Transmission Project Evaluation (ETPE) of the proposed Regulated Economic Transmission Project Regulated Economic Transmission Projects to determine the project's initial eligibility for cost allocation and recovery under the ISO OATT and to identify the beneficiaries that would be allocated the cost of the project. The beneficiaries must approve the project's selection for cost allocation and recovery purposes in accordance with the voting requirements in the ISO OATT.

3. Market Participants and other interested parties may also request that the NYISO perform a Requested Economic Planning Study at the requesting party's expense solely for information purposes, which scope and deliverables will be agreed upon by the NYISO and the requesting entity. ~~described in this Manual.~~

The requirements of the EPP are described in this Manual and Attachment Y of the OATT.

~~is based on the NYISO's CRP, which is produced as part of the RPP. CARIS is conducted in a two phased approach. CARIS Phase 1 examines congestion on the New York bulk power system, and the costs and benefits of generic alternatives to alleviate that congestion. CARIS Phase 2 is the study in which the NYISO evaluates specific transmission project proposals that are submitted under Section 31.3.2.4 of Attachment Y of the NYISO OATT for regulated cost recovery.~~

The fourth component of the CSPP is the Public Policy Transmission Planning Process (PPTPP) ~~which is~~

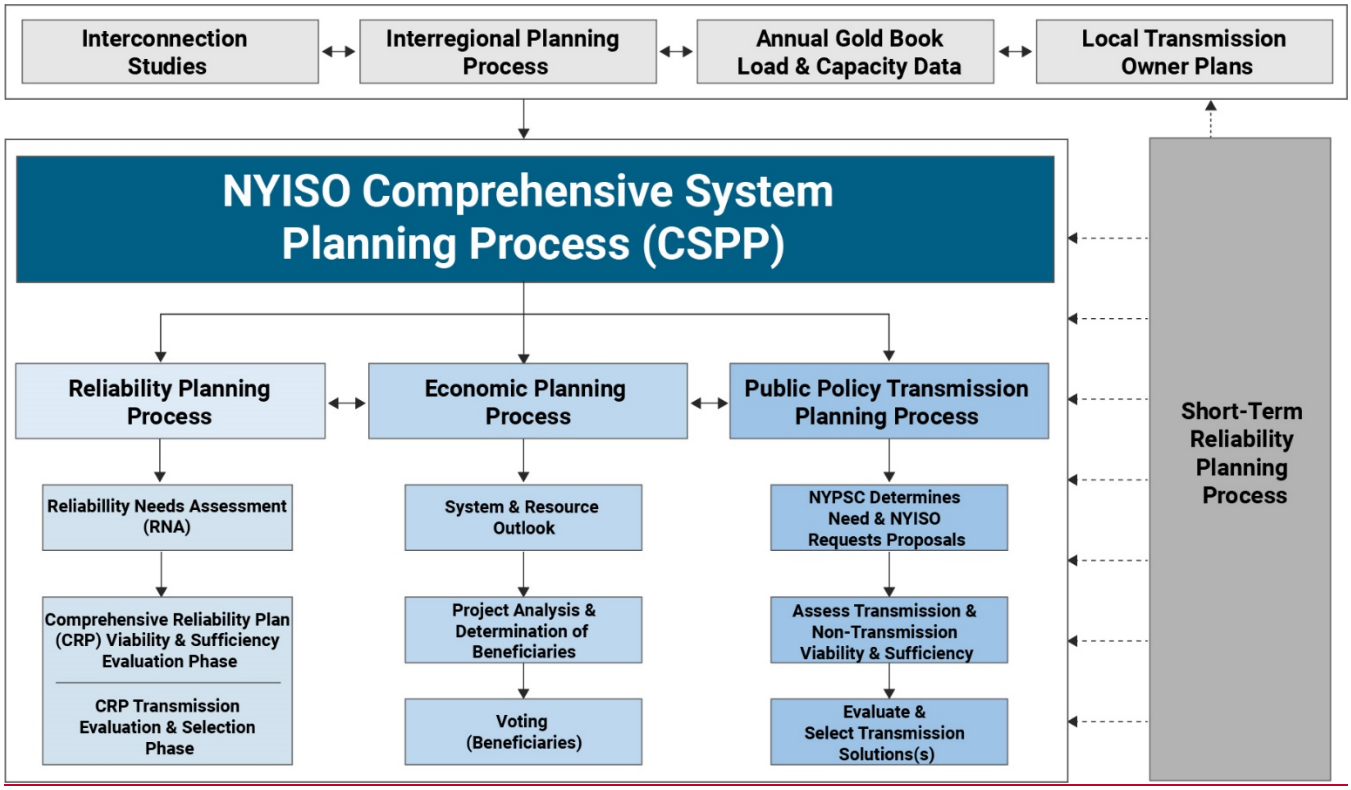
~~described in detail in the public policy transmission planning ("PPTP") manual[3] and Attachment Y to the OATT~~. Under this process interested entities propose, and the New York State Public Service Commission (NYPSC) ~~and New York State Department of Public Service (NYDPS)~~ identifi~~es~~y, transmission needs driven by Public Policy Requirements. The NYISO then requests that interested entities submit proposed solutions to the identified Public Policy Transmission Need. The NYISO evaluates the viability and sufficiency of the proposed solutions to satisfy the identified Public Policy Transmission Need. The NYISO then evaluates and may select the more efficient or cost-effective transmission solution to the identified need. The NYISO develops the Public Policy Transmission Planning Report that sets forth its findings regarding the proposed solutions. This report is reviewed by NYISO stakeholders and approved by the Board of Directors. The requirements of the PPTPP are described in the Public Policy Transmission Planning Manual[4] and Attachment Y of the OATT.

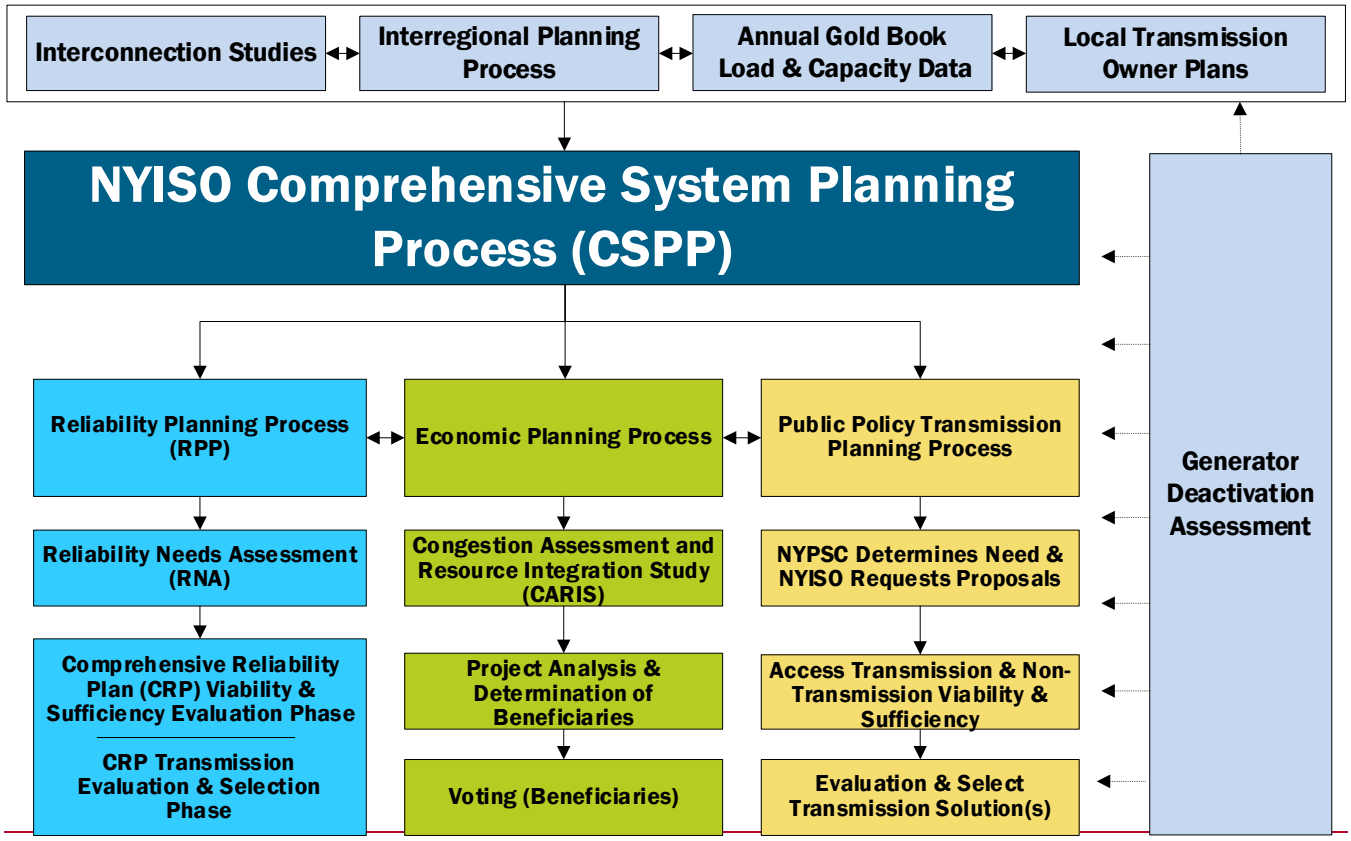
In concert with these four components, interregional planning is conducted with NYISO's neighboring control areas in the United States and Canada under the Northeastern ISO/RTO Planning Coordination Protocol. The NYISO participates in interregional planning and may consider Interregional Transmission Projects in its regional planning processes.

The NYISO CSPP is illustrated in Figure 1.

[3] See the *Public Policy Transmission Planning Process Manual* which is located in the Manuals>Planning folder on the NYISO Manuals, Technical Bulletins & Guides Web site: https://www.nyiso.com/manuals-tech-bulletins-user-guides.

**Figure 1: NYISO Comprehensive System Planning Process**






Unless otherwise defined in this document, capitalized terms used herein shall have the meanings ascribed to them in the NYISO OATT.

~~In concert with these four components of the CSPP, interregional planning is conducted with NYISO's neighboring control areas in the United States and Canada under the Northeastern ISO/RTO Planning Coordination Protocol. The NYISO participates in interregional planning and may consider Interregional Transmission Projects in its regional planning processes. The NYISO also conducts the Generator Deactivation Process as required by Attachment FF to the OATT in order to ensure the reliability of the system is maintained. The NYISO conducts this process to assess the reliability impacts of the loss of a generator due to its notice of retirement or mothball or the generator being placed into the ICAP Ineligible Forced Outage state. Any Generator Deactivation Reliability Need identified by this assessment will be addressed through the Generator Deactivation Process.~~

## 1.2. The Economic Planning Process (EPP)

### 1.2.1. Overview of the EPP

The NYISO's EPP was first developed in 2007 in response to FERC Order No. 890 as a biennial complement to the NYISO's established ~~r~~Reliability ~~p~~Planning ~~p~~Process. The ~~e~~Economic ~~p~~Planning

~~p~~Process is consistent with the core principles identified in Order No~~s~~. 890 and 1000~~, specifically, stakeholder participation, transparency and clear cost allocation rules~~. The ~~e~~Economic ~~p~~Planning ~~p~~Process is also consistent with the NYISO's market-based philosophy in providing resource neutral information to all stakeholders and interested parties to aid in ~~making~~ informed decision makings ~~that considers all resource types as solutions to an identified need.~~ The ~~e~~Economic ~~p~~Planning~~CARIS~~ ~~p~~Process encourages stakeholders' voluntary participation and ~~,~~ provides open and transparent information ~~on historic and~~concerning ~~projected congestion to~~congestion to facilitate the development of ~~market-based~~ solutions to reduce congestion. The process also allows for a qualified Developer to propose a Regulated ~~e~~Economic ~~t~~Transmission ~~p~~Project to seek to allocate and recover the project costs through ~~regulated funded through Rate Schedule 10 of~~ the OATT, but it does not mandate the construction or funding of Regulated ~~e~~Economic ~~related~~ ~~t~~Transmission ~~p~~Projects. The NYISO's role is to serve as a neutral provider of information and analyses to aid in the development of ~~regarding~~ potential projects to address~~remedies to~~ congestion in response to Market Participants' requests. Market Participants can use this information to determine whether they want to propose a Regulated Economic Transmission Project~~come forward with an economic proposal~~. In the event that a New York Transmission Owner or ~~d~~Developer proposes~~comes forward with a~~n Regulated ~~e~~Economic ~~t~~Transmission Project proposal, the EPP~~process~~ provides a process pursuant to~~methodology under~~ which the NYISO would determine the project's initial eligibility for cost allocation and recovery under its OATT, and for the identification of the beneficiaries ~~who~~ that would be allocated the costs of the project and that must approve the project's selection for cost allocation and recovery purposes in accordance with the voting requirements set forth in the OATT.

#### 1.2.2. ~~CARIS Phase 1~~System & Resource Outlook

The EPP requires that the NYISO biennially perform a ~~Congestion Assessment and Resource Integration Study ("CARIS")~~System & Resource Outlook in alignment with ~~the CSPP schedule following the issuance of the CRP~~the Reliability Planning Process. The NYISO actively engages with the ESPWG in vetting the ~~CARIS~~ System & Resource Outlook assumptions, methodologies and results. The NYISO's stakeholder committees must review the ~~CARIS~~ System & Resource Outlook before it is forwarded to the NYISO's Board of Directors for approval.

The ~~CARIS~~ System & Resource Outlook uses a 20-year planning horizon ~~the same 10-year planning horizon as the most recently conducted RNA~~ and assumes a reliable system throughout, as applicable, the most recent 10-year study period evaluated by the Reliability Planning Process or 5-year study period evaluated under the Short-Term Reliability Process. ~~The base case system for the CARIS will first incorporate sufficient and viable market-based solutions and then, if necessary, reliability backstop~~

~~solutions to meet identified Reliability Needs. As part of the CARIS Phase 1 study the NYISO will conduct benefit/cost analysis of generic solutions to address the identified congestion using all resource types (i.e., transmission, generation, energy efficiency and demand response) on a comparable basis.~~ As part of the ~~CARIS Phase 1~~System & Resource Outlook, the NYISO assesses system congestion~~develops estimates of historic and projected system congestion~~ on the New York State Transmission System over the 20 year Study Period for the Economic Planning Process using the metrics set forth in the NYISO OATT, along with assessing the impact on projected congestion and other metrics of various scenarios (e.g. public policy goals) and sensitivities (e.g., higher fuel costs). The NYISO also ~~and~~ conducts a~~n initial cost~~-benefit analysis ~~of each potential solution identified to~~ address~~ing identified~~ system congestion. This includes the NYISO's calculation of an energy deliverability metric, using the base case and/or scenarios. Energy deliverability quantifies the impact that transmission constraints have on the ability for generators to inject energy into the transmission system. Among other things, the metric may be used to identify renewable energy pockets on the transmission system for publication in the System & Resource Outlook report.

The NYISO also develops for the Outlook a summary of the current assessments, evaluations, and plans in the biennial CSPP and the information sources relied upon by the NYISO. Based on ~~these analyses~~these data, analyses, and findings, ~~from~~ the System & Resource Outlook , ~~the CARIS~~ provides ~~-~~ stakeholders ~~are provided~~ with a wide range of information to assist ~~them~~ in making informed decisions, including identifying and developing ~~actual solutions~~projects to address transmission congestion.

#### 1.2.3. ~~CARIS Phase 2~~Economic Transmission Project Evaluation (ETPE)

If~~, in response to the CARIS Phase 1 study~~ a Developer proposes a Regulated Economic Transmission Project to address constraints on the BPTFs identified in the Economic Planning Process~~, a developer proposes an actual project to mitigate identified congestion~~, the NYISO will process that project proposal in an Economic Transmission Project Evaluation in accordance with the beneficiary-based cost allocation principles and methodology described below.

The proposed cost allocation mechanism is based on a "beneficiaries pay" approach. Beneficiaries are those entities that economically benefit from the project, and the cost allocation among them will be based upon their relative economic benefit. While the initial eligibility for regulated cost recovery for a Regulated Economic Transmission Project will be determined on the basis of a NYCA-wide production cost benefit, the beneficiary determination will be based upon the Load Serving Entities' relative Locational Based Marginal Pricing ("LBMP") load savings. Both production cost benefits and LBMP load savings will be measured over the first ten years of the proposed project's life. The NYISO analysis of beneficiaries will provide information, where appropriate, regarding future uncertainties (e.g., load forecasts, fuel prices,

environmental regulation) and potential benefits (e.g., system operation, environmental effects, and renewable integration).

A Regulated Economic Transmission Project will only be eligible for~~The proposed~~ cost allocation and recovery under the OATT ~~mechanism will apply only~~ if a super majority of a project's beneficiaries agree that an economic project should proceed. The super-majority required to proceed equals 80% of the beneficiaries associated with the project present at the time of the vote. If the proposed project meets the required vote in favor of implementing the project, and the project is implemented, all designated beneficiaries, including those not voting to implement the project will pay their allocated share of the cost of the project.

#### 1.2.4. ~~Other CARIS Studies~~Requested Economic Planning Study (REPS)

The EPP also provides for individual Market Participants or other interested parties to request that the NYISO perform ~~congestion and resource integration~~ a Requested Economic Planning Study separate from and in addition to the System & Resource Outlook. The NYISO uses the most recently approved planning database and agreed upon assumptions to perform the study. ~~studies (~~ The requesting party will be responsible for the ~~All~~ actual costs incurred by the NYISO in performing the Requested Economic Planning Study~~with the costs to~~will ~~be paid for by the requesting party)~~.

#### 1.2.5. Study Replication

An~~The EPP also provides for~~ individual Market Participants or other interested parties may also ~~to~~ request that the NYISO replicate the ~~CARIS Phase 1 or CARIS Phase 2~~System & Resource Outlook or Economic Transmission Project Evaluation studies (with the study costs to be paid for by the requesting party).

# 2. ~~CARIS PHASE 1~~System & Resource Outlook ("Outlook")

In the System & Resource Outlook the NYISO will perform a study and prepare and publish a report to: (1) summarize the current assessments, evaluations, and plans in the biennial Comprehensive System Planning Process and the information and sources relied upon by the NYISO; (2) project congestion on the New York State Transmission System and system conditions over a twenty-year Study Period; (3) identify, rank, and group the congested elements on the New York State Transmission System based on metrics set forth in Sections 31.3.1.3.4 and 31.3.1.3.5 of Attachment Y of the ISO OATT; and (4) assess the potential benefits of addressing the identified congestion.

The NYISO will develop the scope of the Outlook in accordance with the tariff, in consultation with the Electric System Planning Working Group (ESPWG) and Transmission Planning Advisory Subcommittee (TPAS) to incorporate inputs from Market Participants and other interested parties.

~~In CARIS Phase 1, the NYISO, in collaboration with its stakeholders and other interested parties, develops a ten-year projection of congestion and together with historic congestion identifies, ranks, and groups the most congested elements on the New York bulk power system. For the top three congested elements or groupings, studies are performed which include: (a) the development of three types of generic solutions to mitigate the identified congestion; (b) a benefit/cost assessment of each solution based on projected NYCA-wide production cost savings and estimated project costs; and (c) presentation of additional metrics for informational purposes. The four types of generic solutions are transmission, generation, energy efficiency and demand response. Scenario analyses are also performed to help identify factors that increase, decrease or produce congestion in the CARIS base case.~~

~~Historic congestion values are calculated using demand congestion data extracted from the NYISO day-ahead market results. Projected congestion, production cost and other metrics are developed utilizing GE-MAPS, an industry-standard, production cost simulation tool that models a four-pool system, NYISO, PJM, IESO and ISO-NE.~~

## 2.1. ~~Base Case Development~~Reference Case Development

The first step in the EPP is the development of a set of ~~the~~ ~~Base Case~~reference cases for the GE-MAPS production cost model. This will entail the benchmarking of the model utilizing historic actual data and the development of model inputs such as fuel and emission forecasts for the twenty~~en~~-year ~~s~~Study ~~p~~Period.

Of the reference cases developed in this process,~~The NYISO will develop a~~ the NYISO will use ~~the base reference~~ case for its ~~will be used for use~~ performance of its analysis for the Outlook and will serve as the model for the evaluation and consideration of any Regulated Economic Transmission Projects in the

Economic Planning Process. In addition to this base case, the NYISO may develop additional reference cases for informational purposes, including a contract case and a policy case. These additional reference cases may be established to provide insights based on different assumptions, such as the impact of renewable procurements and policy drivers. The creation of each reference case will include the development of a GE-MAPS production cost model for each case.

For each planning cycle for the Outlook, the NYISO will discuss the development of the reference case(s) for that cycle with stakeholders at the ESPWG, including the development of any reference cases in addition to the base case. During the development of the reference case models, Market Participants, Developers, and other parties shall provide, in accordance with the schedule set forth in the ISO Procedures, the data necessary to establish the proper modelling assumptions.

### 2.1.1. Study Period

Per Section 31.3.1.3.1 of the ISO OATT, the Study Period for the Economic Planning Process shall be twenty years, with year one being the first year or the second year of the current biennial Comprehensive System Planning Process, as determined by the NYISO in consultation with stakeholders.

### 2.1.2. Benchmarking of the Production Cost Model

The NYISO will commence the Outlook process by benchmarking the NYISO's most recent production cost model against a single year of historic actual data. The NYISO will benchmark the production cost model for the most recent historic year in which data is available. The NYISO will compare select production cost simulation metrics against the NYISO system's actual performance, adjust the model to improve performance, and present the benchmark results to stakeholders at the ESPWG.

### 2.1.3. Base Case

~~The NYISO will develop~~ The NYISO will develop the base case using the assumptions and process ~~in accordance with the process~~ described in this section and present to stakeholders for review and discussion. The assumptions ~~for the study model can be identified in~~fall into two categories: 1) reliability assumptions concerning~~as related to~~ security and adequacy; and 2) economic assumptions, such as fuel price and demand forecast.

#### 2.1.3.1. Reliability Assumptions for the Base Case

The NYISO will develop the assumptions related to reliability for the Outlook base case consistent with the case from the most recent Reliability Planning Process or Short Term Reliability Process, and updated

according to base case inclusion rules in Section 3.2 of the Reliability Planning Process Manual. The ~~R~~reliability assumptions generally concern either~~can be generally analyzed in two concepts,~~ resource adequacy or~~and~~ transmission security:

- The NYISO will use ~~A~~assumptions related to resource adequacy, such as transmission topology, consistent with those used in the Reliability Planning Process and Short Term Reliability Process~~, and updated according to NYISO process and procedures~~. Specifically, resource and facility addition and deactivation assumptions will follow the principles below:
    - Resource and Facility Additions: All new projects that meet the base case inclusion rules in Section 3.2 of the Reliability Planning Process Manual at the time of finalizing the System and Resource Outlook base case will be included in the base case pursuant to their proposed in-service dates.
    - Generation Deactivations~~Retirements:~~ The NYISO will develop the base case for the Outlook using the most recent Reliability Planning Process and Short Term Reliability Process, as updated according to base case inclusion rules in Section 3.2 of the Reliability Planning Process Manual except for the following conditions:
        - If a Generator Owner submitted a completed Generator Deactivation Notice to the NYISO and the study assessment is still underway prior to the base case database lockdown date, the base case will retain the unit. If the Short-Term Assessment of Reliability study assessment found no reliability needs, the unit will be deactivated as requested.
        - If a Generator is operating in accordance with an RMR agreement or RSSA, the Economic Planning base case will retain the unit until a permanent solution is in place to resolve reliability needs.

~~The NYISO will develop the base case in accordance with the reliability and economic assumptions described in this section and present to stakeholders for review and discussion.~~

- The NYISO will use a~~A~~ssumptions related to transmission security, such as transmission network model and interface limits, consistent with Reliability Planning Process and market and grid operation practices, as~~nd~~ expanded to include monitored constraints and contingency pairs either observed in historical market operation~~,~~ or identified in planning and operation studies. In addition, the NYISO will coordinate~~s~~ with the Transmission Owners to incorporate

the Transmission Owners' Local Transmission Owner Plans and model the non-BPTF portion of the New York State Transmission System.

#### 2.1.3.2. Treatment of Reliability Needs in Base Case

The Study Period for the Economic Planning Process is 20 years. This Study Period is~~, which is and~~ greater than the Study Period for both the Reliability Planning Process and Short-Term Reliability Processes, which evaluate 10 years and 5 years, respectively. The base case for the Outlook will assume a reliable system throughout the Study Period covered by the most recent Reliability Planning Process or Short-Term Reliability Process. If any reliability needs in the Study Period for~~in~~ the Reliability Planning Process or Short-Term Reliability Process (*i.e.,* a Reliability Need identified in the Reliability Planning Process or a Short-Term Reliability Process Need identified in the Short-Term Reliability Process) remain unresolved at the time the Outlook is conducted, the base case for the Outlook will incorporate sufficient compensatory MW to resolve those needs for the Reliability Planning Process or Short-Term Reliability Process Study Period. The NYISO will start with the most recently approved base cases from the Reliability Planning Process orShort-Term Reliability Process and update~~d~~ it in according to base case inclusion rules in Section 3.2 of the Reliability Planning Process Manual if necessary.

The NYISO does not assess reliability needs or compensatory MW for the remainder of the Economic Planning Process Study Period. However, if resource shortage is anticipated in the Economic Planning Process Study Period-, the NYISO may adjust load and resources in the remainder of the Economic Planning Process Study Period in the base case and/or scenarios, and will review the adjustment with stakeholders.

In the event that a reliability need is identified in the most recent Reliability Planning Process or Short-Term Reliability Process, the NYISO will include in the base case market-based solutions ("MBS"), regulated solutions, and/or generic generation capacity, in the order listed, to resolve the identified needs. Generic generators will be modeled using representative data provided in the most recent NYISO Installed Capacity Demand Curve report.

The four possible outcomes that may result from the Reliability Planning Process or Short-Term Reliability Process are as follows:

- More than sufficient MBS to meet any identified reliability needs;
- Sufficient MBS to meet any identified reliability needs;
- Insufficient MBS to meet any identified reliability needs; or
- No reliability needs identified through the applicable 5-year or 10-yearreliability Study Period

or the NYISO determined not to solicit a solution in the most recently completed reliability study process

The NYISO will use the following methodologies to address each of the four possible outcomes:

1. More Than Sufficient MBS to meet any identified reliability needs:

- The NYISO will consider all viable MBS resources from the current Reliability Planning Process or Short-Term Reliability Process for inclusion in the base case, unless the NYISO determines, based upon updated information, that such resource is no longer viable.
- The NYISO will "scale back" MBS resources to a level which is the minimum to meet the reliability need (i.e. to achieve a statewide LOLE of 0.1) by the following methodology:
  - The NYISO will sort all MBS by size—from largest to smallest—regardless of resource type.
  - The NYISO will sequentially test each MBS, one at a time for potential removal, starting from the largest and ending with the smallest.
  - The NYISO will remove an MBS from the base case if:
    - There is a surplus in the actual locational reserve and the removal of the resource would not result in the locational reserve falling below the LCR.
    - If the starting point is below a LCR, MBS resources will not be added to meet that LCR. However, MBS resources will not be removed that causes the locational reserve to fall to even lower levels.
    - Statewide LOLE requirement is still met.
    - Any minimum requirements for a specific interconnection point for MBS resources identified in the Reliability Planning Process or Short-Term Reliability Process to maintain transmission security requirements is met
  - If either the Statewide LOLE or the LCR requirement is not met with the removal of a specific unit, then that unit is retained in the base case, and the removal of the next unit is tested
  - If both the Statewide LOLE and the LCR requirements are met with the removal of a unit, that unit is removed from the base case, and subsequent units will be tested sequentially in the same manner
  - The initial determination will be made for the horizon year (e.g. – year 10) of the analysis.

- Considering each project's in-service date, the NYISO will verify each year of the study period to assure that both the Statewide LOLE and the LCR reliability criteria will be met (subject to the caveat that resources will not be added to achieve an LCR that is not met at the starting point).
  - If more resources are needed, the NYISO will add back resources starting with the smallest resource removed and adding each next largest resource until the above requirements are met.
- The NYISO will determine the minimum amount of MBS capacity needed to meet both the LCR and the statewide LOLE requirements.

2. Sufficient MBS to meet any identified reliability needs and no regulated solution is required:
   - In the case that there are sufficient MBS to just meet the statewide LOLE of 0.1, the NYISO will include in the base case all of the MBS resources consistent with the current Reliability Planning Process or Short-Term Reliability Process.
   - The NYISO will make this determination based on whether the removal of any single MBS will cause the statewide LOLE to exceed 0.1.
3. Insufficient MBS to meet any identified reliability needs ~~&~~and regulated ~~S~~solutions are r~~R~~equired:
   - In this situation, the NYISO will include in the base case the combination of MBS resource(s) and regulated solutions [selected by the ISO in the most recent Reliability Planning Process or Short-Term Reliability Process] (whether or not yet triggered) as necessary for a reliable system over the applicable 10-year or 5-year planning horizon.
4. No Reliability Needs or NYISO Elects Not to Solicit Solution in Planning Process:
   - If the current Reliability Planning Process or Short-Term Reliability Process finds no reliability needs throughout the applicable 10-year or 5-year study period or the NYISO determined not to solicit a solution in the most recently completed reliability study process, the NYISO will include in the base case all resources included in the current Reliability Planning Process or Short-Term Reliability Process base case, unless the NYISO determines, based upon updated information, that such resource is no longer viable.

#### 2.1.3.3. Economic Assumptions for the Base Case

The economic assumptions for the base case will be developed based on publicly available data, and may be calibrated by incorporate Market Participant confidential data to improve the database accuracy.

The economic assumptions include, but not limited to, the following categories:

- Load & Energy Forecasts: Forecasts for New York Control Area will be consistent with the most recent NYISO issued Load and Capacity Data Report.

- Fuel Forecast: Regional natural gas price forecast will be based on recently published national annual forecasts with regional and weekly adjustments applied.

- External area assumptions: assumptions such as demand, energy, resource addition and retirement of neighboring control area will be based on recent publicly available data, such as the interconnection queues, or results from the forward capacity market auctions

- Carbon Policies/Emission Forecast: The allowance price forecasts will be consistent with the projected environmental program compliance costs attributed to current state or federal regulations, such as $CO_2$ emissions reduction program (e.g., Regional Greenhouse Gas Initiative, Massachusetts, and Ontario compliance costs), and $SO_2$ and $NO_X$ emission reduction programs (e.g., CSAPR markets).

~~**2.1.1. Inclusion of Market-Based Solutions and Regulated Backstop Solutions**~~

~~The inclusion of market-based solutions (MBS) and regulated backstop solutions (RBS) in the CARIS base case, and the scaling back of MBS is governed by Section 31.3.1.3.2 in Attachment Y to the OATT.~~

~~***Possible Outcomes***~~

~~There are four possible outcomes that may result from the RPP process:~~

- ~~More than sufficient MBS to meet any identified Reliability Needs~~
- ~~Sufficient MBS to meet any identified Reliability Needs~~
- ~~Insufficient MBS to meet any identified Reliability Needs~~
- ~~RNA/CRP finds no Reliability Needs through the 10-year study period~~

~~***Methodology:***~~

~~The intent of this procedure is to produce a CARIS base case that is unbiased by resource type or in the selection or location of particular resources. The NYISO will implement this procedure for each CARIS cycle, in collaboration with stakeholders through the ESPWG.~~

***Base Case Assumptions:***

- In all cases, the base case resource additions (including updated LTPs, if any) included in the current CRP shall be included in the CARIS base case—unless NYISO determines, based upon available information, that such resource is no longer viable.
- All new projects that meet the base case inclusion rules in Section 3.1 of the Reliability Planning Process Manual at the time of finalizing the CARIS base case, shall be included in the base case pursuant to their proposed in-service dates.
- Any regulated solution that has been selected and triggered in accordance with the NYISO's Tariff shall be included in the CARIS base case.
- A gap solution that has previously been triggered shall be considered for inclusion in the CARIS base case consistent with the type and duration of that solution.
- If any such resource that was previously included in the CRP is determined by the NYISO to be no longer viable, the NYISO shall re-analyze the viable MBS solutions to determine whether they remain sufficient to meet the statewide LOLE of 0.1 throughout the study period
- The Statewide and LCR requirements shall be held constant over the ten-year Study Period
- Resources modeled in the CARIS base case are not evaluated as potential economic solutions
- Resources selected for inclusion in the CARIS base case under these assumptions shall not change during subsequent scaling of resources
    - Scenarios may be developed to include a resource mix that differs from the base case, but still meets applicable reliability criteria

***More Than Sufficient MBS***

- All viable MBS resources from the current CRP shall be considered for inclusion in the CARIS base case—unless the NYISO determines, based upon updated information, that such resource is no longer viable
- MBS resources shall be "scaled back" to a level which is the minimum to meet the Reliability Need (i.e., to achieve a statewide LOLE of 0.1) by the following methodology:
    - Sort all MBS by size—from largest to smallest—regardless of resource type
    - Sequentially test each MBS, one at a time for potential removal, starting from the largest and ending with the smallest. Remove from the base case if:
        - There is a surplus in the actual locational reserve and removal would not result in the locational reserve falling below the LCR
        - If the starting point is below a LCR, resources will not be added to meet that LCR. However, resources will not be removed that cause the locational reserve to fall to even lower levels.
        - Statewide LOLE requirement is still met
        - Any minimum requirements for a specific interconnection point for resources identified in the CRP to maintain transmission security requirements is met
    - If either the Statewide LOLE or the LCR requirement is not met with the removal of a specific unit, then that unit is retained in the base case and the removal of the next unit is tested
    - If both the Statewide LOLE and the LCR requirements are met with the removal of a unit, that unit is removed from the base case and subsequent units will be tested sequentially in the same manner

- The initial determination will be made for the horizon year (e.g. – year 10) of the analysis
- Considering each project's in-service date, verify each year of the study period to assure that both the Statewide LOLE and the LCR reliability criteria will be met (subject to the caveat that resources will not be added to achieve an LCR that is not met at the starting point).
  - If more resources are needed, add back starting with the smallest resource removed and increment to the next largest until the above requirements are met
- Determine the minimum amount of MBS capacity needed to meet both the LCR and the statewide LOLE requirements

***Sufficient MBS***

- In the case that there are sufficient MBS to just meet the statewide LOLE of 0.1, all of the MBS contained in the current CRP will be included in the CARIS base case
- This situation will be determined if the removal of any single MBS will cause the statewide LOLE to exceed 0.1

***MBS & Regulated Solutions Required***

- In this situation, the combination of MBS and regulated solutions (whether or not yet triggered) designated in the current CRP as necessary for a reliable system over the 10-year planning horizon shall be included in the CARIS base case.

***No Reliability Needs***

- If the current RNA finds no reliability needs throughout the 10-year study period, the CARIS base case shall include all resources included in the current RNA base case—unless the NYISO determines, based upon updated information, that such resource is no longer viable.

#### 2.1.2. Post-CRP Reliability Issues

Given that the CARIS requires a reliable system to be in place through the Phase 1 study period[5], there may be bulk or local reliability needs that are identified in the CARIS process that were not identified in the RNA or CRP, for example, due to updated load forecasts or newly-submitted retirement or mothball notices.

In these circumstances the NYISO will evaluate and review with the ESPWG the appropriate resource or resources to be included in the model to maintain reliability. This may entail the retention in the model of units which have submitted retirement or mothball notices, as well as the addition of generic units, transmission, and demand resources.

#### 2.1.3. Categorical Parameter Updates

The NYISO will update the CARIS production model database to reflect the most currently available

[5] The process to ensure a reliable system applies similarly throughout the CARIS Phase 2 study period.

~~data, including, but not limited to:~~

- ~~The NYISO will update a number of inputs based on the most recent NYISO Load and Capacity Data report for the New York Control Area: peak load forecast, energy forecast, generating units (accounting for additions and retirements), and generating unit capacities. The NYISO will also develop and review with ESPWG updated fuel and emissions price forecasts for both the NYCA and the neighboring control areas (i.e., PJM, IESO and ISO-NE) as appropriate.~~
- ~~The NYISO will also review the most recent data publicly available to update peak load and energy forecasts for PJM, IESO and ISO-NE. The NYISO will similarly update its models of its neighbors' systems to capture generator additions and retirements, and transmission system changes.~~

~~The NYISO will review its system model assumptions to verify that it is best capturing actual system operations to the extent feasible. Specific changes in modeling assumptions will be reviewed and discussed with the ESPWG.~~

~~Each of the key assumptions will be captured in the Assumptions Matrix (see Appendix A). The Assumptions Matrix will be reviewed and discussed with the ESPWG and modified as necessary to reflect any necessary changes or clarifications. The database will be locked down following the public posting of the NYISO Load and Capacity Data report for the current year.~~

#### ~~2.1.4. Benchmarking~~

~~In order to assess the performance of the production cost model, the NYISO will test the model on one or more historic years utilizing actual data to the extent feasible. The results of this benchmarking exercise will be reviewed and discussed with ESPWG including the rationale for any deviations between the modeled outputs and the historic actual. The benchmarking metrics will include demand congestion, zonal generation, inter-control flows, and LBMPs.~~

~~One key aspect of the benchmarking exercise is the tuning of the hurdle rates which are "cost adders" that capture economic and non-economic factors influencing inter-control transactions and flows. There are both commitment and dispatch hurdle rates for each of the interfaces modeled in the production cost simulation. Through the benchmarking process, starting with historical market transaction rates, the hurdle rates are iteratively adjusted as feasible in order to best align the modeled flows with the historical actual, real-time flows.~~

#### 2.1.4. Contract Case

If the Outlook includes the contract case, the NYISO will extend the inclusion rules for generation and transmission resources beyond what is assumed in the base case. This is intended to capture high probability projects that did not meet the base case inclusion rule requirements within the NYCA and in

directly neighboring systems. These projects typically have been selected through a procurement process and may have a financial contract in place. The reliability and economic assumptions for the contract case may be updated accordingly in coordination with NYISO stakeholders.

#### 2.1.5. Policy Case

If the Outlook includes the policy case, the NYISO will build off of the contract case assumptions and include additional assumptions pertaining to policies that impact the power system, electricity markets, and grid operations in New York. The reliability and economic assumptions for the policy case may be updated accordingly in coordination with NYISO stakeholders.

### 2.2. Scenario & Sensitivity ~~cenario~~ Development

The NYISO will, time permitting, identify additional scenarios and sensitivities to be simulated based on the reference case(s) in accordance with Section 31.3.1.5 of Attachment Y of the ISO OATT. The NYISO will work with stakeholders through ESPWG to identify potential sensitivities and/or scenarios and will determine which to perform based on stakeholder interest level and time requirements.

~~The NYISO will seek input from ESPWG on potential scenarios and develop a draft list of scenarios for further consideration by ESWPG. The list will be reviewed with ESPWG and finalized based on comments from ESPWG. The final list of scenarios should generally not exceed ten and will be modified at the NYISO's discretion subject to schedule and resource considerations.~~

~~Scenarios could include: high / low load forecasts; high / low fuel forecasts; high / low emission cost forecasts; changes in resource mixes due to generator retirements and regulatory mandates; and alternative resource mixes to meet reliability needs. The NYISO will modify the Base Case data and perform production cost analyses for each of the identified scenarios. It will report back to ESPWG with the results of the analysis, specifically the projected production cost and demand congestion, and be prepared to provide the rationale for the direction and magnitude of differences between the Base Case and scenario results.~~

### 2.3. Benefit Metrics for System & Resource Outlook Studies

The NYISO performs production cost simulations for the reference cases, scenarios, and sensitivities. Each simulation produces a set of ~~B~~benefit ~~M~~metrics that detail for stakeholders key information on the various outputs of the production cost model. These metrics can be utilized by stakeholders in estimating the potential benefits of projects across multiple dimensions, such as temporal, geographic, and scenarios.

The NYISO Tariff defines the system production cost as the primary metric in the ~~e~~Economic ~~p~~Planning ~~p~~Process and the metric is utilized in determining the benefit-cost ratios for a Regulated Economic Transmission Project. The NYISO calculates a "NYCA-wide" production cost to identify changes in system cost, which incorporates the total generation cost of producing power to serve NYCA load. The total production cost includes the following components:

1. Fuel cost (fuel consumption mmBtu multiplied by fuel cost $/mmBtu);
2. Variable O&M cost (VOM adder $/MWh);
3. Emission cost (emission allowance price multiplied by total allowance);
4. Start-up Costs (number of starts multiplied by start-up cost); and
5. NYCA Imports and Exports evaluated at the solution case proxy bus LBMP values.

When determining the present value of the NYCA-wide production cost over the Study Period, the calculation will be determined in accordance with the following formula:

$$Present\ Value_{Total} = \sum_{y=1}^{20} Present\ Value_{Year\ y}$$

The discount rate to be used for the present value analysis shall be the current after-tax weighted average cost of capital for the Transmission Owners.

Additional metrics are also calculated in the production cost simulation and ~~a~~represented for stakeholder information. These metrics, while they are not utilized in the benefit-cost ratio, do provide stakeholders with a wider view of the potential impacts of a project. Section 31.3.1.3.5 in Attachment Y to the OATT provides a detailed discussion of each of the additional metrics. The energy deliverability metric is described further in Section 2.7 below.

### ~~2.3.~~2.4. ~~Selection of CARIS Studies~~Historic & Future Transmission Congestion

As part of the System & Resource Outlook, the NYISO develops estimates of historic and projected transmission system congestion. Transmission congestion limits the economic transfer of energy between generation resources and demand, creates inefficient generation commitment and dispatch, causes generation curtailment, and increases the cost of electricity when lower variable cost resources cannot be delivered to consumers. It is important to understand and quantify existing system resources, the expected buildout of renewable generation to comply with State mandates, other generation resources, and, as a result, the past, existing, and projected transmission congestion patterns, including the identification of specific congested paths, impacting the New York Control Area.

The two metrics used to quantify the impact of specific congested transmission elements are demand congestion and constrained hour count. The demand congestion value of a transmission constraint represents the congestion component of the LBMP paid by NYCA load (sum of the total zonal loads) and is defined as the shadow price[6] of each constrained element multiplied by the load affected with consideration for zonal Generator Shift Factors (GSF). The formula used to calculate the demand congestion value of a transmission constraints is as follows:

$$\textbf{\textit{Constraint Demand Congestion}} = \sum_{Hour\ h}^{8760} \sum_{Zone\ i}^{Zone\ K} Shadow\ Price_{i,h} \times Zone\ GSF_{i,h} \times Zone\ Load_{i,h}$$

The constrained hour count metric represents the annual number of hours that a specific transmission constraint is active.

Historic actual transmission congestion metrics for constraints that were active in the NYISO's market are currently posted publicly on a quarterly basis to the NYISO website[7]. This data serves as the basis for the historic transmission congestion analysis. For the historic five year period, individual transmission constraints are compiled and reported in descending order according to their demand congestion value. The NYISO assesses and identifies transmission constraint groupings based on the individual rankings and proximity of congested elements.

Using the simulation results from each of the ~~R~~reference ~~C~~cases (~~B~~base~~line~~, ~~C~~contract, and ~~&~~ ~~P~~policy), the NYISO will compile, rank, and group the 20-year projected transmission constraints. Projected transmission congestion is then combined with congestion data from the historic analysis. The congested elements for the full twenty-five year period (both historic (5 years) and projected (20 years)) are ranked in descending order based on trends in the calculated present value of demand congestion for further assessment. The ranking is then adjusted to exclude any element when future system changes produce a significant declining trend in congestion over such congested element in later years of the study period. Likewise, elements with significant increasing trend in congestion could also be evaluated. ~~The discount rate to be used for the present value analysis is the current weighted average cost of capital for~~

[6] Shadow price is a term used in economic theory to describe the monetary value of goods or services that are difficult to calculate and lack a clear market signal. In power markets where optimization engines determine security constrained economic dispatch, shadow prices are defined for transmission constraints and represent the production cost savings achieved by relaxing the constraint limit by 1 MW. Shadow prices are an indicator of the economic impact that binding transmission constraints have on a power market. For the demand congestion metric, by multiply the shadow price by zonal GSF and zonal load, the economic impact of transmission constraints can be separated into the impact on specific NYISO zones.

[7] See https://www.nyiso.com/ny-power-system-information-outlook/ > Congested Elements Report

~~the New York Transmission Owners.~~

~~The NYISO, in conjunction with ESPWG, will select three congestion and resource integration studies to comprise each CARIS. The study selection criteria are governed by Section 31.3.1.2.2 in Attachment Y to the OATT.~~

~~NYISO shall assess and recommend groupings to ESPWG based on the individual rankings and proximity of congested elements. Selection of the three CARIS studies is a two-step process in which the top ranked constraints are identified and utilized for further assessment in order to identify potential for grouping of constraints. The resultant grouping of elements for each of the top ranked constraints is utilized to determine the three studies.~~

~~Step 1 of the process utilizes the historic and projected demand congestion value for each of the congested elements. The demand congestion value is calculated as the congestion component of the LBMP paid by NYCA load (sum of the total zonal loads). It is defined as the shadow price of each constrained element multiplied by the load affected.~~

~~In Step 1, the top three congested elements for the fifteen-year period (both historic (5 years) and projected (10 years)) are ranked in descending order based on the calculated present value of demand congestion for further assessment. (The discount rate to be used for the present value analysis shall be the current weighted average cost of capital for the NY Transmission Owners.) The top congested elements are then iteratively relieved independently by relaxing their limits. This is to determine if any of the congested elements need to be grouped with other elements, depending on whether new elements appear as limiting with significant congestion when a primary element is relieved.~~

~~Step 2 of the process utilizes the change in the production cost value, or production cost savings, that is attributable to the constraint or group of constraints being relieved. NYCA production cost is the total generation cost of producing power to serve NYCA load. The total cost includes the following components:~~

1. ~~Fuel cost (fuel consumption mmBtu multiplied by fuel cost $/mmBtu);~~
2. ~~Variable O&M cost (VOM adder $/MWh);~~
3. ~~Emission cost (emission allowance price multiplied by total allowance);~~
4. ~~Start-up Costs (number of starts multiplied by start-up cost); and~~
5. ~~NYCA Imports and Exports evaluated at the solution case proxy bus LBMP values.~~

~~The assessed element groupings are then ranked based upon the highest change in production cost as shown with the top 3 groupings selected to be studied.~~

~~Note that, if future system changes (e.g., generation, transmission, energy efficiency or demand side~~

additions) produce a significant declining trend in congestion over an identified congested element in later years of the study period, such element shall be excluded from the rankings.

The NYISO shall perform these computations for each CARIS Phase 1 study and review them with ESPWG.

### 2.4. Potential Generic Solutions

The next step in the CARIS Phase 1 process is to identify the specific solutions that will be studied for each of the three congested transmission elements. These solutions are then integrated into the production cost models, and the models are re-run.

The procedures for developing potential generic solutions are governed by Sections 31.3.1.3.3 and 31.3.1.4 in Attachment Y to the OATT.

#### 2.4.1. Determining Potential Generic Solutions

The NYISO will develop with ESPWG specific project criteria for each resource type (generation, transmission, and demand response, and energy efficiency) including block size and construction assumptions. Following the identification of the three studies, each resource type shall be applied in year one of the planning horizon, in sufficient quantities of generic block sizes associated with each resource type and specific locations to alleviate a substantial and comparable portion of the identified congestion over the planning horizon.

One potential generic solution will be determined by NYISO for each resource type (generation, transmission, and demand response (DR), and energy efficiency (EE)) for each of the three congestion studies. The NYISO will collaborate with the ESPWG to identify the most appropriate sizing of each solution to ensure that the solutions are evaluated on a comparable basis.

The NYISO will determine the transmission solutions for each of the studies based on its engineering judgment and in consultation with the appropriate transmission owners. The specific generation solutions will be developed based on relevant publicly available data such as engineering and cost data developed as part of the NYISO ICAP Demand Curve Reset process. These studies will inform the selection of the generic unit whose specific unit characteristics will be modeled in the production cost simulations. To determine the appropriate sizing or quantity of generic units to be sited, the NYISO will report to the ESPWG on the impact on demand congestion reduction, production cost savings and MWs (either the unit size or increase in transfer limitations across the constraint) for various unit sizes. These comparisons will inform the decision on the sizing of the generator solutions to ensure comparability with the transmission solution.

The DR) and EE solutions will be sized in total to be equivalent to the increase in transfer capability achieved with the transmission solution. DR and EE will be assigned on a zonal basis in block sizes of no greater than 200 MW of peak load reduction. In order to maintain reasonableness, the quantity of MWs of demand response and energy efficiency will be limited to the lesser of 200 MWs or 5% of the zonal peak load. The DR and EE solutions will be assigned first to the zone immediately downstream of the congested element. To the extent that the total MWs for the solution exceeds the size % limitation, the residual MWs will be assigned to zones further downstream. The energy efficiency solution will be reflected with a reduced zonal load forecast based on the peak MWs reduced and the zonal load shape; the demand response solution will be reflected with a reduced zonal load forecast for the 100 peak zonal hours.

Based on these analyses, the NYISO will then recommend to the ESPWG the MW block size of generation, transmission, DR, and EE capacity needed for each of the three congestion studies.

#### 2.4.2. Cost Data for Potential Solutions

The NYISO will provide recommended order of magnitude costs for each resource type. The costs will be developed for relevant geographic locations during each CARIS cycle. The order of magnitude costs will be provided to the ESPWG for their review and acceptance during each CARIS cycle as part of the Assumption Matrix approval process. The NYISO will utilize typical MW block size generic solutions and a standard set of assumptions in developing the costs for each resource type. The cost matrix will be developed during each CARIS cycle as part of the Assumptions Matrix.

If upon a cursory review of the location for the potential solution identifies unusual complexities, a contingency factor will be applied to the costs included in the matrix. These complexities may include but are not limited to right of way restrictions, terrain and/or permitting difficulties, etc. Field inspections will not be completed as part of the cursory review.

***Potential Solutions Assumptions***

The assumptions used to determine the order of magnitude costs included in the cost matrix will be stated as part of the Assumptions Matrix. These assumptions will address the following items:

Generation Resource

1. type of plant
2. length, type, voltage and ampacity of generator lead
3. step-up transformer (s)
4. substation interconnection
5. length of gas line
6. rights of way
7. permitting

8. system upgrade facilities
9. order of magnitude cost estimate.

Transmission Resource

1. type of construction (i.e. overhead or underground)
2. voltage and ampacity capability
3. substation interconnection
4. rights of way
5. permitting
6. system upgrade facilities
7. order of magnitude cost estimate.

Demand Response

1. order of magnitude cost estimate
2. zonal locations

Energy Efficiency

1. order of magnitude cost estimate
2. zonal locations

### 2.5. Benefit Metrics for CARIS Phase 1 Studies

The Benefit Metrics provide stakeholders key information on the impact of the generic solutions on the various outputs of the production cost model. These metrics can be utilized by stakeholders in determining the overall value of the project across multiple dimensions (e.g., load payments, supplier payments, environmental).

The NYISO Tariff defines the system production cost as the primary metric in the CARIS Phase 1 process, i.e., the metric utilized in determining the benefit-cost ratios for each of the generic solutions. There are additional metrics which are calculated and presented for stakeholder information. These metrics, while they are not utilized in the benefit-cost ratio, do provide stakeholders with a wider view of the benefits attributable to the generic projects under study. Section 31.3.1.3.5 in Attachment Y to the OATT provides a detailed discussion of each of the CARIS metrics.

### 2.5. Congestion Relief Analysis

The operational and economic impact of transmission congestion on the New York State Transmission System can be quantified through congestion relief analyses. With the projected potential future constraints and groupings initially identified for the Rreference Ccase simulations, as described in Section 2.4 above, the NYISO will perform additional simulations to further analyze transmission paths as warranted to identify the change in benefit metrics, and review with ESPWG to identify the reference cases and specific constraints for study.

To perform the constraint relief analysis, selected individual or groups of congested elements are iteratively relieved independently by relaxing their respective limits. For each binding constraint that has been relaxed, the production cost model is re-run to produce results that reflect the system conditions that would occur were that transmission element not congested. By comparing this information with the associated ~~R~~reference ~~C~~case, the economic and operational impact of the constraint can be determined. The metrics used to evaluate the impact may include production cost, demand congestion, LBMP, and energy deliverability.

Another part of the constraint relief analysis will determine if any of the congested elements must be grouped with other elements, depending on whether new elements appear as limiting with significant congestion when a primary element is relieved.

### 2.6. Renewable Generation Pocket Formation

When specific areas of the New York State Transmission System contain one or more constrained transmission elements, preventing renewable energy resources from dispatching based on their availability, a renewable generation pocket exists. As part of the System & Resource Outlook, the NYISO will use the metrics and results from the future transmission congestion projection in the ~~R~~reference ~~C~~case(s) to identify, define, quantify, and visualize the potential renewable pockets formed. In consultation with the stakeholders in~~via~~ ESPWG, the NYISO will identify the ~~R~~reference ~~C~~case(s) simulation year(s) and the potential need for seasonal assessments for renewable pocket determination in each Outlook study.

To define a renewable generation pocket, the NYISO will first identify the specific renewable generators that experience curtailment throughout the study period being analyzed. Where needed, a seasonal analysis well be conducted to account for factors specific to certain resource technologies. The GE-MAPS generation shift factor report (YRGSF) will be used to identify the specific transmission constraints directly contributing to the curtailment of renewable generation resources. This can include multiple lines and multiple impacted generators from each congested transmission line. The NYISO will qualitatively and, if warranted by the degree of the constraint, quantitatively collect transmission constraints causing curtailed generation and other electrically similar transmission paths into a grouping to form a renewable generation pocket. When reporting the findings of this analysis the NYISO will identify specific transmission paths comprising each renewable generation pocket such as interface(s) or circuit(s), and consider other measures to help stakeholders understand the results, such as providing a graphical representation of the identified renewable pockets.

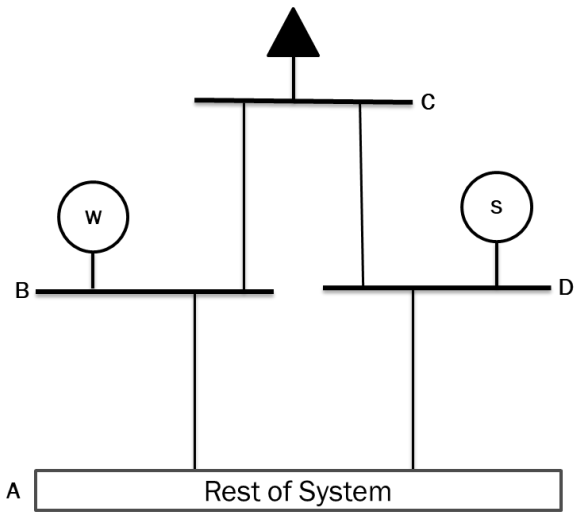
## 2.7. Energy Deliverability Analysis

The NYISO will evaluate the relationship between transmission congestion and the operation of resources throughout the system utilizing an energy deliverability metric. This metric will consider potential seasonal factors and account for the respective fuel availability of each Resource type, including wind, solar, and water, and quantify the energy projected to be produced by such Resource considering the impact of applicable local, statewide, and interregional transmission constraints as compared to the total amount of energy it would otherwise produce absent transmission constraints. The formulation used to determine energy deliverability for each resource on the system is as follows:

$$Energy\ Deliverability\ (\%) = \frac{Energy\ Production}{Energy\ Production\ Capability}\ x\ 100$$

Data from production cost simulations will be used to quantify the collective impact of resources on energy deliverability at locations on the system that are identified as being constrained. Generation shift factors, which quantify the incremental impact of generation on the flow of transmission facilities, will be used to identify groupings of generators with similar energy deliverability impacts. Information on the collective impact of transmission congestion on resource groupings will be provided.

Shown below is an illustrative example system with a load, wind generator, and solar generator interconnected by four transmission lines and 3 buses. The example network is assumed to connect to a larger bulk power system.




| Parameter | Value |
|---|---|
| Wind "W" Capacity | 500 MW |
| Solar "S" Capacity | 250 MW |
| Load | 100 MW |
| Line Limits | 100 MW |

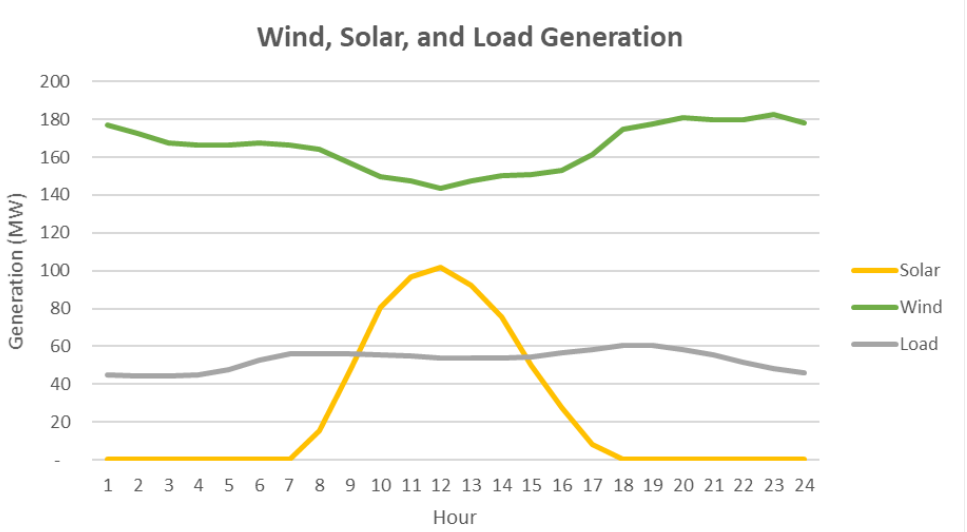
Transmission line flows on the example system are dictated by the electrical impedances of the transmission lines, which are assumed to be equal in this example. In this example, assuming that bus "A" acts as the reference point, if the wind generator at bus "B" produced 1 MW, 0.75 MW would flow on line "B-A" and 0.25 MW would flow on lines "B-C", "C-D", and "D-A". The full set of relationships between

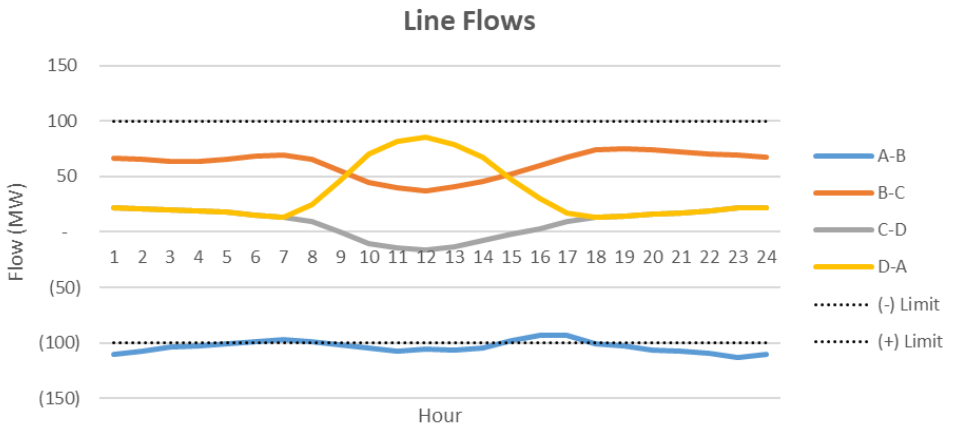
generators and the transmission system can be captured through a generation shift factor matrix. The GSF matrix for this example system is show below:

| GSF Matrix | A-B | B-C | C-D | D-A |
|---|---|---|---|---|
| Wind | -0.75 | 0.25 | 0.25 | 0.25 |
| Solar | -0.25 | -0.25 | -0.25 | 0.75 |
| Load | 0.5 | 0.5 | -0.5 | -0.5 |

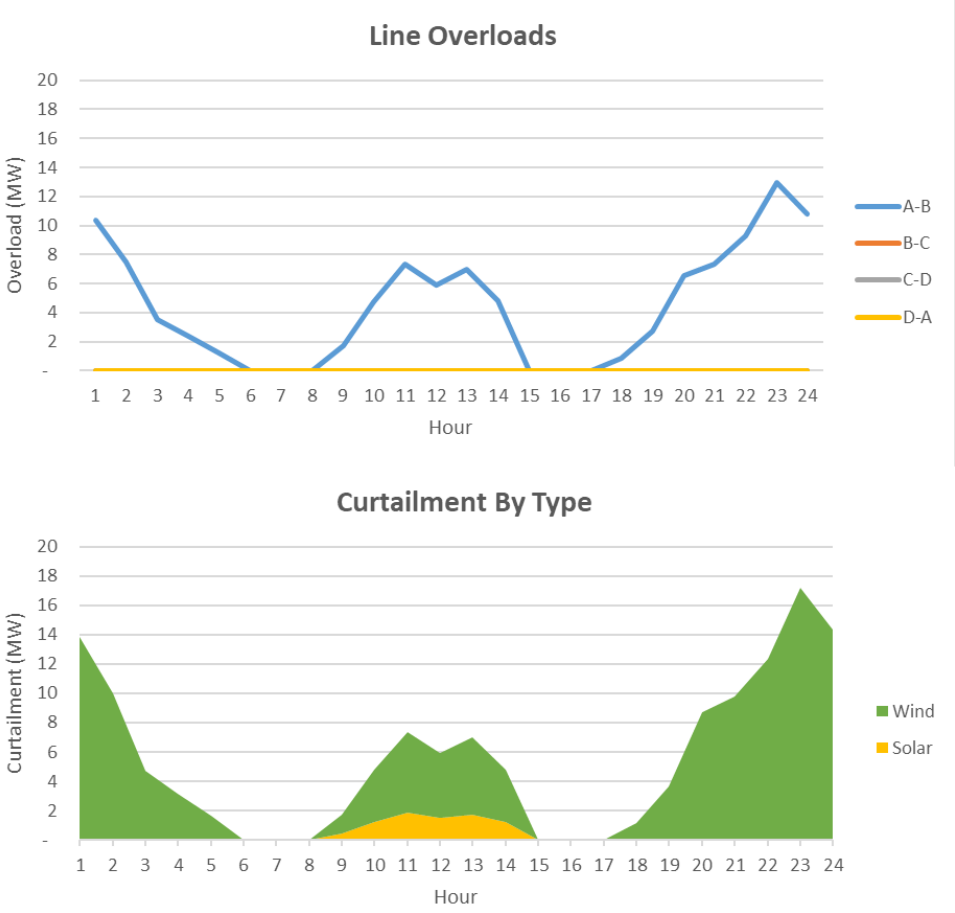
Note that GSF values must be between the values of 0 and 1, positive or negative, depending on the defined direction of the transmission line.

With the example system defined, a representative day of generator and load dispatch values can be applied to evaluate the transmission flows compared to their limits. This allows transmission constraints and generator curtailments to be identified. The charts below show an example 24 hour period of generator dispatch and transmission line flows.




The charts show the interaction between the transmission system and the varying dispatch patterns of these generators.. For the "A-B" transmission line, it can be noted that the flow exceeds the line limit of 100 MW. As a result, absent upgrades, the generators contributing to the line limit violation must be curtailed to reduce the flows to fall within operating limits. The charts below quantify line "A-B" overload levels and the required curtailment levels of the wind and solar generators where the current infrastructure would be sufficient to keep the transmission system within its limits.




Note that, for this example system, if only one of the technology types is producing energy at the time of line overloads, the amount of curtailment necessary to remedy line overloads will exceed the overload amount. This is due to a particular generators shift factor relationship to the overloaded line. The interrelationship between the specific unit or units operating in a given period and the required level of curtailment to bring the system within criteria will be captured.

Using the 24-hour period from this example, the energy deliverability metric can be calculated for each of the technology types. The table below shows the potential energy, curtailed energy, actual energy, and energy deliverability metrics relevant to this example.

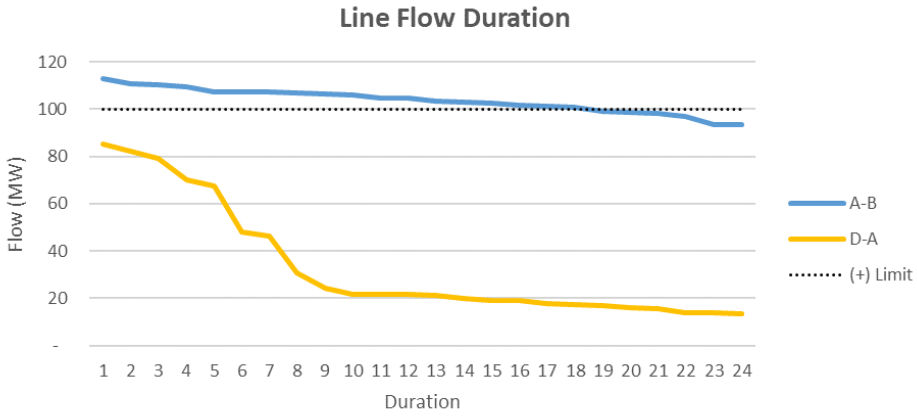
| Energy (MWh) | Potential | Curtailment | Actual | Energy Deliverability (%) |
|---|---|---|---|---|
| Solar | 595 | 8 | 587 | 99% |
| Wind | 3,963 | 124 | 3,839 | 97% |

The potential energy metric shows the total amount of energy that each resource could produce absent transmission constraints. The actual energy metric projects the energy each resource will produce considering the curtailed energy metric, which will be impacted by applicable local, control area-wide, and interregional transmission constraints. Where warranted, seasonal impacts will be quantified.

Where applicable, the energy deliverability metric may also include quantification of the collective impact of Resources at locations on the system that are identified as being constrained, in whole or in part. For example, if the sample system presented were identified as a renewable pocket, these metrics can be calculated and presented to produce the overall impact on the resources taken together. The table below shows the calculation for a renewable generation pocket encapsulating the example system.

| Energy (MWh) | Potential | Curtailment | Actual | Energy Deliverability (%) |
|---|---|---|---|---|
| Pocket | 4,558 | 132 | 4,426 | 97% |

Where available, resource areas that have been identified will also include such additional information resulting from the study analysis concerning capability remaining on the transmission system to support energy deliverability. The metric may be expressed as a percentage of such total amount of energy or as the amount of curtailed energy. As an example, the hourly flows for line "A-B" and "D-A" can be quantified and compared to the line limit to determine the capability of the line to support additional flows. A duration curve for both of these lines during the sample time period is shown below.




In the chart, the area below each curve represents the energy transferred throughout the day over the line. The area above the curve but below the line limit represents the unused capability of the line to transact energy, sometimes known as energy headroom. Any area below a curve but above the line limit represents the transmission line overload, which results in curtailed energy. Calculation of this quantity

requires simulations from the congestion relief analysis. These values are quantified in the table below. While it is not possible to calculate the energy headroom on each line on the system, the NYISO will collaborate with stakeholders to identify a subset of lines that should be considered based on the NYISO's expertise and experience and will provide the associated energy headroom information respectively.

| Energy (MWh) | Max Flow | Actual Flow | Overload | Headroom | Headroom (%) |
|---|---|---|---|---|---|
| Line A-B | 2,400 | 2,487 | 107 | 20 | 1% |
| Line D-A | 2,400 | 803 | 0 | 1,597 | 67% |

As part of the analysis, results from simulations may be analyzed to identify electrical, geographic, and/or temporal patterns in energy deliverability.

### ~~2.6.~~2.8. ~~CARIS Phase 1~~System & Resource Outlook Report

The ~~CARIS Phase 1~~System & Resource Outlook ~~R~~report informs NYISO stakeholders, including its regulators and Market Participants as well as prospective project developers of the findings of the System & Resource Outlook. In particular, the identification of potential transmission constraints may be used to guide the Public Policy Transmission Process. ~~on the opportunities for mitigating system congestion through the implementation of generic solutions (i.e., generation, transmission, energy efficiency and demand response). In doing so~~Additionally, the Report ~~also~~ provides potential transmission developers information upon which to decide whether to pursue cost recovery for a R~~r~~egulated~~,~~ E~~e~~conomic T~~t~~ransmission P~~p~~roject under the NYISO's Tariff.

~~It provides for stakeholders a comprehensive record of the CARIS process and outcomes, describing modeling assumptions, the historic and projected system congestion, the identified constrained transmission elements to be studied, proposed generic solutions, and the projected system benefits. Report appendices also include detailed tables of non-confidential model outputs for each of the solution cases and scenarios.~~

#### 2.8.1. State of NYISO System & Resource Planning

The Outlook will include a summary of the current assessments, evaluations, and plans in the biennial CSPP and the information and sources relied upon by the NYISO, including, among other things, the following.

#### 2.8.1.1. Demand Forecasting & Analysis Summary

The NYISO produces the Load & Capacity Data Report ("Gold Book") on an annual basis. The Gold Book details: (i) historical and forecast seasonal peak demand and energy usage, and energy efficiency, electrification, and other distributed energy resources and load-modifying impacts; (ii) existing and proposed generation and other capacity resources; and (iii) existing and proposed transmission facilities. The Outlook will summarize, as applicable, trends concerning energy demand, behind-the-meter resources, and electrification derived from the Gold Book.

#### 2.8.1.2. Public Policy Transmission Planning Process Summary

The NYISO solicits transmission needs driven by Public Policy Requirements on a biennial basis. If the New York Public Service Commission has identified a Public Policy Transmission Need and/or an ongoing solicitation and evaluation of solutions to address a Public Policy Transmission Need is underway, the Outlook will describe any Public Policy Transmission Need and the state of the solicitation and evaluation of proposed solutions in the NYISO's Public Policy Transmission Planning Process.

#### 2.8.1.3. Summary of Reliability Planning Processes

The Short-Term Reliability Process establishes the process by which the NYISO identifies and addresses Short-Term Reliability Process Needs that would result from a Generator's deactivation or other Reliability Needs that cannot be timely addressed in the Reliability Planning Process. The Reliability Planning Process establishes the identification of any Reliability Needs in the Reliability Needs Assessment (RNA), which needs are addressed in a Comprehensive Reliability Plan (CRP). The Outlook will describe the evaluations performed in the Short-Term Reliability Process, the RNA, and the CRP.

#### 2.8.1.4. Interconnection Studies Summary

The NYISO evaluates the proposed interconnection of generators and transmission facilities to the NYISO system. The NYISO maintains an interconnection queue list, which details developer-proposed projects by type, size, location, etc. The Outlook will include a summary of this information.

#### ~~2.6.1.1. Other Studies~~

~~The Outlook may also include summaries from other NYISO studies or efforts. For example, NYISO studies concerning upcoming market rule changes may contain helpful information~~

~~concerning impacts on how the market functions. This information would be pertinent to include and may help guide analyses in the Outlook.~~

### 2.8.2. Report Contents

The Outlook may include~~comprise~~ the following components as described in Section 2 of this Manual~~report~~: State of NYISO System & Resource Planning, Reference Case Development, Economic Planning Model Development, Historic & Future Transmission Congestion, Congestion Relief Analysis, Renewable Generation Pocket Formation, Energy Deliverability Analysis, Projected Operations & Market Impact Analysis, and Scenarios and Sensitivities.

### 2.8.3. Stakeholder Review and Board Approval of System & Resource Outlook Report

The NYISO will develop the draft Outlook in accordance with Section 31.3.1.7 of Attachment Y. The requirements for Market Participants' review of the draft Outlook are set forth in Section 31.3.1.8.1 of Attachment Y. The requirements for the Market Monitoring Unit's review of the draft Outlook are set forth in Section 31.3.1.8.2 of Attachment Y. The requirements for the NYISO Board of Directors' review and action on the Outlook are set forth in Section 31.3.1.8.2 of Attachment Y.~~prepares an initial draft of the Report for review by ESPWG. Comments provided by ESPWG members are considered by the NYISO in an iterative process and may be reflected in subsequent drafts of the Report. A final draft of the CARIS Phase 1System & Resource Outlook Report is reviewed with ESPWG and TPAS ("Transmission Planning Advisory Subcommittee") for comment before it is submitted to the Business Issues Committee ('BIC') for approval. Following action by the BIC, the Report is submitted to the Management Committee ("MC') for its approval. Following MC action, the Report is submitted to the NYISO Board of Directors ("BOD") for its action. The BOD may opt to approve the Report as is, or provide comments requiring edits to the document. Any edits to the Report must be reviewed with the MC and any comments from the MC must be provided to the BOD prior to its final determination on the Report.~~

### ~~2.7.~~2.9. Public Information Session

Following the BOD's approval of the Outlook~~Report~~, the NYISO is to report on the System & Resource Outlook~~CARIS~~ in an open forum for all interested parties. The NYISO's presentation provides background on the Outlook~~CARIS~~ process as well as a high-level discussion of the study methodology and findings. There is an opportunity for forum participants to ask questions and to engage in a dialogue with NYISO leadership on any aspect of the study.

## 3. ~~CARIS PHASE 2~~ Economic Transmission Project Evaluation (ETPE)

[Placeholder]

## 4. Requested Economic Planning Study (REPS)

[Placeholder]

## ~~3.~~5. Procedure for Study Replication

[Placeholder]

# Appendix A Typical ~~CARIS Base~~Reference Case Assumptions Matrix

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# Appendix B ~~Additional CARIS Study~~Requested Economic Planning Study (REPS) Request Form

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# Appendix C ~~Additional CARIS Study~~ Requested Economic Planning Study (REPS) Agreement Form

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# Appendix D ~~Specific Project Submittal~~ Economic Transmission Project Evaluation (ETPE) Request Form

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# Appendix E ~~Specific Project Submittal~~ Economic Transmission Project Evaluation (ETPE) Agreement Form

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## Appendix F Study Replication Request Form

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## Appendix G Study Replication Agreement Form

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## Appendix H NYISO Developer Qualification Form

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