2019 Northeastern Coordinated System Plan

ISO New England, New York ISO, and PJM

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Preface

The New York Independent System Operator (NYISO), the Independent System Operator (ISO) for the state of New York; PJM Interconnection (PJM), the Regional Transmission Organization [RTO] for all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and the District of Columbia); and ISO New England (ISO-NE), the RTO for the six New England states (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont), coordinate planning under the *Amended and Restated Northeastern ISO/RTO Planning Coordination Protocol* and other joint agreements. The protocol includes the following requirements:

- Exchanging data and information
- Coordinating interconnection requests and transmission requests with cross-border impacts
- Developing a Northeastern Coordinated System Plan
- Performing planning studies through an open stakeholder process
- Allocating the costs associated with interregional projects having a cross-border impact consistent with each party's tariff and applicable federal regulatory policy

The ISO/RTOs implement the protocol consistent with interregional planning requirements of the Federal Energy Regulatory Commission (FERC) Order No. 1000, including the following:

- The sharing of information about the respective needs of each region and potential solutions to these needs
- The identification and joint evaluation of interregional transmission facilities that may be more efficient or cost-effective solutions to these regional needs

This report summarizes the 2018 and 2019 interregional planning activities under the responsibilities of the Joint ISO/RTO Planning Committee (JIPC). The report also references other interregional planning activities, including those associated with the work of the North American Electric Reliability Corporation (NERC).

Executive Summary

Through their interregional processes, the New York Independent System Operator (NYISO), ISO New England (ISO-NE), and PJM must identify and resolve planning issues with potential interregional impacts, consistent with North American Electric Reliability Corporation (NERC) reliability requirements and other applicable state, regional, and local reliability criteria.[1] Interconnections with neighboring systems provide opportunities for the exchange of capacity and energy, and tie lines facilitate access to a diversity of resources and potential economic opportunities for energy exchange.[2] In its Order No. 1000, the Federal Energy Regulatory Commission (FERC) emphasized the importance of implementing processes for identifying and quantifying the potential benefits and other impacts of interregional transmission projects and system reinforcements and coordinating the planning of the interconnected system.[3]

PJM, ISO-NE, and NYISO participate in numerous national and interregional planning activities with NERC and its regional entities—the Northeast Power Coordinating Council (NPCC), the SERC Reliability Corporation (SERC) and Reliability*First* Corporation (RFC)—and other balancing authority areas in the United States and Canada.[4] The three entities proactively coordinate planning activities, such as interconnection and transmission studies, and work closely with each other as needed to conduct interregional reliability and production cost studies. The three Independent System Operators/Regional Transmission Organizations (ISO/RTOs) also coordinate system planning studies with neighboring systems across the Eastern Interconnection, and they participate in the Eastern Interconnection Planning Collaborative (EIPC).[5] The aim of these coordinated planning efforts is to enhance the widespread reliability and efficiency of the interregional electric power system.

PJM, ISO-NE, and NYISO follow the *Amended and Restated Northeastern ISO/RTO Planning Coordination Protocol* (Amended Planning Protocol) to enhance the coordination of their planning activities and address interregional planning issues.[6] To implement the original protocol (effective

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[1] More information about NERC is available at http://www.nerc.com/. See also the *Northeast Power Coordinating Council (NPCC) Regional Reliability Reference Directory #1—Design and Operation of the Bulk Power System* (September 30, 2015), https://www.npcc.org/Standards/Directories/Directory_1_TFCP_rev_20151001_GJD.pdf; *ISO-NE Planning Procedure 3 - Reliability Standards for the New England Area Pool Transmission Facilities* (September 15, 2017), https://www.iso-ne.com/static-assets/documents/2017/10/pp3_r8.pdf; and *New York State Reliability Council Reliability Rules and Compliance Manual* (April 11, 2019), http://www.nysrc.org/pdf/Reliability%20Rules%20Manuals/RRC%20Manual%20V44.pdf.

[2] NYISO and PJM, and NYISO and ISO-NE, have coordinated transaction scheduling that features scheduling every 15 minutes, external transaction bidding, coordinated economic clearing of transactions, and the elimination of fees and charges for interface bids. *See* NYISO webpage, "Energy Market & Operational Data," at https://www.nyiso.com/energy-market-operational-data.

[3] FERC, *Transmission Planning and Cost Allocation by Transmission Owning and Operating Public Utilities*, Order No. 1000, 18 CFR Part 35, 136 FERC ¶ 61,051 (July 21, 2011) (Order No. 1000).

[4] NERC defines a *balancing authority area* as the generation, transmission, and loads within metered boundaries for which a responsible entity (defined by NERC to be a balancing authority) integrates resource plans for that area, maintains the area's load-resource balance, and supports the area's interconnection frequency in real time.

[5] Information about EIPC is available at http://www.eipconline.com.

[6] PJM, NYISO, and ISO-NE, *Amended and Restated Northeastern ISO/RTO Planning Coordination Protocol* (Amended Planning Protocol) (July 13, 2015), http://www.iso-ne.com/static-assets/documents/2015/07/northeastern_protocol_dmeast.doc. Hydro-Québec TransÉnergie, the Independent Electric System Operator of Ontario (IESO), and the Transmission and System Operator Division of New Brunswick Power participate in the protocol on a limited basis to share data and information.

in 2004), the group formed the Joint ISO/RTO Planning Committee (JIPC) and the Interregional Planning Stakeholder Advisory Committee (IPSAC) open stakeholder group.[7] Through the open stakeholder process, the JIPC addresses interregional transmission planning issues, including system needs and proposed system improvements that reflect resource diversity, environmental compliance obligations, and resource retirements, in addition to the integration of distributed and variable energy resources.

The *2019 Northeastern Coordinated System Plan* (NCSP19) documents planning activities during 2018 and 2019 under the provisions of the amended protocol and other documents FERC accepted in response to the interregional requirements of its Order No. 1000.[8] NCSP19 builds on the interregional planning activities summarized in the *2017 Northeastern Coordinated System Plan* (NCSP17), emphasizing interregional planning activities under the Amended Planning Protocol and summarizing several of the planning issues the three ISO/RTOs are addressing.[9] NCSP19 demonstrates PJM, ISO-NE, and NYISO successfully implemented the Amended Planning Protocol, through the following activities:

- Continued coordination and exchange of data
- Provision of regional and interregional stakeholder opportunities for reviewing and recommending regional and interregional transmission planning needs and solutions
- Review of transmission needs and solutions proposed by neighboring systems and coordination of necessary planning studies across interregional boundaries
- Coordination of the interconnection queue, long-term firm transmission service, and transmission projects that potentially affect or could affect interregional system performance, and
- Coordination of other internal planning studies across ISO/RTO boundaries.

[7] All IPSAC presentations, studies, and other supporting material are available at each ISO/RTO's website: https://www.pjm.com/committees-and-groups/stakeholder-meetings/ipsac-ny-ne.aspx; https://www.nyiso.com/ipsac; and https://www.iso-ne.com/committees/planning/ipsac. For access to the protected NYISO IPSAC site, contact the NYISO Customer Service Department at (518) 356-6060 or https://www.nyiso.com/support. To request access to ISO-NE critical energy infrastructure information (CEII) materials, contact ISO-NE Customer Service at (413) 540-4220 or custserv@iso-ne.com. To request access to PJM CEII material, visit http://www.pjm.com/library/request-access.aspx.

[8] See (1) the Amended Planning Protocol; (2) ISO-NE, NYISO, and PJM, *Filing of Amended and Restated Northeastern ISO/RTO Planning Coordination Protocol on behalf of ISO New England Inc., New York Independent System Operator, Inc., and PJM Interconnection, L.L.C.*, Docket No. ER13-1957-000 (July 10, 2013), http://www.iso-ne.com/regulatory/ferc/filings/2013/jul/er13-1957-000_7-10-2013_protocol.pdf; and (3) FERC, *Order 1000 Compliance Filing*, Docket Nos. ER13-1957-001, ER13-1942-001, ER13-1946-001, ER13-1960-001, ER13-1947-001, and ER15-2200-000, final order (November 19, 2015), http://www.iso-ne.com/static-assets/documents/2015/11/er13-1957-001_er13-1960-001_ltr_order_accept_regional_transmission_require_cost_allocation_order_1000.pdf. NYISO, PJM, and ISO-NE also made separate filings of tariff and agreement changes to reflect compliance with interregional planning requirements of Order No. 1000.

[9] See 2017 Northeastern Coordinated System Plan https://www.iso-ne.com/static-assets/documents/2018/05/2017_ncsp_final_043018.pdf

The NCSP19 discusses system needs and plans for meeting these needs for the period 2020 through 2028. The key findings and conclusions of NCSP19, as discussed in Section 6, are as follows:

- Regional and interregional stakeholders provide the ISO/RTOs with key input for system planning activities through an open process.
- The ISO/RTO regional and interregional planning activities conducted during 2018 and 2019 reviewed regional needs and solutions and did not identify any need for new interregional transmission projects for cost allocation that would be more efficient or cost effective in meeting the transmission system needs of multiple regions than proposed regional system improvements included in the ISO/RTOs' respective regional plans.
- Queue interconnection studies remain well coordinated across ISO/RTO boundaries, including studies of additional generating and transmission facilities that could affect interregional system performance.
- The ISO/RTOs demonstrate compliance with all planning criteria and regulatory requirements.

While each Northeastern Coordinated System Plan is a snapshot in time, the planning process is continuous and flexible, and the ISO/RTOs update the results of planning activities as needed, accounting for the status of ongoing projects, studies, and new initiatives. The JIPC continues working toward meeting all challenges for planning and operating the system in accordance with all requirements in the ISO/RTOs' respective Open Access Transmission Tariffs (OATTs), all planning criteria, and planning procedures.

1. Interregional Transmission Planning and Cost-Allocation Requirements

The Federal Energy Regulatory Commission (FERC) Order No. 1000, issued on July 21, 2011, includes planning requirements, as follows, for all jurisdictional transmission providers, including Independent System Operators (ISOs) and Regional Transmission Organizations (RTOs):[10]

- Establish interregional planning procedures and cost allocation between neighboring regions
- Remove tariff provisions that may provide a federal right of first refusal (ROFR) for incumbent Transmission Owners
- Provide an open and transparent process for soliciting and selecting more efficient or cost-effective transmission projects for cost allocation and inclusion in the regional plan, and
- Incorporate public policy considerations into the planning process.

Order No. 1000 builds on FERC Order No. 890 requirements, which expanded regional planning to include economic planning and cost allocation.[11] While in many ways already meeting or exceeding the interregional planning requirements formalized by FERC in Order No. 1000, NYISO, ISO-NE, and PJM worked together, with their stakeholders, and with members of the Interregional Planning Stakeholder Advisory Committee (IPSAC) (see Section 3), during 2012, 2013, and again in 2015 to revise the Northeastern ISO/RTO Planning Coordination Protocol for meeting the requirements of Order No. 1000. The *Amended and Restated Northeastern ISO/RTO Planning Coordination Protocol* (Amended Planning Protocol), submitted to FERC in July 2015, provides for a multilateral planning process among the three regions. The three regions further submitted accompanying tariff provisions for cost allocation.[12] In 2015, FERC accepted the Amended Planning Protocol and cost-allocation methodology as compliant with the interregional coordination requirements of Order No. 1000.[13]

As summarized in NCSP19, many of the interregional activities during 2018 and 2019 focused on satisfying these compliance requirements. A high-level overview of the interregional planning requirements of Order No. 1000 follows.

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[10] FERC, *Transmission Planning and Cost Allocation by Transmission Owning and Operating Public Utilities*, Order No. 1000, 18 CFR Part 35, 136 FERC ¶ 61,051 (July 21, 2011) (Order No. 1000). Also, see additional Order No. 1000 filings and materials.

[11] FERC, *Preventing Undue Discrimination and Preference in Transmission Service*, Order No. 890, 18 CFR Parts 35 and 37, FERC Stats. and Regs. ¶ 31,241 (February 16, 2007).

[12] PJM, NYISO, and ISO-NE, *Amended and Restated Northeastern ISO/RTO Planning Coordination Protocol* (Amended Planning Protocol) (July 13, 2015), http://www.iso-ne.com/static-assets/documents/2015/07/northeastern_protocol_dmeast.doc.

[13] FERC, *Letter Order Accepting Order No. 1000 Interregional Transmission Planning and Cost-Allocation Requirements,* Docket Nos. ER13-1957-001, ER13-1942-001, ER13-1946-001, ER13-1960-001, ER13-1947-001, and ER15-2200-000, (November 19, 2015), https://www.iso-ne.com/static-assets/documents/2015/11/er13-1957-001_er13-1960-001_ltr_order_accept_regional_transmission_require_cost_allocation_order_1000.pdf. See also FERC's *Order on Compliance Filings*, 151 FERC ¶ 61,133 (May 14, 2015). https://www.ferc.gov/whats-new/comm-meet/2015/051415/E-2.pdf.

1.1 Interregional Coordination Requirements

Order No. 1000 required each pair of neighboring regions to include interregional coordination procedures in their respective tariffs. Specifically, the order required all transmission providers to develop further procedures with neighboring regions to provide for the following:

- The sharing of information regarding the respective needs of each region and potential solutions to these needs
- The identification and joint evaluation of interregional transmission facilities that may be more efficient or cost-effective solutions to these regional needs

Additionally, the order requires a developer of an interregional transmission project to first propose its project through the regional transmission planning processes of each of the neighboring regions where the facility is proposed to be located. The interregional evaluation must be conducted in the same general timeframe as each regional evaluation.

FERC emphasized the central importance of the regional planning processes, noting that interregional transmission coordination should complement local and regional transmission planning processes and not substitute for these processes. Periodic review of each ISO/RTO's regional plan identifies the potential need for interregional transmission projects. Consistent with applicable FERC regulations, the Amended Planning Protocol states that interregional planning is an integral part of each regional process.

In accordance with the Amended Planning Protocol, the Joint ISO/RTO Planning Committee (JIPC) discussed interregional coordination procedures at IPSAC meetings (see Section 3).[14]

1.2 Cost-Allocation Requirements

Another Order No. 1000 requirement is for each pair of neighboring transmission providers to include interregional cost-allocation procedures in their tariffs. For both regional and interregional cost allocation, Order No. 1000 adopted a principles-based, rather than a "one-size-fits-all," approach and recognized that regional differences may warrant different methodologies. FERC determined that the interregional cost-allocation method to which two regions agree may differ from their respective regional cost-allocation methodologies. In addition, the method to allocate a region's share of the costs for an interregional facility may differ from the method the respective regions use to allocate the costs of a regional facility. The order requires all transmission providers to demonstrate compliance with six cost-allocation principles—which contain variants for both regional and interregional cost allocation.[15] Both regional planning processes must first select an interregional transmission project for it to receive cost allocation under the interregional cost-allocation process.

The default cost-allocation methodology for interregional projects filed by the ISO/RTOs and accepted by FERC is based on the avoided costs of the respective regional projects the interregional solution would replace.[16]

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[14] The proposed annual coordination process was discussed at the IPSAC meeting held May 19, 2017. The final annual coordination process was discussed with IPSAC on December 11, 2017. *See* https://www.iso-ne.com/static-assets/documents/2017/11/a02_2017_12_11_ipsac_annual_coordination_process.pdf.

[15] *See, generally,* FERC Order No. 1000 at ¶¶ 612–685, http://www.ferc.gov/whats-new/comm-meet/2011/072111/E-6.pdf.

[16] Refer to the pertinent portions of the July 10, 2013, filings in FERC Docket Nos. ER13-1926 (PJM Transmission Owners); ER13-1942 (NYISO Transmission Owners); and ER13-1960 (ISO-NE Transmission Owners).

2. Implementation of the ISO/RTO Planning Processes

Under FERC Order No. 1000, regional planning is the foundation for interregional planning, which includes requests for interconnection to the transmission system and for transmission service that may have cross-border impacts. Each ISO/RTO has a regional planning process with timelines and an open stakeholder process for informing regional stakeholders of regional system needs (whether driven by reliability, economic, or public policy requirements), and opportunities for satisfying these needs. While each ISO/RTO is responsible for planning within its footprint, all must comply with North American Electric Reliability Corporation (NERC) Bulk Electric System (BES) standards.[17] In addition, NYISO and ISO-NE must comply with Northeast Power Coordinating Council (NPCC) requirements for the Bulk Power System (BPS).[18]

The ISO/RTOs' system plans identify system needs and plans for meeting such needs in accordance with their respective Open Access Transmission Tariffs (OATTs). PJM, NYISO, and ISO-NE coordinate these short- and long-term system needs and plans with neighboring systems to identify opportunities for interregional system improvements. Projects in the respective ISO/RTO interconnection queues may also have potential interregional effects on neighboring systems, which require coordinating studies across ISO/RTO borders. Stakeholders are encouraged to engage in the regional stakeholder processes, as well as the IPSAC, to provide input to the ISO/RTOs regarding potential interregional planning issues.

This section summarizes the respective ISO/RTOs' system planning processes, including the timing of their planning cycles. The section also provides references for each system's planning study results and other key documents.

2.1 PJM

The PJM Regional Transmission Expansion Planning Protocol (RTEPP) set forth in the Amended and Restated Operating Agreement of PJM Interconnection, L.L.C., at Schedule 6, outlines the process used to develop transmission system enhancements and expansions that satisfy identified reliability, market efficiency, operational performance, and public policy needs, all collectively termed baseline upgrades approved by the PJM Board of Managers. The RTEPP also includes provisions for the Transmission Owners to develop enhancements and expansions identified as Supplemental Projects, which are not required to satisfy PJM criteria and are not approved by the PJM Board. The culmination of these efforts results in the PJM Regional Transmission Expansion Plan (RTEP). The interregional process and opportunities can be followed through participation in PJM stakeholder activities.[19]

The Transmission Expansion Advisory Committee (TEAC) and Subregional RTEP Committees meetings, and the associated meeting materials, are open and available to the public for monitoring all PJM's transmission-system needs and potential solutions for the entire Bulk Electric System as they are developed by PJM staff, as well as monitoring the Transmission Owners' process used for

[17] The NERC term, "Bulk Electric System" (BES), includes transmission elements operated at 100 kilovolts (kV) or higher and real power and reactive power resources connected at 100 kV or higher. A BES does not include facilities used in the local distribution of electric energy.

[18] The NPCC term, "Bulk Power System" (BPS), refers to the interconnected electrical system within northeastern North America comprising system elements on which faults or disturbances can have a significant adverse impact outside of the local area.

[19] Obtaining a PJM account and sign in enables easy access to training, committee activities, notifications, and in-person / WebEx meetings. Find this resource on the PJM home page at http://www.pjm.com.

the planning of Supplemental Projects. This information is essential in evaluating proposals for interregional transmission projects, which must satisfy needs in more than one region and be a more efficient or cost-effective solution compared with the regional solution.[20]

PJM's annual RTEP Report describes transmission study input data, processes, and results, as well as board-approved transmission upgrades. The RTEP Report also details process changes implemented during the previous year. Periodically, PJM publishes white papers that present study input parameters and address transmission planning topics of current stakeholder interest.[21]

PJM implemented changes to the load forecast modeling beginning in 2019, for the 2020 RTEP year, which are focused on providing both a more accurate load forecast and one that better aligns with ongoing load trends. Most importantly, PJM is moving to a model which calibrates key variables of heating, cooling, and non-weather sensitive load to publicly available sector data. This contributes to the new load forecast model being less reliant on some economic factors that have become less well correlated with load, as well as providing PJM with greater insight into load growth composition. Separately, PJM continues making improvements in two key areas: distributed solar generation and plug-in electric vehicle (PEV) contributions to the load forecast model. For solar generation, PJM is taking greater advantage of solar production forecasting capabilities to reflect linkages with weather. For the first time, PJM is incorporating the effects of PEVs as an explicit adjustment to both peak and energy forecasts.

Interregional projects are proposed in PJM's competitive transmission solution solicitation ("windows") process and specified as an interregional project proposal.[22] Website postings on regional and interregional planning provide interested stakeholders with necessary information to prepare for participation in interregional planning under the Amended Planning Protocol and the Northeast protocol version of IPSAC (note that a Midcontinent ISO version of the IPSAC also exists). As of 2020, stakeholders can participate in PJM's new two-year regional transmission planning cycle that incorporates reviews of all drivers for transmission upgrades. Opportunities for stakeholder proposals will be identified, and stakeholders may provide input to PJM regarding possibilities for interregional transmission that may be more efficient or cost effective.

[20] Information on PJM's TEAC is available at https://pjm.com/committees-and-groups/committees/teac.aspx.

[21] Information on PJM's RTEP and related reports is available at https://pjm.com/documents/reports/rtep-documents.aspx.

[22] Additional information on this competitive transmission solution solicitation process is available at PJM's "Competitive Planning Process" webpage; https://pjm.com/planning/competitive-planning-process.aspx. Information on generator interconnections, merchant transmission, long-term firm transmission service requests, customer information, generator deactivation requests, and other relevant PJM planning information is available at PJM's "Planning" webpage; http://pjm.com/planning.aspx. PJM's posted material on interregional planning under the Amended Planning Protocol is available at its "Inter-Regional Planning Stakeholder Advisory Committee—New York/New England" webpage; https://www.pjm.com/committees-and-groups/stakeholder-meetings/ipsac-ny-ne.aspx.

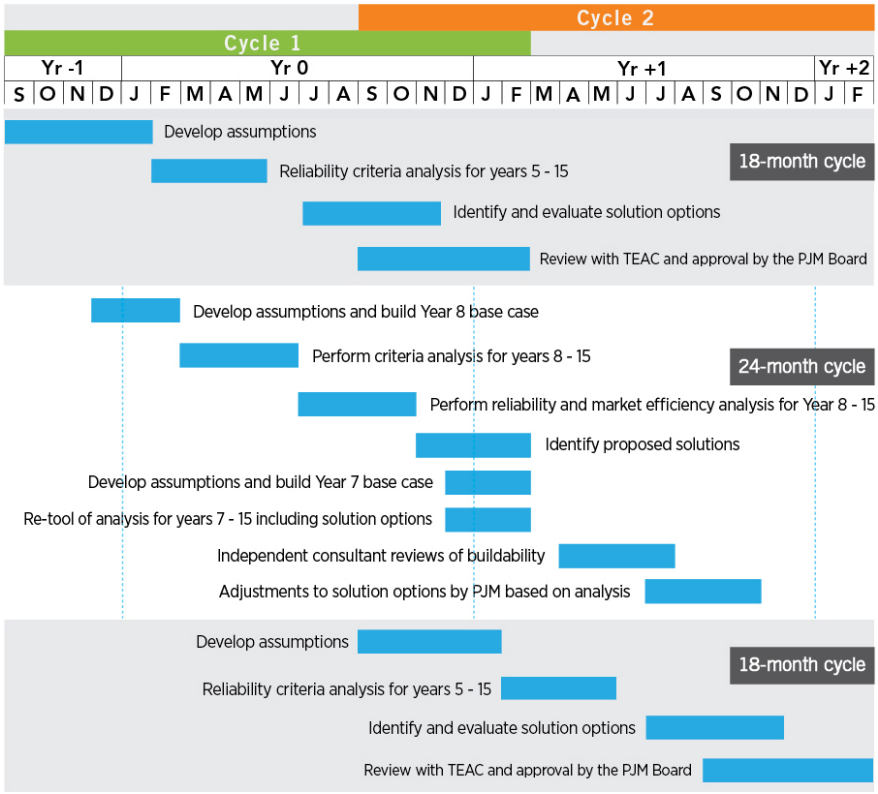

Figure 2-1: PJM's Two-Year Reliability Planning Cycle

As shown in Figure 2-1 and Figure 2-2, PJM's two-year transmission planning cycle includes an 18-month reliability cycle, a 24-month and two 12-month market-efficiency cycles. The 18-month reliability cycle, initiated annually, overlaps with the previous 18-month cycle and includes the full set of NERC reliability analysis. The 12-month market-efficiency cycle determines any economic benefits of advancing the in-service date of the previous cycle's approved reliability upgrades, and if determined as beneficial, may result in earlier timing of previously approved reliability projects. The two-year cycle also includes analysis of a longer planning horizon for both reliability and market-efficiency needs. A long-term proposal window solicits project proposals for identified reliability issues that may require longer implementation timelines, if any, and for identified, projected congestion issues. In practice, most of the reliability planning occurs in the 18-month cycle of criteria evaluations. Interregional projects may be identified as such and presented in any PJM proposal window; however, the long-term window of the two-year cycle is likely to be the most realistic option for coordinating with the schedules of neighboring regions.

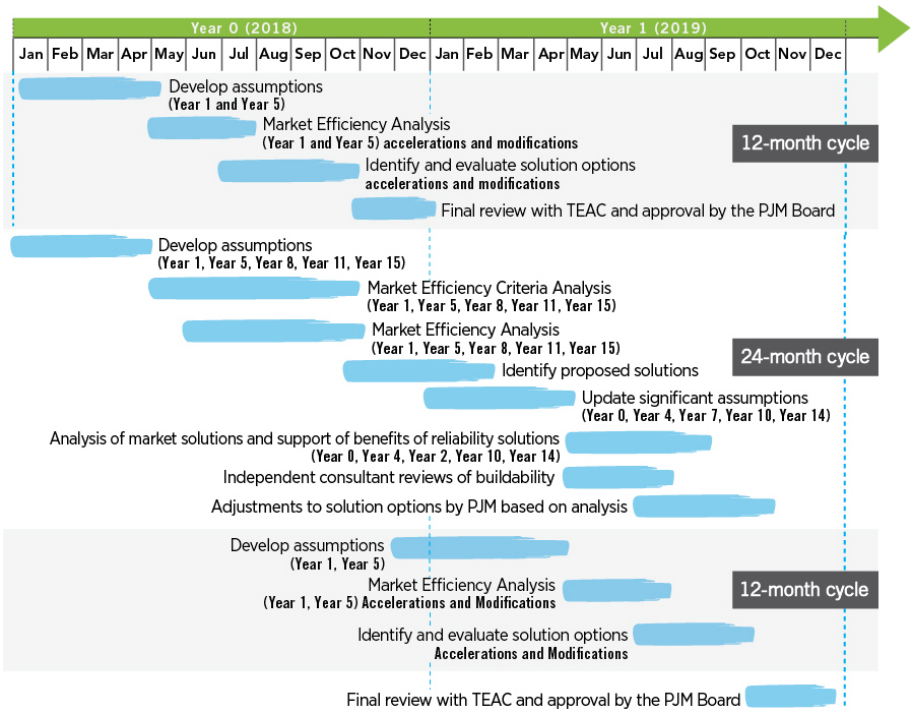

Figure 2-2: PJM's Two-Year Market-Efficiency Planning Cycle

2.2 NYISO

The NYISO's Comprehensive System Planning Process (CSPP) provides for evaluation of transmission, generation, and demand-side solutions on a comparable basis to address reliability, economic, and public policy issues. The NYISO identifies reliability needs and economic congestion, while the New York Public Service Commission identifies public policy transmission needs. The NYISO administers a process whereby solutions are proposed, evaluated, and implemented. Figure 2-3 shows the NYISO's Comprehensive System Planning Process. The NYISO's planning activities under the CSPP are regularly discussed with stakeholders at the Electric System Planning Working Group (ESPWG).[23]

The Reliability Planning Process (RPP) component of the CSPP is a biennial process that consists of two studies: the Reliability Needs Assessment (RNA) and the Comprehensive Reliability Plan (CRP).[24] The RNA evaluates the resource adequacy and transmission system security of New York Bulk Power Transmission Facilities (BPTFs) over a 10-year study period, identifying Reliability Needs in accordance with applicable reliability criteria.[25] After the RNA is complete, the NYISO requests the submission of solutions to satisfy the Reliability Needs. The CRP sets forth the NYISO's findings regarding the proposed solutions and its plan to maintain reliability for the 10-year study period.

[23] NYISO, "Electric System Planning Working Group," webpage (2019), https://www.nyiso.com/espwg .

[24] NYISO, *Reliability Planning Process Manual* (July 2018), https://www.nyiso.com/documents/20142/2924447/rpp_mnl.pdf.

[25] NYISO's Bulk Power Transmission Facilities include all of the facilities it designates as Bulk Power System elements as defined by the New York State Reliability Council (NYSRC) and NPCC, as well as other transmission facilities relevant to planning the New York State transmission system.

The NYISO also conducts a Generator Deactivation Process to identify and address reliability impacts that may arise due to generators proposing to leave service. A Market Participant must provide the NYISO with a minimum of 365 days prior notice, which begins when the NYISO determines that the Generator Deactivation Notice is complete, before its generator may be retired or enter into a mothball outage. The NYISO conducts studies to review the reliability impact on the Bulk Power Transmission Facilities (BPTFs) resulting from the generator being retired, entering into a mothball outage, or being unavailable due to an Installed Capacity (ICAP) Ineligible Forced Outage. The Responsible Transmission Owner(s) conducts the necessary studies of reliability impacts on their local transmission systems, which the NYISO reviews and verifies, to review the reliability impact on the non-BPTFs within the New York State Transmission System. If necessary, the NYISO may invoke a reliability solution including, as a last resort, reliability must-run agreements with generators.

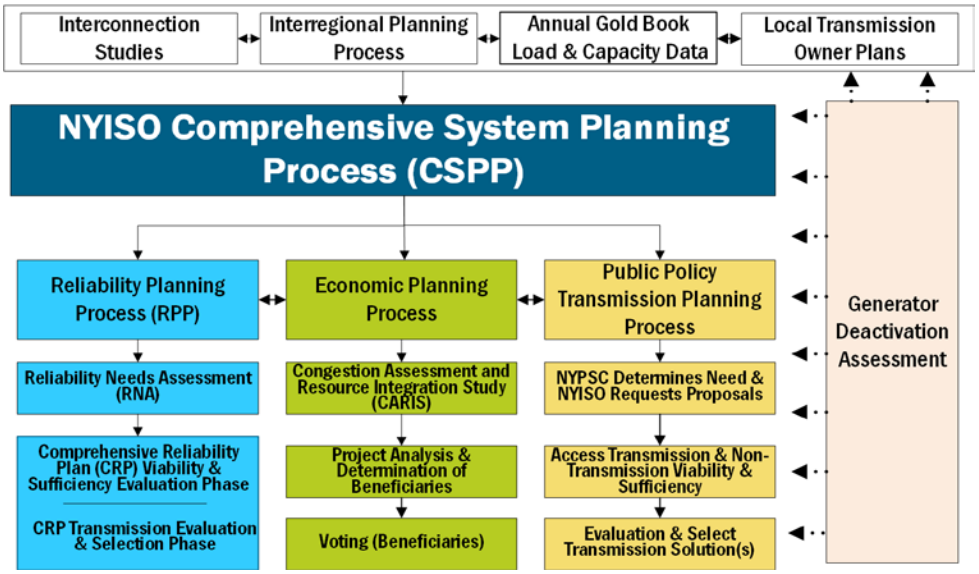

Figure 2-3: NYISO's Comprehensive System Planning Process

Congestion Assessment and Resource Integration Studies (CARIS) is the economic planning process component of the CSPP based on the CRP, and it is also a biennial study.[26] CARIS Phase 1 examines congestion on the New York BPTFs and the costs and benefits of generic alternatives to alleviate that congestion. During CARIS Phase 2, the NYISO evaluates specific transmission project proposals for regulated cost recovery.

The latest component of the CSPP is the Public Policy Transmission Planning Process.[27] Under this process, interested parties propose and the New York State Public Service Commission (NYSPSC) identifies transmission needs driven by Public Policy Requirements. A Public Policy Requirement is a federal, state, or local law or regulation that drives the need for transmission. Phase 1 of the Public Policy Transmission Planning Process involves identifying needs and soliciting solutions. The NYISO then evaluates the viability and sufficiency of the proposed solutions to satisfy each

[26] NYISO, *Economic Planning Process Manual – Congestion Assessment and Resource Integration Studies (CARIS)* (May 2019), https://www.nyiso.com/documents/20142/2924447/epp_caris_mnl.pdf.

[27] NYISO, *Public Policy Transmission Planning Process Manual* (July 2015), https://www.nyiso.com/documents/20142/2924447/M-36_Public%20Policy%20Manual_v1_0_Final.pdf.

identified Public Policy Transmission Need. In Phase 2, the NYISO evaluates and may select the more efficient or cost-effective transmission solution to each identified need.

Interregional planning is conducted with the NYISO's neighboring control areas in the United States and Canada under the Amended Planning Protocol. Interregional Transmission Projects are proposed at the same time as regional solutions in accordance with the NYISO CSPP. The NYISO's RNA, CRP, CARIS, and Public Policy Transmission Planning reports provide interested parties with the necessary information to prepare for participation in interregional planning under the Amended Planning Protocol.

2.3 ISO New England

The ISO New England planning process continuously and comprehensively identifies system needs and solutions to meet these needs, such as upgrades to the transmission system, market responses, generation, or demand response.[28] The process involves the following major activities:

- Forecasting the annual and peak use of electric energy, energy efficiency, and photovoltaic capacity
- Projecting systemwide need for capacity and operating reserves, including generators and demand-side resources, to meet consumer demand for power and replace retiring power plants
- Analyses of the amount, operating characteristics, and locations of needed energy, capacity, and operating reserves and how the region can meet these needs
- Determining how the region's power system can continue to address reliability concerns by identifying areas of the grid where transmission upgrades are needed, transmission system solutions, and cost considerations
- Complying with interregional planning requirements; conducting required activities
- Assessing energy-security risks and solutions for addressing resource adequacy and regional energy-security issues
- Keeping abreast of existing and pending environmental regulations, emissions analyses, and other studies affecting generator operating requirements and the need for remediation measures
- Integrating renewable and other resources to meet system needs as the grid transforms to one with high amounts of inverter-based technologies
- Assessing multistate, ISO-NE, and state initiatives that affect system planning

Through an open and transparent process, ISO-NE discusses study scopes of work, assumptions, and draft results with stakeholders. ISO-NE's stakeholder planning forum is the Planning Advisory

[28] The ISO-NE planning process is documented on its website at http://www.iso-ne.com/system-planning. The *Transmission Planning Process Guide* outlines the steps in the regional system planning process. The *Transmission Planning Technical Guide* documents several assumptions used in ISO-NE planning studies. The guides are available at http://www.iso-ne.com/system-planning/transmission-planning/transmission-planning-guides. Also see ISO-NE's *Open Access Transmission Tariff*, Attachment K, "Regional System Planning Process" (January 22, 2020), at https://www.iso-ne.com/participate/rules-procedures/tariff/oatt.

Committee (PAC).[29] PAC attendance is diverse and open to all and currently includes representatives from state and federal governmental agencies; Participating Transmission Owners (PTOs); ISO-NE market participants; other New England Power Pool (NEPOOL) members; consulting companies; manufacturers; and other organizations, such as universities and environmental groups.[30]

The Regional System Plan (RSP) is developed every other year.[31] RSPs demonstrate that ISO-NE meets reliability requirements established by FERC, NERC, and NPCC, and the reports are produced in accordance with the requirements in Attachment K of ISO-NE's OATT. Each RSP is a snapshot of the power system and relevant studies and forecasts at a point in time, and the results are updated as needed.

ISO-NE studies evaluate proposed interconnections to and transmission service over the New England transmission system for projects listed in the ISO-NE's Interconnection Queue.[32] The studies are performed to ensure that system reliability criteria and no-adverse-impact standards are met. They typically consist of thermal, voltage, stability, and short-circuit analyses and address the following topics:

- Interconnections of proposed generators
- Requests for an elective transmission expansion
- Requests for transmission service

ISO-NE makes available the databases used in its analyses and other relevant information required to perform simulations consistent with FERC policies and the ISO-NE Information Policy requirements pertaining to confidential information and critical energy infrastructure information (CEII) requirements.[33] Stakeholders can access the *Forecast Report of Capacity, Energy, Loads, and Transmission* (the CELT Report) to obtain key data of the New England system.[34] In addition, power system models are available to stakeholders wishing to conduct their own independent studies.[35]

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[29] There are no membership requirements to become part of the PAC. PAC materials are available at http://www.iso-ne.com/committees/comm_wkgrps/prtcpnts_comm/pac/index.html. PAC agendas, minutes, materials, draft reports, including stakeholder questions and ISO-NE responses, and final reports are posted on the ISO-NE website. Review of CEII materials at PAC are subject to the additional requirements described on the website.

[30] NEPOOL members serve as ISO stakeholders and market participants. More information on NEPOOL participants is available at http://www.iso-ne.com/participate/governing-agreements/nepool-agreement.

[31] ISO-NE, *2019 Regional System* Plan (October 31, 2019), https://www.iso-ne.com/system-planning/system-plans-studies/rsp.

[32] See the latest information on ISO-NE studies at http://www.iso-ne.com/system-planning/system-plans-studies/interconnection-request-studies.

[33] *ISO New England Information Policy* (ISO tariff, Attachment D) (2015) contains the requirements for controlling the disclosure of CEII and confidential information; see http://www.iso-ne.com/static-assets/documents/regulatory/tariff/attach_d/attachment_d.pdf.

[34] ISO-NE, *Capacity, Energy, Loads, and Transmission (CELT) Forecast Report* (May 1, 2019) and related information, https://www.iso-ne.com/system-planning/system-plans-studies/celt/. Earlier ISO-NE CELT reports and the 2020 CELT are available at the same website.

[35] Stakeholders with CEII approval can obtain publicly available models of the transmission system network through the FERC 715 process, which requires transmitting utilities that operate facilities rated at or above 100 kV to submit information to FERC annually. See ISO-NE's "FERC Form No. 715 Reports," webpage (2019), https://www.iso-ne.com/

3. Coordination of the Regional ISO/RTO Planning Processes with the Interregional Planning Process

The ISO/RTOs have implemented and coordinated their respective regional planning processes with the interregional planning process. The Joint ISO/RTO Planning Committee, consisting of representatives of the three ISO/RTOs, coordinates and reconciles the regional practices and assumptions used for interregional planning. The JIPC and stakeholders have reviewed the interregional planning timelines in conjunction with the regional planning cycles, and the JIPC has concluded that the interregional planning cycle effectively coordinates with the respective regional timelines.[36]

The JIPC ensures that the interregional planning process actively engages stakeholders through the IPSAC. The JIPC convenes meetings, which are typically held as webinars, and allows for stakeholder opportunities to review materials and provide comments.

3.1 Coordination of ISO/RTO Planning Timelines and Power System Models

All three ISO/RTOs issue long-term planning assessments and allow for qualified developers to propose solutions through a competitive process.[37] The completion dates of individual ISO/RTO studies and reports differ, but the coordination of planning activities across system borders occurs continuously. Table 3-1 summarizes several key completion dates for the ISO/RTOs.

The three ISO/RTOs have coordinated data and planning models. PJM updates its demand forecasts annually every January, NYISO every April, and ISO-NE every April. Interconnection queues are publicly available. PJM and ISO-NE update their interconnection queues continuously. NYISO updates its queue monthly. The ISO/RTOs annually coordinate their interregional power flow and stability models but may update coordinated models more frequently as required. Power flow and stability models are available to stakeholders subject to CEII and Information Policy constraints. The JIPC periodically updates interregional production cost databases, typically by exchanging economic information and power flow models as part of activities conducted by the Eastern Interconnection Planning Collaborative (EIPC). (See Section 5.2). As required, the ISO/RTOs share resource adequacy data, which are used in loss-of-load-expectation (LOLE) analysis and other studies.

system-planning/transmission-planning/ferc-form-no-715-reports and FERC's "Form No. 715 – Annual Transmission Planning and Evaluation Report," webpage (September 15, 2017), http://www.ferc.gov/docs-filing/forms/form-715/overview.asp.

[36] *See* the December 14, 2015, IPSAC discussion, "Interregional Planning Timelines in the Context of Order 1000" at http://www.iso-ne.com/static-assets/documents/2015/12/121415_ipsac_interregional_timelines.pdf.

[37] All three ISO/RTOs allow for qualified developers of transmission to participate in their regional planning processes. The qualified developers are called Qualified Transmission Providers in ISO-NE, Qualified Developers in NYISO, and pre-qualified Designated Entities in PJM.

Table 3-1:
Timing of Regional Planning Activities with Interregional Planning Requirements

Key Activity that Affects Interregional Planning	ISO/RTO		
	NYISO	PJM	ISO-NE
Reliability needs	Continuously; summarized in a report every even year	Continuously identified and reported to stakeholders throughout the year; summarized in an annual report	Continuously; summarized in a report the fourth quarter of every odd year
Reliability solutions	Continuously; summarized in a report every odd year	Potential solutions identified, evaluated, and selected throughout the year in a transparent process with stakeholders	Continuously; summarized three times per year in a project list; summarized in a report every odd year
Economic needs	Continuously; summarized in a report every odd year	Identified midyear of year one of two-year cycle and reviewed with stakeholders Q3 and Q4	Continuously
Economic solutions	Continuously; summarized in a report for each proposed project	Potential solutions identified November 1 of year one of the two-year cycle through February of second year; solutions evaluated and selected in the second year	Continuously; summarized three times per year in a project list; summarized in a report every odd year
Public policy needs	As regional needs are identified	As regional needs are identified	At least once every three years (last evaluated 2017)
Public policy solutions	Following identification of a public policy transmission need	Following identification of a public policy transmission need	Following identification of a public policy transmission need

3.2 JIPC Process for Coordinating Interregional Projects and Administering the IPSAC

The JIPC reviews potential opportunities where interregional projects might satisfy the needs of more than one region. Qualified developers may submit proposals to two or more neighboring ISO/RTOs consistent with the requirements of the respective regional processes. The proposals can be for reliability projects, economic projects, public policy projects, and other transmission system projects planned by the respective regions.

The JIPC also coordinates studies needed to identify potential interregional impacts, as well as the system data and models used in studies, after which it would identify and evaluate the performance of projects that could affect interregional system performance. Several interconnection studies of projects having potential interregional impacts have been discussed.

The JIPC convenes IPSAC meetings a minimum of two times annually. Approximately 100 stakeholders typically attend these meetings, and several have recorded significantly higher attendance. Attendees, including state and federal regulators, represent a wide spectrum of individuals and companies that participate in one or more of the ISO/RTO planning processes. Meeting agendas allow for adequate time for stakeholder discussions of the following topics:

- A review of the interregional coordination process, which emphasizes important changes
- The JIPC response to stakeholder comments

- Regional planning needs for each of the ISO/RTOs, which, in additional to information discussed at regional stakeholder meetings, helps qualified developers formulate interregional transmission project proposals that can potentially meet the needs of more than one system
- Coordination of interconnection queues and long-term firm transmission requests
- Scopes of work for special items, such as the biennial NCSP
- General stakeholder comments, interregional planning achievements, and next steps

Typically, stakeholders have at least 10 business days after an IPSAC meeting to submit comments, and longer review periods are often granted.

On a biennial basis, the JIPC posts a draft Northeastern Coordinated System Plan for stakeholder review, comment, and discussion at a future IPSAC meeting. The process of posting written comments and JIPC responses increases transparency and reduces misunderstandings that may result from stakeholder discussions.

4. IPSAC Review of System Plans

The IPSAC discusses respective ISO/RTO planning processes, system needs, and transmission projects proposed and evaluated to address potential interregional impacts.[38] The IPSAC also discusses studies of interconnection queues and long-term firm transmission requests for projects with potential impacts on neighboring systems.

4.1 IPSAC Discussions of the ISO New England System

During 2018 and 2019 IPSAC meetings, ISO-NE presented updates to several regional planning processes and activities in New England, including the ability for stakeholder input through ISO's Planning Advisory Committee. IPSAC discussions included the continuous nature of ISO-NE's regional planning process; how ISO-NE identifies reliability, market efficiency, and public policy transmission needs; and how ISO-NE identifies transmission upgrades satisfying these needs. ISO-NE presented a summary of the *2019 Regional System Plan* (RSP19) and the status of several studies and projects with potential interregional impacts.[39]

RSP19 summarizes the needs of the New England system from 2019 through 2028 and how these needs can be addressed. The report addresses planning study proposals, scopes of work, assumptions, draft and final study results, and other materials discussed with ISO-NE's Planning Advisory Committee. The document covers the following topics:

- Forecasts of annual energy use and peak demand from 2019 to 2028
- Strategic issues facing the region, including the integration of variable energy resources (*e.g.,* wind generation and solar photovoltaic [PV] installations), resource retirements and additions, and fuel-security risks
- The need for resources, including generators and demand resources, to meet consumer demand for power and replace retiring power plants
- How the region's power system can continue to address reliability concerns by identifying areas of the grid where resource additions or transmission upgrades are needed
- Coordination of New England's planning process with those of neighboring regions

As part of the 2018 and 2019 IPSAC discussions, ISO-NE presented the status of several ongoing planning needs assessments and the status of solutions. The following specific planning items were discussed:

- Maine (ME)
- New Hampshire (NH)
- Boston

[38] These topics are typically discussed at every IPSAC meeting. (See IPSAC meeting materials held May 18, 2018, December 10, 2018, May 13, 2019, and December 9, 2019 at: https://www.pjm.com/committees-and-groups/stakeholder-meetings/ipsac-ny-ne.aspx, http://www.iso-ne.com/committees/planning/ipsac, and https://www.nyiso.com/ipsac. For example, see the information posted with the December 9, 2019, IPSAC materials: "Queue Interconnection Studies of Projects Potentially Affecting Neighboring Systems," "NYISO Updates on Comprehensive System Planning Process," "PJM Regional Transmission Expansion Planning Process," and "ISO-NE Regional Planning Needs and Solutions."

[39] The ISO-NE RSP19 is posted at https://www.iso-ne.com/system-planning/system-plans-studies/rsp.

- Southeastern Massachusetts/Rhode Island (SEMA/RI)
- West and Central Massachusetts (WCMA)
- Eastern Connecticut (ECT)
- Southwest Connecticut (SWCT)
- Regular updates to the ISO New England Project Listing and Asset Condition Listing

After stakeholder discussions at the PAC and the IPSAC and additional JIPC discussions described in this document, ISO-NE determined that no new interregional transmission facilities would more efficiently or cost effectively meet New England's system transmission security needs than already identified separate regional solutions, which have been shown to have no adverse impact on neighboring systems.

At the same time, several new interconnections are currently proposed between ISO-NE and its neighboring systems. These elective transmission upgrades are proposed to import resources to the New England region. The ISO-NE Interconnection Queue includes these proposed projects, which could have potential impacts on neighboring systems. Proposed projects in the queue include generating facilities and elective transmission upgrades interconnecting New England and either New York or Canada. Several of the proposed interconnections require analyses of coordinated interregional control system interactions among high-voltage direct-current (HVDC) ties to ensure system stability and acceptable system response to contingencies in New England.

The ISO-NE planning and interregional coordination processes also consider transmission asset conditions. In December 2017, ISO-NE and NYISO coordinated the replacement cables on the tie-line between Plattsburgh substation in New York and the Sandbar substation in Vermont. The Sandbar substation is also scheduled to undergo substation asset condition upgrades in June 2021.

4.2 IPSAC Discussions of the NYISO System

The NYISO's Comprehensive System Planning Process provides for the evaluation of solutions to address reliability, economic, and public policy needs. At the four IPSAC meetings held in 2018 and 2019, the NYISO presented the planning activities under the Comprehensive System Planning Process for stakeholder review and inputs. As part of the IPSAC discussions, the NYISO presented the status of several needs and solutions:

- The NYISO completed both the Phase 1 and Phase 2 evaluations of the Western New York Public Policy Transmission Need to add transfer capability from western New York for hydroelectric output and Canadian resource imports.[40] In October 2017, the NYISO Board approved the Western New York Public Policy Transmission Planning Report selecting the NextEra's Empire State Line Proposal 1 (T014) to satisfy the Western New York Transmission Need.[41]

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[40] NYSPSC, *Order Addressing Public Policy Requirements for Transmission Planning Purposes*, Western New York Public Policy Transmission Need Order (July 20, 2015), http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={CF11366C-8CE3-4D84-A1A7-DA54B2F69D96}.

[41] NYISO, *NYISO Board of Directors' Decision on Approval of Western New York Transmission Planning Report and Selection of Public Policy Transmission Project* (October 17, 2017), https://www.nyiso.com/documents/20142/2892590/Western-NY-Board-Decision-Report-20171017.pdf.
Western New York Public Policy Transmission Planning Report and appendices (October 17, 2017), https://www.nyiso.com/documents/20142/2892590/Western-New-York-Public-Policy-Transmission-Planning-

- The NYISO completed both the Phase 1 and Phase 2 evaluations for the AC Transmission Public Policy Transmission Needs to increase transfer capability across the Central East and UPNY/SENY (upstate New York/southeast New York) transmission interfaces in New York.[42] In April 2019, the NYISO Board of Directors selected the Segment A Double-Circuit project, proposed jointly by North American Transmission (NAT) and the New York Power Authority (NYPA), as the more efficient or cost effective solution for Segment A. The Board also concluded that for Segment B, the more efficient or cost effective solution is the New York Energy Solution (NYES) Segment B project, which was jointly proposed by the Niagara Mohawk Power Corporation d/b/a National Grid (National Grid) and the New York Transco, LLC (Transco).[43]

With the discussions at the Electric System Planning Working Group and the IPSAC and additional JIPC discussions, the NYISO determined that no interregional transmission projects would be more efficient or cost effective than the regional plans to address the needs.

At the IPSAC meetings, the NYISO also presented a list of interconnection projects with potential interregional impacts. The NYISO continues to coordinate its interconnection studies with ISO-NE and PJM. Projects that may have potential interregional impacts are studied by both the NYISO and the impacted regions.

4.3 IPSAC Discussions of the PJM System

During the course of the four 2018 and 2019 IPSAC web conferences, PJM provided updates on its regional planning results, including baseline plans, interconnection projects under joint interregional review, and generator deactivation updates. This information was presented for review and input to include any stakeholder-identified transmission needs or solutions that contribute to the efficiency or cost effectiveness of PJM's regional plans. The analyses and results discussed are summarized in Table 4-1 and Table 4-2 and available in detail on the PJM.com TEAC webpages.

Report.pdf and https://www.nyiso.com/documents/20142/2892590/Western-New-York-Public-Policy-Transmission-Planning-Report-Appendices.pdf.

[42] NYSPSC, *Proceeding on Motion of the Commission to Examine Alternating Current Transmission Upgrades*, AC transmission public policy transmission need order (December 17, 2015), http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={6E1E0177-5682-4083-9AB8-A91B167E66AE}.

[43] NYISO, *NYISO Board of Directors' Decision on Approval of AC Transmission Public Policy Transmission Planning Report and Selection of Public Policy Transmission Projects* (April 8, 2019), https://www.nyiso.com/documents/20142/2892590/Board-Decision-AC-Transmission-2019-04-08.pdf *AC Transmission Public Policy Transmission Planning Report* and appendices (April 8, 2019), https://www.nyiso.com/documents/20142/5990681/AC-Transmission-Public-Policy-Transmission-Plan-2019-04-08.pdf and https://www.nyiso.com/documents/20142/5990681/AC-Transmission-Appendices-2019-04-08.pdf.

Table 4-1:
PJM RTEP Proposal Windows and Board Baseline Upgrade Approvals, 2018

RTEP Proposal Windows	2018-1	2018-2	2018 Board Baseline Upgrade Approvals
Objective	All Reliability Criteria	Market Efficiency	
Flowgates Identified	202	4	
Issues Identified near NYISO	7	0	
Proposals	7	31	139 new baseline upgrades
Cost Range	$0 - $13.5M	$0.5 - $291M	~$2.1 billion

Table 4-2:
PJM RTEP Proposal Windows and Board Baseline Upgrade Approvals, 2019

RTEP Proposal Windows	2019-1	2019 Board Baseline Upgrade Approvals
Objective	All Reliability Criteria	
Flowgates Identified	128	
Issues Identified near NYISO	10	
Proposals	15	141 new baseline upgrades
Cost Range	$1 - $71M	~$1.27 billion

Opportunities for stakeholders to offer transmission development proposals addressing issues identified in ongoing analysis and review process is managed through PJM's RTEP competitive window process. The annual RTEP planning assessment includes a comprehensive review of all PJM Bulk Electric System facilities pursuant to the standards set forth by NERC TPL-001-4.[44] The annual baseline reliability analysis encompasses thermal, voltage, short circuit, and stability, satisfying all the TPL standards for all PJM BES facilities. In addition, testing includes reviews of market efficiency, scenarios, and operational performance. Pursuant to the PJM competitive window process, all eligible identified issues are presented for competitive proposal solicitation. During 2018 and 2019, PJM conducted open, competitive solicitation processes, as shown in Table 4-1 and Table 4-2.

PJM did not receive any proposals in its regional windows for interregional transmission facilities to be evaluated for identified PJM transmission issues with respect to New York.

[44] NERC, *Standard TPL-001-4 – Transmission System Planning Performance* Requirements (January 1, 2015), http://www.nerc.com/pa/Stand/Reliability%20Standards/TPL-001-4.pdf.

5. Other Coordinated Planning Activities

The ISO/RTOs conduct studies as needed with other entities within and outside the region, including neighboring areas, that aim to, for example, improve production cost models, share simulation results, investigate the challenges to and possibilities for integrating renewable resources, and address other common issues affecting the planning of the overall system. The ISO/RTOs also participate in numerous interregional planning activities with other entities, including the Eastern Interconnection Planning Collaborative, US Department of Energy (DOE), the North American Electric Reliability Corporation and its regional reliability councils, and other planning authorities in the United States and Canada. The overriding purpose of these involvements is to enhance the widespread reliability of the interregional electric power system.

This section discusses the main collaborative efforts the ISO/RTOs undertake with neighboring areas to analyze the interconnection-wide system, study and address interregional transfers and seams issues, and improve competitive electricity markets in North America.

5.1 Electric Reliability Organization (NERC) Overview, Long-Term Reliability Assessments, and Other Studies

The ISO/RTOs are responsible for complying with applicable NERC standards addressing bulk system operations and planning. In addition, the ISO/RTOs participates in regional and interregional studies required for compliance.

Through its committee structure, NERC as the FERC-designated Electric Reliability Organization (ERO) regularly publishes reports that assess the reliability of the North American electric power system. Annual long-term reliability assessments evaluate the future adequacy of the power system in the United States and Canada for a 10-year period. The reports project electricity supply and demand, evaluate resource and transmission system adequacy, and discuss key issues and trends that could affect reliability. Summer and winter assessments evaluate the adequacy of electricity supplies in the United States and Canada for the upcoming peak demand periods in these seasons. Special regional, interregional, or interconnection-wide assessments are conducted as needed.

Annual long-term reliability assessments (LTRAs) evaluate the future adequacy of the power system in the United States and Canada for a 10-year period. The reports project electricity supply and demand, evaluate resource and transmission system adequacy, and discuss key issues and trends that could affect reliability. Summer and winter assessments evaluate the adequacy of electricity supplies in the United States and Canada for the upcoming peak demand periods in these seasons. Special regional, interregional, or interconnection-wide assessments are conducted as needed.

In December 2019, NERC issued its annual LTRA, analyzing reliability conditions across the North American continent.[45] This report describes transmission additions, generation projections, and reserve capability by reliability council area. Although the 2019 assessment identified several key findings for the overall system, the following items are particularly relevant to NCSP19:

- The resource adequacy assessment concluded there is sufficient generation supply in PJM, NYISO, and ISO-NE.
- Large amounts of new wind, solar, and natural gas resources increase the need for flexible resources that provide ancillary services, meeting challenges presented by

[45] NERC, *2019 Long-Term Reliability Assessment* (December 19, 2019), https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_LTRA_2019.pdf.

inverter-based resource interconnections, and coordinated planning to maintain fuel assurance.

- The growth of energy storage resources requires coordination between the distribution and transmission systems, especially data and information sharing used to address system planning, forecasting, and modeling issues.
- Transmission plans and infrastructure development need to keep pace with the development of solar and wind resources

The LTRA recognizes grid transformation issues and recommends a series of actions for the ERO as follows:

- Incorporate energy adequacy metrics and evaluate scenarios posing the greatest risk to reliability.
- Increase communications and outreach with state and provincial policymakers on resource adequacy risks and challenges.
- Publish reliability guidelines, develop requisite tools, and validate models to establish common industry practice for planning and operating the bulk power system with increasing energy limitations and disruption risks.
- Assess the effect of electric energy storage on bulk power system planning and operations.
- Review the challenges of transmission development and reliability risks resulting from the changing resource mix.

The LTRA recommends actions by industry to identify, design, and commit flexible resources needed to meet increasing system ramping and variability requirements. The report also recommends that the ERO work with industry to capture the effect of distributed energy resource (DER) development on system analyses.

The shift toward using inverter-based resources may reduce system strength and contribute to subsynchronous resonance and control-interaction issues that should be addressed. System assessments should include short-circuit ratio calculations to identify potential issues.[46] Solutions include control settings that avoid adverse interactions, improved transmission system strength, and the deployment of synchronous condensers.

In addition, a number of NERC groups have been formed to address several reliability issues:

- The Inverter-Based Resource Performance Task Force (IRPTF) shares lessons learned through worldwide experience about the growing amount of resources asynchronously connected.[47] The task force also examines methodologies to determine sufficient levels of ancillary services to address the challenges and potential risks from increasing amounts of DERs.

[46] The *short-circuit ratio* is a measure of the strength of the system in areas where inverter-based resources connect the system. It is calculated as the short-circuit availability divided by the nameplate million volt-amperes (MVA) rating of the IBRs connected to a given bus. Ratios under 3.0 (as is the case in much of Maine), pose particular technical challenges for establishing acceptable control system performance of the interconnecting IBR.

[47] Refer to NERC's "Inverter-Based Resource Performance Task Force," webpage (2019), https://www.nerc.com/comm/PC/Pages/Inverter-Based-Resource-Performance-Task-Force.aspx.

- The System Planning Impacts from Distributed Energy Resources Working Group (SPIDERWG) addresses the effects of the growing penetrations of DERs on bulk power system planning, modeling, and reliability.[48] The SPIDERWG consists of four subgroups focusing on DER: models used in studies, verification of these models, studies of increasing penetration, and coordination with other industry activities to share information.
- The Electric-Gas Working Group (EGWG) will assess the wide range of BES and natural gas interdependency concerns raised in the NERC report, *Special Reliability Assessment: Potential Bulk Power System Impacts Due to Severe Disruptions on the Natural Gas System*.[49] The EGWG will also identify the need for new simulation methods and current best practices as a means to better educate and inform the electric power industry. (Section 7 of ISO-NE's RSP19 discusses New England's energy-security risks in more detail.)
- Other groups are addressing a variety of reliability issues in a number of ways:[50]
    - Assessing resource performance and methods for evaluating resource adequacy to properly account for variable energy resources and DERs
    - Improving system models and analysis to assess the reliability effects of geomagnetic disturbances
    - Providing guidance on system event analysis and application of phasor measurement units (PMUs)[51]
    - Collecting data necessary for modeling and assessing the system
    - Addressing system protection and control issues arising from variable short-circuit availability and high penetrations of inverter-based resources

5.2 Eastern Interconnection Planning Collaborative

Most of the electric power planning coordinators of the Eastern Interconnection, including ISO New England, New York ISO, and PJM, formed the Eastern Interconnection Planning Collaborative (EIPC) in 2009 to address their portion of North American planning issues, combine the existing regional transmission expansion plans, and analyze the interconnection-wide system. Since that time the EIPC has conducted several studies. The *State of the Eastern Interconnection* describes EIPC's planning activities and summarizes results from studies and analyses on the collective transmission plans in the Eastern Interconnection.[52]

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[48] This effort succeeds NERC's Distributed Energy Resources Task Force (DERTF) and Essential Reliability Services Task Force/Working Group (ERSTF/ERSWG).

[49] NERC, *Special Reliability Assessment: Potential Bulk Power System Impacts Due to Severe Disruptions on the Natural Gas System* (November 2017), https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_SPOD_11142017_Final.pdf.

[50] Additional information about these activities is available at https://www.nerc.com/comm/PC/Pages/default.aspx.

[51] A *phasor measurement unit* is a device that measures the electrical waves on the power grid at a remote site using synchronized real-time measurements (i.e., synchrophasors) and global positioning satellite (GPS) technology, which accurately monitor the performance of the grid and provide specific data for operating the system and enhancing its design.

[52] EIPC, *State of the Eastern Interconnection* (October 3, 2018), https://static1.squarespace.com/static/5b1032e545776e01e7058845/t/5bb502d41905f4207c241e4d/1538589397643/EIPC-State+of+the+Eastern+Interconnection+10-3-18.pdf. Also see "Eastern Interconnection Planning Collaborative Completes Report on the State of the Eastern Interconnection, press release (October 4, 2018),

EIPC produces "Roll-Up Reports" that combine the individual plans of each of the major planning coordinators in the Eastern Interconnection.[53] These reports verify that the individual plans function well together to maintain bulk power system reliability throughout the interconnection and identify potential constraints resulting from interconnection-wide power-flow interactions, which provide feedback to inform and enhance regional plans. EIPC has used several power-flow models to analyze various future scenarios of interest to the states and other stakeholders. It also has extensively investigated the gas-electric power system interface and continues sharing important lessons.[54]

EIPC provides information, data, and support regarding planning issues relevant to the Eastern Interconnection to various state and federal agencies (*e.g.,* National Council on Electricity Policy [NCEP], DOE, and FERC).[55] EIPC issued comments to DOE on its *Annual Transmission Data Report* and supported DOE's National Renewable Energy Laboratory (NREL) on the *Eastern Renewable Generation Integration Study*.[56] EIPC has advised NCEP on several issues affecting the electric power industry, such as the means of overcoming challenges posed by the large-scale development of distributed energy resources.

EIPC entities responsible for system planning developed a production-cost model of the Eastern Interconnection. With stakeholder input, EIPC plans to conduct production-costing analyses in the future.

With the addition of inverter-based, nonsynchronous generation and planned synchronous resource retirements, the ability of the Eastern Interconnection (EI) to maintain frequency should be reviewed. The EIPC conducted an analysis that improved the models of system response to frequency events and assessed the 2022 system.[57] The results showed acceptable system performance after fully considering the anticipated retirements of older high-inertia synchronous generators and additions of planned nonsynchronous resources within the Eastern Interconnection.

5.3 ISO/RTO Council Activities

Created in April 2003, the ISO/RTO Council (IRC) is an industry group consisting of the nine functioning ISOs and RTOs in North America.[58] These ISOs and RTOs serve two-thirds of the electricity customers in the United States and more than 50% of Canada's population. The IRC works collaboratively to develop effective processes, tools, and standard methods for improving competitive electricity markets across much of North America. Each ISO/RTO manages efficient,

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https://static1.squarespace.com/static/5b1032e545776e01e7058845/t/5bb503b38165f55177b274f3/1538589619569/Press+Release+EIPC+Completes+State+of+Grid+Report+FINAL+10-4-18.pdf.

[53] EIPC Roll-Up Reports are available at https://www.eipconline.com/eipcstudydocuments.

[54] The final reports from EIPC's work undertaken with the support of DOE is available at https://www.eipconline.com.

[55] The National Council on Electricity Policy has subsumed the activities of the Eastern Interconnection States Planning Council (EISPC); see http://electricitypolicy.org/eispc.

[56] DOE, *Annual US Transmission Data Review* (March 2018), https://www.energy.gov/sites/prod/files/2018/03/f49/2018%20Transmission%20Data%20Review%20FINAL.pdf. NREL, "Eastern Renewable Generation Integration Study," webpage (n.d.), https://www.nrel.gov/grid/ergis.html.

[57] EIPC, *Frequency Response Task Force 2018 Final Report* (February 27, 2019), https://static1.squarespace.com/static/5b1032e545776e01e7058845/t/5ca541769b747a55f8444c03/1554334072121/EIPC_FRTF_2018_Final_Report_Public_Version_EC_Approved_2019-02-27.pdf.

[58] More information on the ISO/RTO Council is available at https://isorto.org/.

robust markets that provide competitive and reliable electricity service, consistent with its individual market and reliability criteria.

While the IRC members have different authorities, they have many planning responsibilities in common because of their similar missions. Each ISO/RTO independently and fairly administers an open, transparent planning process among its participants. These activities include exchanging information, treating participants comparably, resolving disputes, coordinating infrastructure improvements regionally and interregionally, conducting economic planning studies, and allocating costs. This ensures a level playing field for developing infrastructure driven efficiently by competition and meeting all reliability requirements.

IRC members have coordinated on a number of reports, filings, and presentations with national government agencies.[59] The IRC has issued coordinated positions on NERC reports and proposed standards and has submitted FERC filings on issues of common concern for its members, such as interconnection issues under FERC Order No. 845. IRC members also have coordinated on a number of technical issues, including the use of software and the sharing of planning techniques, such as the modeling of distributed energy resources.

5.4 Northeast Power Coordinating Council

The Northeast Power Coordinating Council is one of six regional entities (REs) located throughout the United States, Canada, and portions of Mexico responsible for enhancing and promoting the reliable and efficient operation of the interconnected bulk power system. NERC has authorized NPCC to create regional standards to maintain and enhance the reliability of the international, interconnected BES in northeastern North America. As members of NPCC, NYISO and ISO-NE fully participate in NPCC-coordinated interregional studies with neighboring areas, including PJM which provides study support as may be required.

NPCC assesses seasonal reliability and, periodically, the reliability of the planned Bulk Power System (BPS). It also evaluates annual long-range resource adequacy. All studies are well coordinated across neighboring area boundaries and include the development of common databases that can serve as the basis for internal studies by the ISOs. ISO New England and NYISO assessments demonstrate full compliance with NERC and NPCC requirements for meeting resource adequacy and transmission planning criteria and standards.

NPCC activities also include issuing several special reports and updating guidelines and criteria. One ongoing project will provide guidelines for analyzing DERs in planning studies to capture interactions with the bulk power system. Another establishes methods for identifying busses that must be considered in planning assessments and that require redundant protection schemes.

5.5 Reliability*First*

As one of the eight NERC-approved regional entities in North America, Reliability*First* Corporation (RFC) conducts an annual long-term transmission assessment. This satisfies its responsibility to provide a judgment on the ability of the regional transmission system to operate reliably under the expected range of operating conditions over the applicable assessment period. RFC fulfills this responsibility by examining work already performed according to the planning processes of PJM, Midcontinent Independent System Operator (MISO), Midwest Reliability Organization (MRO), SERC Reliability Corporation, and Virginia-Carolinas Area (VACAR) and studies performed by the Eastern

[59] Refer to the IRC website (2019) at https://isorto.org/#committee-section.

Interconnection Reliability Assessment Group (ERAG).[60] In addition, RFC performs its own long-term transmission assessment in conjunction with affected Transmission Owners, which includes identification, analysis, and projections of trends in transmission adequacy and other industry developments that may have an impact on future electric power system reliability.[61]

[60] Information on the Eastern Interconnection Reliability Assessment Group is available at https://rfirst.org/ProgramAreas/RAPA/ERAG

[61] More information on RFC is available at https://rfirst.org.

6. Summary and Conclusions

Each ISO/RTO develops individual system reliability plans, production cost studies, and interconnection studies mindful of significant interregional impacts. To facilitate interregional coordination and communication among all interested parties, the JIPC and IPSAC were established to implement *the Amended and Restated Northeastern ISO/RTO Planning Coordination Protocol*.

FERC Order No. 1000 affected the coordination of interregional transmission planning, cost allocation, and consideration of public policy requirements. The final rule required all transmission providers to develop further procedures with neighboring regions to provide for the following:

- Sharing information regarding the respective needs of each region and potential solutions to these needs
- Identifying and jointly evaluating interregional transmission facilities that may be more efficient or cost-effective solutions to these regional needs

ISO New England, NYISO, and PJM, with input from their stakeholders and IPSAC, jointly developed and implemented the Amended Planning Protocol and other documents that FERC has determined to comply with the interregional planning principles required by Order No. 1000. The three regions conducted NCSP19 in accordance with these requirements.

Interregional stakeholders, including qualified developers, can participate in regional planning stakeholder processes conducted by ISO-NE, NYISO, and PJM, which identify regional needs and solutions. The interregional planning process provides opportunities for stakeholder review and input to transmission needs and identified solutions that may be more efficient or cost effective than transmission improvements identified in the respective regional plans of PJM, NYISO and ISO-NE.

IPSAC discussions of system needs and a listing of recent projects in ISO-NE, NYISO, and PJM have demonstrated that the ISO/RTOs coordinate with each other on issues that could affect the interregional performance of the overall system (see Section 4). This project listing contains reliability, economic, and system interconnection projects planned by their respective regions. As of the end of 2019, through JIPC, the ISO/RTOs have not identified the need for new interregional transmission projects that would be more efficient or cost effective in meeting the transmission system needs of multiple regions than proposed regional system improvements.

The ISO/RTOs have successfully implemented the Amended Planning Protocol in 2018 and 2019, which has further improved interregional planning among neighboring areas and will continue to do so as part of regional compliance with Order No. 1000. NCSP19 shows that a number of enhancements to the interregional planning process have been achieved, including the timely exchange of needed databases and models required to perform planning studies (*see* Section 3.1). The ongoing nature of planning studies allows the ISO/RTOs to effectively align the timing of their interregional planning activities and studies. Interregional studies for resource adequacy, transmission planning, economic performance, and other issues have been well coordinated through the ISO/RTO interregional planning efforts described in this report. Interregional issues, such as the effects of environmental regulations and the development of renewable/intermittent resources, have also been well coordinated through the JIPC, IRC, and EIPC.

The ISO/RTOs' planning activities are closely coordinated with neighboring systems. This NCSP report demonstrates the collaborative efforts undertaken by ISO-NE, NYISO, and PJM for continued interregional planning. Communication among the members of the JIPC has helped address regional needs as well as neighboring system concerns. Input from the IPSAC has provided additional perspectives in addressing current and future challenges, and stakeholder input will continue to provide valuable contributions in future planning cycles.

7. Acronyms

BES	Bulk Electric System (NERC)
BPS	Bulk Power System (NPCC)
BPTS	Bulk Power Transmission System (NYISO)
CO_2	carbon dioxide
CARIS	Congestion Assessment and Resource Integration Study (NYISO)
CEII	Critical Energy Infrastructure Information
CELT	Capacity, Energy, Loads, and Transmission (CELT Report) (ISO-NE)
CRP	Comprehensive Reliability Plan (NYISO)
CSPP	Comprehensive System Planning Process (NYISO)
DER	distributed energy resource
DOE	US Department of Energy
EGWG	Electric-Gas Working Group (NERC)
EI	Eastern Interconnection
EIPC	Eastern Interconnection Planning Collaborative
EPA	US Environmental Protection Agency
ERAG	Eastern Interconnection Reliability Assessment Group
ERO	Electric Reliability Organization
ESPWG	Electric System Planning Working Group (NYISO)
FERC	Federal Energy Regulatory Commission
HVDC	high-voltage direct-current
IESO	Independent Electric System Operator of Ontario
IPSAC	Interregional Planning Stakeholder Advisory Committee
IRC	ISO/RTO Council
IRPTF	Inverter-Based Resource Performance Task Force (NERC)
ISO	Independent System Operator
ISO-NE	Independent System Operator of New England
ISO/RTO	Independent System Operator/Regional Transmission Organization
JIPC	Joint ISO/RTO Planning Committee
kV	kilovolt
LOLE	loss-of-load expectation (analysis)
LTRA	long-term reliability assessment (NERC)
MISO	Midcontinent Independent System Operator
MMWG	Multiregional Modeling Working Group (NERC/EIPC)
MRO	Midwest Reliability Organization
NAT	North American Transmission
NCSP	Northeastern Coordinated System Plan
NEPOOL	New England Power Pool (ISO-NE)
NERC	North American Electric Reliability Corporation
NOPR	notice of proposed rulemaking (DOE and FERC)

NPCC	Northeast Power Coordinating Council
NREL	National Renewable Energy Lab
NYES	New York Energy Solution (NYISO)
NYISO	New York Independent System Operator
NYPA	New York Power Authority
NYSPSC	New York State Public Service Commission
NYSRC	New York State Reliability Council
OATT	Open Access Transmission Tariff
PAC	Planning Advisory Committee (ISO-NE)
PMU	phasor measurement unit
PTO	Participating Transmission Owner (ISO-NE)
PV	photovoltaic
RE	Regional entity
RFC	Reliability*First* Corporation
RNA	Reliability Needs Assessment (NYISO)
ROFR	right-of-first-refusal
RPP	Reliability Planning Process (NYISO)
RSP	Regional System Plan (ISO-NE)
RTEP	Regional Transmission Expansion Plan (PJM)
RTO	Regional Transmission Organization
SERC	SERC Reliability Corporation
SPIDERWG	System Planning Impacts from DER Working Group (NERC)
TEAC	Transmission Expansion Advisory Committee (PJM)
Transco	New York Transco, LLC
UPNY/SENY	upstate New York/southeast New York (NYISO)
VACAR	Virginia-Carolinas Area