ConOp

A --- Controllable Lines

Concept of Operation

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1. Introduction

COO 619 previously described the concept of operations for the NYISO business systems required for commercial operation of a particular controllable line, the Cross Sound Cable. This concept of operations identifies the generalized business system requirements for commercial operation of controllable lines that interconnect with the NYISO transmission grid, but whose schedules or settings are not jointly optimized by the NYISO in conjunction with other schedules over that interface in the case of MTF's interconnecting with adjacent control areas, or in conjunction with the rest of the NYISO coordinated transmission grid in the case of MTF's internal to the NYISO.

This concept of operations therefore applies to two situations. First, the situation in which another entity determines the schedules on the controllable line and provides those schedules to the NYISO. In this case the NYISO would perform security analysis but would not adjust the level of schedules over the controllable line based on economics. Second, a situation in which MPs can submit both bids and schedules on the controllable line but the set of MPs that can submit bids and schedules on the controllable line is restricted, and thus the NYISO does not jointly optimize schedules on the controllable line and overall control area interface.

2. Definitions and Abbreviations

Item	Description
ATC	Available Transmission Capacity
BME	Balancing Market Evaluation
CRG	Customer Relations Group
DNI	Desired Net Interchange
HVDC	High Voltage Direct Current
IS+	The Interchange Scheduling Package
MIS	Market Information System
MP	Market Participant
MTF	Merchant Transmission Facility
NERC	North American Electric Reliability Council
NYCA	NY Control Area
OASIS	Open Access Same Time Information System
PI	Plant Information, an application that collects real-time time-series data
PTF	Power Transmission Facility
SCUC	Security Constrained Unit Commitment

3. Discussion

3.1 Background

3.2 Objective

Development of NYISO systems required for commercial operation of controllable lines other than the Cross Sound Cable.

3.3 Scope and Deliverables

The following is a high-level overview of the projected scope and deliverables of this project:

- Parties will be able to submit schedules and/or offer prices for transactions on the controllable lines.
- An additional proxy bus will be modeled for each controllable line.
- Parties will have the ability to bid in both directions on controllable lines.
- If appropriate, MIS will be updated to reflect parties that are qualified to bid transactions on the controllable line.
- In the case of controllable lines interconnecting with adjacent control areas, scheduling procedures will be developed in coordination with the other control areas.
- Definition of security issues (i.e., ramping limits).
- Installation of required metering and sign verification.
- Definition of possible changes to interchange accounting and load calculations.
- Modifications to dispatchers' displays.
- System model modifications.
- Revision to *NYISO Facilities Requiring Coordination and Notification in NYISO Operating Manuals*

3.4 System Impact

3.4.1 Functional Business Units

The following NYISO functional business units will be impacted by this project:

- Market Services
  - The following manuals may require updating: *Emergency Operations, Outage Scheduling, and Transmission and Dispatching Operations*.
  - Customer registration procedures will require modification.
- Operations and Reliability
  - Display changes will be required.
  - Operating Instructions and Procedures will require updating.
  - Scheduling procedures will require development.
  - Operating procedures will need to be incorporated into NYISO dispatcher training.
- Billing and Accounting

3.4.2 NYISO Systems

The following NYISO systems will be impacted by this project:

- NYISO Website: In the MIS and OSS Upload/Download interface an application will need to be developed to pull approved ISO-NE transactions from the NE OASIS.
- MIS and OSS: The database will need to be updated for customers approved to bid transactions on the controllable line.
- BAS:
  - Addition of PTIDs to the sub-zone load tables.
  - Inclusion of PTIDs in relevant templates for download of MWh and settlement data.
- Mainframe/Spider:
  - Addition of a proxy in the unit commitment models (SCUC and BME).
  - Addition of PTIDs to PTS.
  - Addition of the controllable line to the State Estimator.
  - Addition of controllable line data to PI.

4. Description

4.1 Creation of Additional Proxy Buses

An additional external proxy bus would be created for each controllable line connecting with adjacent control areas and MPs could submit offers or transaction schedules to or from this proxy via the MIS or OSS for transactions desired across the controllable line. The model would involve creating a new Control Area radially connected to NY but physically separated from the existing adjacent Control Area. It would be similar to the model used for the HQ Chateauguay connection. A clearing price would be calculated on this bus, independent of the major proxy for the adjacent Control Area.

This functionality associated with the CSC project was designed to allow for additional new external proxy bus scheduling nodes in any of the four existing neighboring control areas.

4.2 Identification of Parties Qualified to Bid

In some cases, only certain MPs may be eligible to offer or schedule transactions on a particular controllable line. Therefore, the CRG will need the ability to indicate which MPs are qualified and update the MIS appropriately. Transactions scheduled on each controllable line will be uniquely identified in IS+.

4.3 NYISO Joint Scheduling Procedures

4.3.1 Scheduling Prior to the Schedule Hour:

Third parties seeking service on the controllable line, which is an MTF, are required to make appropriate reservation requests. For scheduling transactions prior to the schedule hour on the controllable line, the procedure would be as follows.

Schedule Day Minus 1:

- The controllable line will be modeled as a full proxy bus. **[Should virtual transactions be permitted at these proxy buses?]**
- Prior to 0500, the NYISO will pull the list of transactions that have valid transmission reservations and could be scheduled in the DAM over the controllable line. These will be evaluated by the SCUC for the DAM. The cutoff time for making this list available will be determined.

- The NYISO posts the DAM schedule by 1100. As part of the DAM posting, the adjacent control area will receive an hourly schedule of scheduled transfers on the controllable line.
- Prior to 1600, the NYISO checkout procedure for the DAM occurs. This includes verification of the scheduled hourly transactions on the controllable line. Subsequent to checkout, the NYISO will inform the operator of the MTF of the final DAM hourly schedules for the controllable line.

Schedule Day:

- 90 minutes prior to market close, the NYISO will pull the list of transactions eligible to offer transactions on the controllable line in the real-time market. Included in this information will be the required NERC tags. These will be evaluated by BME for the real-time market.
- 75 minutes prior to the hour, the NYISO initiates the BME for the schedule hour.
- 30 minutes prior to the hour, BME posts the schedules for the upcoming hour.
- After BME posts, NYISO and the adjacent control area undergo checkout procedures for the upcoming hour. Any transactions that do not pass checkout are not scheduled. The agreed-upon schedule is loaded for the hour.
- Controllable line is ramped to the new schedule from 5 minutes of to 5 minutes after the hour.

4.3.2 In-hour Schedule Changes

In general, the NYISO and the adjacent control will agree to redispatch their systems to maintain schedules on controllable lines. In LMP based systems, the cost of this redispatch will be reflected in the price of energy at the point of injection and withdrawal. In other systems, alternative cost recovery mechanisms may be required but that is not a concern of the NYISO, as long as the other control area redispatches to support the schedules.

In the event an in-hour schedule change is required, the NYISO will coordinate the change with the adjacent control area and MTF operator to make the change.

Formal notification procedures for in-hour schedule changes will need to be developed, which will include the following:

- Coordination of the NYISO, adjacent control area, MTF operator and affected TOs for various scenarios.
- Specification of the number of MWs required, direction of change, ramp rate and time of change initiation.
- Communication among the parties for various scenarios.
- Conditions when parties other than the above need to be notified.
- Conditions when defined procedures may be deviated from, such as an extreme emergency (risk to life or equipment). Post-event communication procedures will be defined for these cases.
- Post-event notification and coordination procedures, which will include schedule verifications.

In the event that actual flows over a controllable line differ from hourly schedules, the NYISO markets will settle based on the actual flows over the controllable line. Thus, if actual deliveries are less than schedules, only the actual deliveries will be compensated based on the proxy bus price for the controllable line.[1]

Curtailment and settlement procedures will need to be developed.

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[1] Provisions will be established for each controllable line governing the allocation of settlement revenues across the entities scheduling on a controllable line in the event actual flows are not consistent with schedules.

4.4 Inadvertent Accounting and Load Calculation

To avoid creating an additional neighboring Control Area, each controllable line will be included in the NYISO actual and scheduled net interchanges with the relevant adjacent control area. The NYISO DNI will include the controllable line proxy bus schedules and the NYCA Actual Net Interchange will include actual controllable line flows.

In the calculation of NYCA loads, the controllable lines will be treated as a tie line.

4.5 Metering and Sign Verification

Metering required to properly monitor and operate the controllable line will need to be identified. Quantities to be metered and required granularity will be determined. Upon installation, readings will need to be verified for accuracy and that they conform to NYISO sign convention.

4.6 LBMP Determination

In most circumstances, energy scheduled and delivered over a controllable line will be priced as if delivered into the NYISO from a generator located at the delivery point of the controllable line or withdrawn from the NYISO by a load located at that point. There are two circumstances in which this would not be the case. The first circumstance is that in which the outage of the controllable line is one of the binding contingencies.[2] The second circumstance is that in which the pre- or post-contingency flows over the controllable line are a binding constraint.[3]

In the circumstance in which the outage of the controllable line is one of the binding contingencies, energy scheduled and delivered over the controllable line would receive the same price as energy scheduled from the main proxy bus. In the circumstance in which pre- or post-contingency flows over the controllable line are a binding constraint, the price would be determined in one of two ways depending on the rules applicable to the individual controllable line. If the rules applicable to the controllable line required the NYISO to reduce schedules to a reliable level based on bids, then the price paid for energy delivered pursuant to the accepted schedules would be determined by the accepted bids and offers over the controllable line. If the rules applicable to the controllable line required the NYISO to reduce schedules to a reliable level based on a non-price mechanism, then the accepted schedules would be settled based at the LBMP price at the point of delivery to or withdrawal from the NYISO transmission grid (i.e. as if the net injections were delivered by a generator at that location or withdrawn by a load at that location).

In any case, the pricing of energy delivered over the controllable line would be governed by the fundamental LBMP pricing equation:

$$P_i = (1 + L_i)\, P_{ref} + \Sigma_j \Sigma_k SP_{jk}\, SF_{jki}; \qquad [1]$$

where

P_i = Locational price at Bus i;

L_i = Marginal loss factor at Bus i;

P_{ref} = Locational price at the reference bus;

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[2] It is anticipated that DC lines will generally be sized such that their outage would normally not be the binding contingency, but such a situation may nevertheless arise from time to time. This situation may be more frequent for PAR controlled lines.

[3] It is anticipated that this situation would also be somewhat unusual, particularly in the case of DC lines, as the entity scheduling the line or allocating access to the line, would normally not accept schedules or allocate access in excess of the capacity of the line. This circumstance would be more common for PAR controlled line as the scheduling entity would not be able to account for the post contingency flows on the line.

SP_{jk} = Shadow price of constraint j in contingency k; and

Sf_{jki} = Shift factor for real load at Bus i on constraint j, in contingency k.

The special consideration in applying the LMP pricing equation to deliveries over controllable lines is that energy scheduled to flow over a controllable line would be priced as a distinct proxy bus, i.e., energy schedule to flow over a controllable line would be modeled distinctly from energy injected by generation at the point of delivery from the controllable line and distinctly from power injected at the source of the controllable line and delivered over free-flowing ties. Thus, distinct prices would be calculated for deliveries of energy over a controllable line to a bus and from a generator at that bus, and the prices could differ, depending on the binding constraints and contingencies. In circumstances in which the proxy bus price for energy delivered over the controllable line was lower than the generator price at the delivery point of the controllable line, there would a congestion charge for deliveries scheduled over the controllable line. Conversely, if the proxy bus price for energy scheduled to flow over the controllable line was equal to the price at the delivery point of the controllable line, there would be no congestion charge for deliveries scheduled over the controllable line.

Similarly, the proxy bus price for energy injected at a given point[4] and scheduled to flow over a controllable line would be distinct from the proxy bus price for energy injected at the same point but flowing over open ties. Thus, in circumstances in which there was transmission congestion limiting deliveries over the open ties but not over the controllable line, the price of energy delivered over the controllable line could be higher and the congestion charge lower within the receiving control area than for energy delivered over the open ties.

In general, the price of energy delivered over a controllable line would be greater than or equal to the price of power generated at the point of delivery and could be higher than the price of energy injected at the source of the controllable line but flowing over the open ties if the outage of the controllable line were not a binding contingency. If the outage of the controllable line were the only binding contingency, then price of energy delivered over the controllable line would be less than the price of power delivered from a generator at the delivery point and less than or equal to the price of energy injected at the source of the controllable line but flowing over the open ties. If the outage of the controllable line were one of two or more binding contingencies, then price of power delivered over the controllable line could be less than or greater than the price of power delivered from a generator at the delivery point.

4.7 Billing and Settlement

4.7.1 Primary Service

4.7.2 Secondary Service

Administrative charges for NYISO scheduling and posting services to address secondary transmission service will be determined and included in the appropriate billing and settlement procedures.

4.8 ICAP/UCAP Treatment

[4] This point could either be another control area or the source bus of the controllable line.

4.8.1 UDR

4.8.2 General DAM/RT Scheduling Requirements

5. Issues, Positions, and Resolutions

5.1 Security Issues

5.1.1 Ramping

Although addressed for the test period, certain ramping issues will require resolution prior to commercial operation:

- What will be the maximum amp limit on the controllable line?
- Will ramp limits be directional?
- Will ramp limits be limited by a Control Area's total ramp limit, or will it be independent?
- What conditions on Long Island may limit the ramp?
- What conditions internal to the NYCA may limit the ramp?
- If system conditions warrant restricting the ramp limit, procedures for notifying affected parties will need to be developed.

Some of these issues will be addressed in OSS.

5.1.2 Emergency Transactions

The controllable line may be used for Emergency Transactions between the NYISO and adjacent control areas, requiring resolution of various issues:

- Will the NYISO import emergency power only for emergencies in certain areas?
- Will there be cases when emergency transactions are scheduled between another control area and the NYISO where only a portion is scheduled on the controllable line and the remainder across the free-flowing ties?
- Emergency transactions (or portions of them) scheduled on the controllable line should be priced according to the controllable line proxy bus price. This may require a revision to the Interconnection Agreement.