

Style Definition: H3ItalicsHdr:  
Space Before: 12 pt, After: 10 pt

*Draft*  
*for discussion purposes only*

# *Ancillary Services Manual*

*November 2005*

---

### 3. VOLTAGE SUPPORT SERVICE

This section describes the voltage support service (VSS).

#### 3.1 Description

In order to maintain transmission voltages on the NYS Transmission System within acceptable limits, generation facilities under the control of the NYISO are operated to produce (or absorb) reactive power. Thus, Reactive Supply and Voltage Control Service (“Voltage Support Service”) must be provided to support all Transactions on the NYS Transmission System. The amount of VSS that must be supplied will be determined based on the reactive power support necessary to maintain transmission voltages within limits that are generally accepted in the region and consistently adhered to by the NYISO.

Formatted: Highlight

Formatted: Highlight

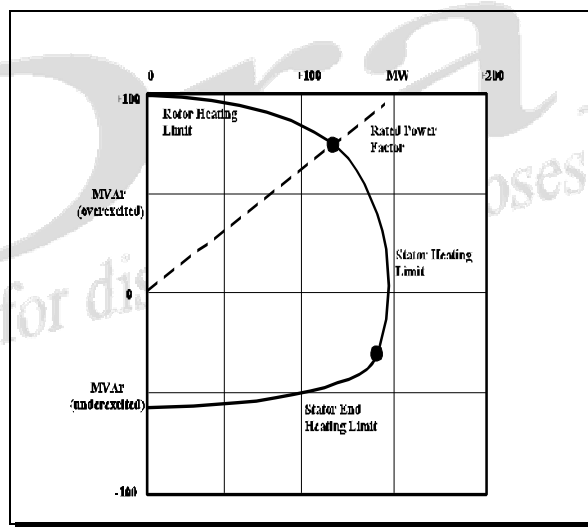


Figure 3.1: Generator MVAR versus MW Capability

The ability of a generator to produce or absorb reactive power (MVAR) is limited by generator heating considerations. At full load, a generator is able to produce or absorb a relatively small amount of reactive power. As the generator’s production of real power decreases, its ability to produce or absorb reactive power increases. Figure 3.1, called a capability curve or a D-Curve, is representative of generators limiting characteristics. The capability curve can “shrink” with heating and “expand” with cooling of the machine.

Formatted: Highlight

[Note: The generator’s capability curve (D-curve) can “shrink” with heating and “expand” with cooling of the machine.]

Formatted: Font: Bold

### 3.2 Responsibilities for Service

The NYISO directs the Supplier's Resources to operate within their tested reactive capability limits. The scheduling of VSS is the responsibility of the NYISO.

Deleted: Generating

Formatted: Highlight

- NYISO — The NYISO coordinates the NYS Power System voltages throughout the NYCA.
- Transmission Owners — Transmission Owners are responsible for the local control of the reactive power resources that are connected to their network.
- Suppliers — To qualify for payments, Suppliers of VSS must provide a Resource that has an Automatic Voltage Regulator and has successfully performed Reactive Power (MVAR) capability testing in accordance with the NYISO Procedures and prevailing industry standards. Suppliers are expected to operate their Resources within these demonstrated reactive capability limits. VSS includes the ability to produce or absorb Reactive Power within the Resource's tested reactive capability range, and the ability to maintain a specific voltage level as directed by the NYISO and the Transmission Owner System Operator, under both steady-state and post-contingency operating conditions subject to the limitations of the Resource's tested reactive capability.

### 3.3 Payment for Service

This section describes the payments for VSS and covers the following:

- Method for determining payment
- Payments made to suppliers of VSS
- Payment for lost opportunity cost
- Payments made by transmission customers and LSEs

Formatted: Font: 9 pt

Formatted: spacer

For more information, see NYISO Accounting & Billing Manual.

Deleted: <#>Payments for VSS by non-utility generators¶

Formatted: Font: Bold, Italic, Highlight

Formatted: Highlight

#### 3.3.1 Method for Determining the Payments for Voltage Support Service

Payments to synchronous generators and synchronous condensers eligible for VSS are based upon a fixed dollar amount per MVAR as specified in the NYISO Market Services Tariff Rate Schedule 2 and MVAR the gross lagging capability as determined by annual capability testing performed by the generator and verified by the NYISO.

Deleted: G

#### 3.3.2 Payments made to Suppliers for Voltage Support Service

The rate provided in Rate Schedule 2 shall be used to calculate payments to all eligible Suppliers providing VSS as applied on a Resource-specific basis. The NYISO shall calculate the payments on an annual basis, as the product of the compensation rate specified in Rate Schedule 2 and the gross lagging MVAR capability as demonstrated by actual test in the preceding calendar year. The NYISO shall make payments to Suppliers on a monthly basis. Suppliers whose Resource(s) meet the requirements to supply Installed Capacity and are under contract to supply Installed

Deleted: and

Capacity receive one-twelfth the annual payment for VSS except as noted below for Non-Utility Generators. Suppliers whose Generators are not under contract to supply Installed Capacity and Suppliers with synchronous condensers receive one-twelfth the annual payment pro-rated by the number of hours that Generator or synchronous condenser operated in that month, as recorded by the NYISO.

For Non-Utility Generators that are operating under existing power purchase agreements, the entity that is purchasing Energy and/or Capacity under such agreement or providing Transmission Service under that agreement is contacted by the NYISO when the NYISO requires VSS from the contracted Resource.

Formatted: Highlight

### 3.3.3 Payments for Voltage Support Service Provided by Non-Utility Generators with Existing Power Purchase Agreements

The NYISO pays each holder of a contract for a Non-Utility Generator operating under an existing power purchase agreement, which provides VSS.

- If that non-utility Generator provides installed capacity, the NYISO will pay it the product of: (1) one -twelfth of the annual \$/MVar rate for NYISO payments to Suppliers of VSS and (2) the lesser of the tested Reactive Power production capability (MVar) of the Non-Utility Generator or the contract MVar capability.
- If that non-utility Generator does not provide Installed Capacity, the NYISO will pay it the product of (1) and (2), as calculated above, multiplied by the number of hours in the month the Non-Utility Generator provided VSS divided by the number of hours in the month.

The NYISO calculates and makes payments on a monthly basis.

### 3.3.4 Payments for Lost Opportunity Cost

A Supplier providing VSS from a Generator that is In-Service is entitled to receive Lost Opportunity Costs (LOCs) in the event the NYISO dispatches or directs the Generator to reduce its real power (MW) output in order to allow the unit to produce or absorb more reactive power (MVar).

The method for calculating LOC is based on the following:

- Real-Time LBMP
- Original dispatch point
- New dispatch point
- Bid curve of Generation supplying VSS

Figure 3.3.4 graphically portrays the calculation of the LOC for a Generator that reduced its MW output to allow it to produce or absorb more reactive power (MVar).

Formatted: Default Paragraph Font

Deleted: 3.2

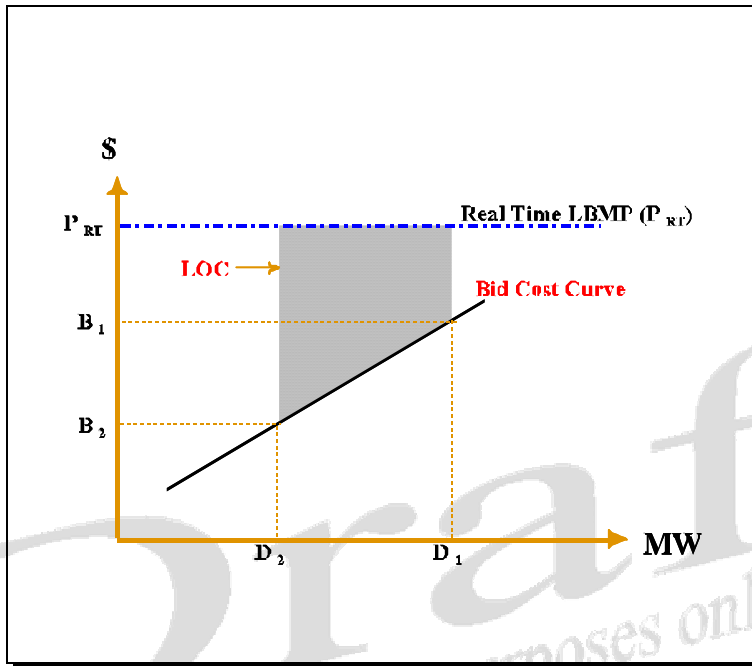


Figure 3.3.4-1: Method for Calculating LOC

$$LOC = P_{RT} (D_1 - D_2) - \int_{D_2}^{D_1} Bid$$

Where:  $P_{RT}$  = Real Time LBMP  
 $D_1$  = Original Dispatch Point  
 $D_2$  = New Dispatch Point  
 Bid = Bid curve for generation supplying voltage support services

### 3.3.5 Payments made by Transmission Customers and LSEs

- Transmission Customers and Load Serving Entity (LSEs) taking service under the NYISO OATT pay the NYISO for VSS associated with energy withdrawals from the transmission system in accordance with Rate Schedule No. 2 of the OATT.

## 3.4 Failure to Perform by Suppliers

A resource will have failed to provide voltage support if it:

- fails at the end of 10 minutes to be within 5% (+/-) of the requested reactive power (VARs) level of production or absorption as requested by the NYISO or applicable Transmission Owners for levels below the resource's demonstrated reactive power capability at Dependable Maximum Net Capability (DMNC).

Deleted: 2

Formatted: Highlight

Deleted: The NYISO computes the VSS Rate as follows:  
 The sum of the projected NYISO payments to Suppliers providing Voltage Support including:  
 <#>total annual costs eligible for payment.  
 <#>any applicable Lost Opportunity Costs to provide VSS.  
 total of prior year payments to Suppliers of VSS less the total of payments received by the NYISO from Transmission Customers and LSEs in the prior year for VSS (including all payments for penalties).

Deleted: <#>This sum is divided by annual forecasted transmission usage for the year as projected by the NYISO, including Load within the NYCA, Exports, and Wheels Through.  
 Transmission Customers engaging in Wheels-Through or Exports pay to the NYISO a charge for this service equal to the rate as determined above multiplied by their Energy wheeled in the hour.  
 Load Serving Entities serving loads in the NYCA pay to the NYISO a charge for this service equal to the hourly rate as determined above multiplied by the Energy withdrawn from the transmission system in order to serve that LSEs Load in the hour.  
 The NYISO calculates the payment hourly and bills each Transmission Customer or LSE monthly.

Formatted: spacer

Formatted: Font: 9 pt

- 2) fails at the end of 10 minutes to be at 95% or greater of the resource's demonstrated reactive power capability (tested at its Normal Operating Limit or at 90% of its DMNC, whichever is greater in MW) in the appropriate lead or lag direction when requested to go to maximum lead or lag reactive capability by the NYISO or applicable Transmission Owner.
- 3) fails to automatically respond, following a system contingency, to produce (or absorb) the reactive power required in accordance with published NYISO (or Transmission Owner) system operating studies.
- 4) fails to maintain its automatic voltage regulator (AVR) in service and in automatic voltage control mode, or fails to commence timely repairs to the AVR.

Any resource that fails to provide voltage support when it is being paid to provide voltage support and is not otherwise excused pursuant to a forced outage, derate or maintenance outage as addressed in Section 3.6.2 will be penalized in accordance as described below.

Formatted: Highlight

### 3.4.1 Failure to Respond to NYISO's Request for Steady State Voltage Control

- a) An installed capacity supplier of voltage support that fails to provide steady-state voltage support on a given day will forfeit 1/12th of the annual payment that resource would have received for providing voltage support, and must reimburse the NYISO for any lost opportunity costs paid to replacement sources of steady-state voltage support.
- b) A non-installed capacity supplier of voltage support that fails to provide steady-state voltage support on a given day will forfeit the voltage support payment received by that resource in the last month in which that payment was positive (as a proxy for 1/12th of the annual payment that resource would have received for providing voltage support), and must reimburse the NYISO for any lost opportunity costs paid to replacement sources of steady-state voltage support.
- c) A Resource will be disqualified as a supplier of voltage support after it fails to provide steady-state voltage support on three separate days within a 30-day period.

Deleted: provider

Formatted: Highlight

Deleted: provider

Formatted: Highlight

Deleted: provider

Deleted: provider

### Reinstatement of Payments

The NYISO may reinstate payments once the Supplier complies with the following conditions to the NYISO's satisfaction:

- the Supplier's Resource must successfully perform a Reactive Power (MVar) capability test, and
- the Resource must provide VSS for 30 consecutive days without any compliance failures. No payments for VSS or LOC are made to the Supplier during this period.

### 3.4.2 Failure to Provide Voltage Support Service when a Contingency Occurs on the NYS Power System

- a) An installed capacity supplier of voltage support that fails to provide voltage support following a contingency on a given day will forfeit 1/12th of the annual payment that resource would have received for providing voltage support on the first such occurrence, and 1/4th of the annual payment that resource would have received for providing voltage support on the second such occurrence. Generators that fail to provide voltage support following contingencies will not be charged lost opportunity costs for replacement sources of voltage support because there will not be enough time to arrange for replacement sources.
- b) A non-installed capacity supplier of voltage support that fails to provide voltage support following a contingency on a given day will forfeit the voltage support payment received by that resource in the last month in which that payment was positive (as a proxy for 1/12th of the annual payment that resource would have received for providing voltage support) on the first occurrence. Additionally, it will forfeit the payment received by that resource in the last three months in which those payments were positive (as a proxy for 1/4th of the annual payment that resource would have received for providing voltage support) for the second failure.
- c) A Resource will be disqualified as a supplier of voltage support after it fails to provide voltage support following a contingency on two separate occasions within a 30-day period.

Deleted: provider

Deleted: provider

Deleted: provider

Deleted: provider

#### ***Reinstatement of Payments***

In addition, the Supplier that is in violation is prohibited from receiving VSS payments for the non-complying Resource until the Supplier complies with the following conditions to the NYISO's satisfaction:

- the Supplier's Resource successfully performs a Reactive Power (MVAR) capability test, and
- the Resource provides VSS for 30 consecutive days without any compliance failures. No payments for VSS or LOC are made to the Supplier during this period.

### **3.4.3 Failure to Maintain Automatic Voltage Regulator in Service**

- a) A Resource will be disqualified as a supplier of voltage support after it fails to maintain the automatic voltage regulator in operation and fails to commence timely repairs following a failure of the automatic voltage regulator within a 30-day period.

Formatted: Heading 3

Formatted: spacer

Formatted: a-c, Numbered + Level: 1 + Numbering Style: a, b, c, ... + Start at: 1 + Alignment: Left + Aligned at: 1.25" + Tab after: 1.5" + Indent at: 1.5"

Formatted: H3ItalicsHdr

#### ***Reinstatement of Payments***

The Supplier will not receive Voltage Support Service payments for the disqualified Resource until the Supplier complies with the following conditions:

- the Supplier provides documentation to the NYISO of the completion of the repairs.

Formatted: H3BULLET

- the Supplier's Resource successfully performs a Reactive Power (MVar) capability test and
- the Resource provides Voltage Support Service for 30 consecutive days without any compliance failures. No payments for Voltage Support Service or LOC are made to the Supplier during this period.

Formatted: Bullets and Numbering

Formatted: spacer

### 3.5 Generator Reactive Capability Testing

The purpose for capability testing is to establish a uniform procedure of determining, confirming, and documenting the reactive capability of resources for real-time system voltage control, and provides the basis for compensation to suppliers of voltage support service. This procedure provides the NYISO with accurate and timely information on the reactive capability of the generating units.

Deleted: generators used

Deleted: .

#### Units to be Tested

All resources that participate in Voltage Support Service must be tested in accordance with this procedure. All tests will be coordinated with the NYISO and the Transmission Owner in whose service territory the unit is located. Test data reports must be submitted electronically within five (5) business days of the test to the NYISO for review and, upon acceptance, will be incorporated into the appropriate databases.

Deleted: are used for

Deleted: by

Formatted: Highlight

Deleted: for any unit will be accepted

Deleted: and

#### Definitions

**Lagging MVar** — Reactive power that is generated out of a generator and into the power system. By convention, lagging MVar is a positive (+) number.

**Leading MVar** — Reactive power that is absorbed by a generator out of the power system. By convention, leading MVar is a negative (-) number.

#### 3.5.1 Frequency of Testing

Each synchronous generator and synchronous condenser providing voltage support service must be tested at least once each calendar year to demonstrate maximum lagging and leading MVar capability. The demonstrated Gross Lagging MVar capability will be the basis for compensation in the next compensation (calendar) year.

Deleted: this

Formatted: Font: Italic

Lagging MVar and Leading MVar capability testing must be performed only during the Summer capability period (May 1 through October 31, inclusive). Failure to perform required testing will result in the disqualification of the unit(s) in the next compensation year.

Deleted: can be demonstrated any time during the year while lagging MVar capability can be tested

Deleted: peak load

Deleted: of the year for the Transmission District where that resource is located. More frequent tests may be performed by the Suppliers

#### 3.5.2 Test Procedure for Generators

Each Supplier has the responsibility to perform and report reactive capability testing on its respective units. The tests are to be carried out under normal operating conditions. Extreme measures are not to be taken to avoid overstating a unit's

Deleted: forfeiture of the voltage support payments

Deleted: .

Deleted: conduct



normally expected reactive capability. Both leading and lagging MVAR are to be measured at the generator terminal (gross) and at the point of interconnection (net). Measurements should be made with the unit operating with normal hydrogen pressure (or other normal coolant conditions). The Transmission Owner System Operator is responsible for coordinating the test with the respective plant. Each Transmission Owner System Operator notifies the NYISO at least one hour prior to the initiation of generator MVAR testing. The NYISO in turn notifies any other affected Transmission Owners.

Deleted: terminals

Formatted: Highlight

Formatted: Highlight

Deleted: all

Formatted: Highlight

### Annual Tests

It is the responsibility of the supplier to submit appropriate bids in the NYISO Day-Ahead Market such that the unit will be operating at the appropriate MW level for all tests. The Lagging MVAR test should be performed during the on-peak period of the load cycle, and the Leading MVAR test should be performed during the off-peak period of the load cycle.

To test maximum lagging MVAR capability, the unit being tested must be operated at or above 90% of its Demonstrated Maximum Net MW Capability (DMNC). The unit is then moved to maximum lagging MVAR and held at this point for a minimum of one hour.

Deleted: normal

Deleted: Operating

To test maximum leading MVAR capability, the unit being tested is operated at its normal MW low limit. The unit is moved to maximum leading MVAR and held at this point for a minimum of one hour.

Deleted: VAR

For Nuclear units and units with normal MW low limits equal to normal MW operating capability, both leading and lagging MVAR capability are tested with the unit operating at its normal MW operating capability. Maximum lagging and leading MVAR test points are held for a minimum of one hour each.

### Test Results

Attachment A shows the form that is used to document the test results that are submitted by the Supplier to the NYISO within five (5) business days after the test. The test report shall include the supporting performance data, and must be submitted electronically. If the lagging and leading MVAR capability tests are performed on different dates, then the results can be submitted separately.

Formatted: Highlight

### 3.5.3 Test Procedure for Synchronous Condensers

Each synchronous condenser providing this service will be required to demonstrate the maximum leading and lagging MVAR capability it can maintain for one hour.

Formatted: spacer

### **3.5.4 Allowance for Out-of-period Reactive Capability Testing**

There are three (3) conditions where NYISO will provisionally accept testing for Voltage Support Service when that test is not conducted within the specified Summer Capability Period:

- A new resource entering commercial operation, or
- An existing provider's resource returning to service from an extended forced outage, or
- An existing resource becoming eligible to qualify as a VSS supplier.

#### **Initial Qualification of New Resource**

For a new resource entering commercial service and requesting qualification as a Voltage Support Service supplier, the resource must complete the annual test requirements within thirty (30) days of entering service, and forward the completed test report, in electronic form, to NYISO within five (5) business days of the completion of that test. The resource shall also provide, in writing, the required documentation of the resource's reactive capability and automatic voltage regulator.

#### **Existing Resource returning from Extended Forced Outage**

An existing supplier's resource returning to service following an extended forced outage must complete the annual test requirements within thirty (30) days of returning to service, and forward the completed test report, in electronic form, to NYISO within five (5) business days of the completion of that test.

#### **Existing Resource becoming eligible as a VSS Supplier**

If, as the result of equipment upgrades or changes in qualification requirements, an existing supplier's resource becomes eligible, the Supplier must complete the annual test requirements within thirty (30) days of the effective date of the change in qualification requirement or equipment upgrade, and forward the completed test report, in electronic form, to NYISO within five (5) business days of the completion of that test.

#### **Follow-up Testing Requirement**

For any of the above conditions, the following conditions and requirements apply:

The NYISO will accept the demonstrated lagging MVAr capability as the basis for compensation on a provisional basis until the beginning of the next Summer Capability Period.

To continue qualification to receive VSS payments the resource is required to perform a complete annual test within thirty (30) days of the start of the Summer Capability Period, and forward the completed test report, in electronic form, to NYISO within five (5) business days of the completion of that test.. This "in period"

Formatted: Heading 3

Formatted: H3 Text

Formatted: H3BULLET

Formatted: H3ItalicsHdr

Formatted: H3 Text

Formatted: H3ItalicsHdr

Formatted: H3 Text

Formatted: H3ItalicsHdr

Formatted: H3 Text

Formatted: H3ItalicsHdr

Formatted: H3 Text

test will also qualify the resource for continued participation in the VSS in the next compensation year.

Formatted: spacer

### 3.6 Voltage Support

The following procedures apply to VSS.

#### 3.6.1 Request for Voltage Support Service

The NYISO may request corrective actions from voltage support facilities that are already in service and available. The procedures for Real-Time voltage control are covered in the NYISO Emergency Operations and Transmission & Dispatching Operations Manuals.

Formatted: Font: Bold

Formatted: Font: Bold

Deleted: Automatic

Deleted: Regulator

#### 3.6.2 Voltage Support Availability

##### Supplier Actions:

The supplier is obligated to provide timely notification of any operational restrictions that may limit the voltage support capability.

The supplier must perform the following:

- 1) The Automatic Voltage Regulator (AVR) shall be maintained in service in automatic voltage regulation mode at all times, unless instructed otherwise by the NYISO or the Transmission Owner System Operator.
- 2) Provide immediate notification to the NYISO through the Transmission Owner System Operator whenever the AVR, or any other equipment necessary for maintaining the resource's demonstrated reactive power capability (including, but not limited to, auxiliary cooling systems, exciters, etc.) is forced out of service or derated or prior to removal from service for scheduled maintenance.
- 3) Notify the NYISO and Transmission Owner System Operator of the estimated time for completion of necessary AVR (or other) repairs, or scheduled maintenance.
- 4) Notify the NYISO and Transmission Owner System Operator when maintenance is complete and the resource's voltage support capability is fully restored.

Deleted: its

Deleted: 2

Deleted: needed