

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, 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.

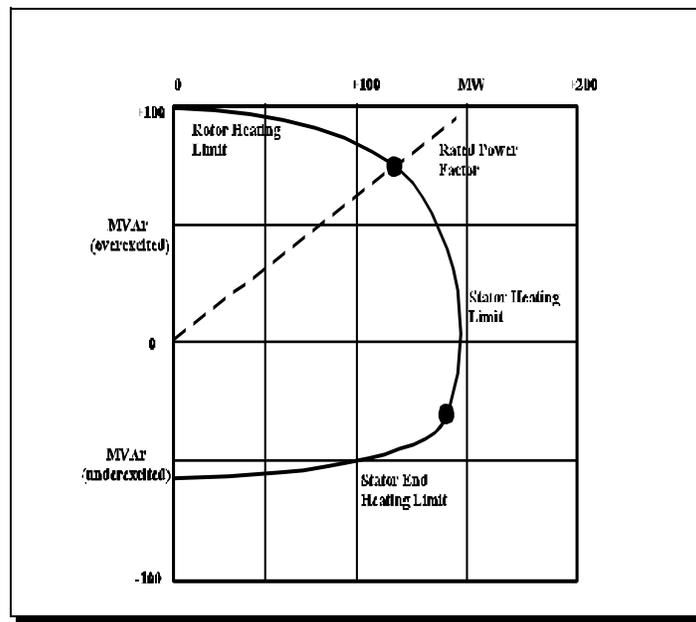


Figure 3-1 Generator MVAR versus MW Capability

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 reactive capability curve or a D-Curve, is representative of generators limiting characteristics at a particular temperature. Reactive capability decreases as the generator heats up and increases as the generator cools down. The reactive capability curve therefore will “shrink” with heating and “expand” with cooling of the machine.

3.2 Supplier Qualification

The NYISO requires that VSS suppliers meet the following criteria. Each resource must:

- Be able to produce and absorb Reactive Power within its tested reactive capability range
 - If the resource is precluded from running in “lead” mode in which it can absorb reactive power, then the unit is not eligible to provide Voltage Support Services.
 - The requirement to absorb Reactive Power may be set aside by the NYISO with input from the Transmission Owner in whose Transmission District the Resource is located. To grant an exemption from the requirement that the Resource be able to absorb Reactive Power, the NYISO shall have determined that: (1) the resource is unable, due to transmission system configuration, to absorb Reactive Power; (2) the ability of the resource to produce Reactive Power is needed for system reliability; and (3) for purposes of system reliability the resource does not need to have the ability to absorb Reactive Power.
- Be able to maintain a specific voltage level under both steady-state and post-contingency operating conditions, subject to the limitation of its tested reactive capability
- Be able to automatically respond to voltage control signals; for a generator, a functioning Automatic Voltage Regulator (AVR) is required
- Be under the operational control of the NYISO or a Transmission Owner
- Successfully perform a Reactive Power (MVar) capability tests in accordance with the NYISO Procedures described below

In order to qualify to receive payments as a VSS Supplier the candidate Supplier, including previously disqualified VSS Suppliers that must re-qualify, must:

- complete a VSS Qualification Form. That form is provided as [Error! Reference source not found. Attachment A-1](#) of this manual. The Qualification Form must:
 - be completed by a representative of the Supplier and signed by a Vice-President (or equivalent signing authority) of the corporation,
 - include a statement of intent to provide Voltage Support Services,
 - have generator documentation attached, including the manufacturer’s model number or equivalent data as determined by the NYISO, manufacturer’s specifications, a block diagram and associated data, and a generator reactive capability datasheet (“D-curve”), and
 - have documentation that the synchronous generator or synchronous condenser has an automatic voltage regulator (AVR). This documentation shall include the AVR manufacturer model number, manufacturer’s specifications, voltage regulator block diagram, and associated data.
- return the Voltage Support Service Suppliers Qualification Form, and supporting data to the following e-mail box or address:

vss_test_results@nyiso.com

Manager, Auxiliary Market Operations
 New York Independent System Operator, Inc.
 10 Krey Boulevard
 Rensselaer, NY 12144

3.3 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.

- 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 – Suppliers are expected to operate their Resources within demonstrated reactive capability limits. VSS suppliers are also expected 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.

3.4 Payment for Service

Please refer to [Rate Schedule 2 Section 15.2](#) of the NYISO Market Services Tariff for information about Payments for Supplying Voltage Support Service.

3.5 Failure to Perform by Suppliers

Please refer to [Rate Schedule 2 Section 15.2](#) of the NYISO Market Services Tariff for information about VSS Supplier failure to perform penalties.

3.6 Reactive Power Capability Testing or Demonstration

The purpose of the Reactive Power capability testing or demonstration is to establish a uniform procedure of determining, confirming, and documenting the Reactive Power capability of VSS Suppliers for real-time system voltage control. VSS suppliers must have a functioning automatic voltage regulator (AVR). The procedures set forth below provide the NYISO with accurate and timely information on the Reactive Power capability of the VSS Suppliers. The demonstration also provides confirmation that the supplier's AVR is in proper working condition and that the supplier is able to automatically adjust its reactive power production or consumption to properly control voltage.

Each year resources that participate in VSS must be tested to demonstrate Lagging and Leading Reactive Power capability. ~~Once every three years, resources that participate in Voltage Support Service must be tested to demonstrate Leading Reactive Power Capability.~~ Resources can alternatively provide data collected during actual operation to demonstrate both Lagging and Leading Reactive Power capability. If granted an exemption for absorbing Reactive Power as described in section [3.6.63-6.6](#) of this manual, a resource is not required to demonstrate Leading Reactive Power capability. In all cases, the Supplier's AVR must be enabled and providing automatic voltage control during the demonstration period. Tests may take the form of demonstration of Reactive Power capability based upon actual generator output data or tests conducted pursuant to the procedures set forth in this

Manual. Tests must be coordinated with the NYISO and the Transmission Owner (TO) in whose service territory the unit is located. Test data reports must be submitted electronically by the VSS Supplier within ten (10) business days of the test to the NYISO for review and acceptance. The demonstrated performance of the Lagging and Leading Reactive Power capability tests is the basis for compensation to Suppliers of VSS.

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.

3.6.1 Frequency, Timing, and Other Requirements

At least once each calendar year each Resource providing Voltage Support Service must test or demonstrate Lagging and Leading Reactive Capability. ~~At least once every three calendar years, each Resource providing Voltage Support Service must test or demonstrate Leading Reactive Capability.~~ If granted an exemption for absorbing Reactive Power as described in section 3.6.63-6.6 of this manual, a resource is not required to demonstrate Leading Reactive Power capability.

The demonstrated ~~Gross-gross~~ Lagging and Leading MVAR capability, as verified by metering data transmitted for the NYISO through existing Transmission Owner communication equipment, will be the basis for compensation in the next compensation (calendar) year. If gross metering data is not available, net metering data of Lagging and Leading MVAR capability will be the basis for compensation in the next compensation (calendar) year. If Transmission Owner communication equipment is down during the test period, the NYISO will accept real time Generator Owner data via direct communications to the NYISO.

Small units at the same site may apply test results from one unit to another unit at the same site. In order to qualify for this treatment, the units must be electrically identical and must be less than 60 MW nameplate capacity. Qualification to apply test results from one unit to another requires one-time submittal of the D-curve and registration information for each unit, along with a request for this treatment, and pre-approval by the Manager, Auxiliary Market Operations. The form to request this treatment is provided as Error! Reference source not found. Attachment A-2. Each year, a test result form must be submitted for each unit that is requesting this treatment. The test form must reference the PTID of the unit at the site that actually performed the test and the date and time of the test.

Both Lagging MVAR and Leading MVAR capability must be tested or demonstrated during the Summer Capability Period (May 1 through October 31, inclusive). Failure to test or demonstrate the resource's Reactive Power capability will result in the disqualification of the resource in the next compensation year. If granted an exemption for absorbing Reactive Power as described in section 3.6.63-6.6 of this manual, a resource is not required to demonstrate Leading Reactive Power capability. The Supplier's AVR must be enabled and providing automatic voltage control during the demonstration period.

Demonstration results must be retained for the current and most recent prior test period. Any supplemental engineering analysis to support data for the current and most recent prior test period must also be retained.

Beginning with the Summer 2012 Capability Period, VSS suppliers that do not make adequate metering data available for the NYISO through existing Transmission Owner communication equipment as required during the Capability Year will be disqualified as VSS suppliers. If Transmission Owner communication equipment is down during the test the NYISO will accept real time Generator Owner data via direct communications to the NYISO. If Transmission Owner communication equipment and Generator Owner real-time data via direct communications to the NYISO are not available, the NYISO will, under an extraordinary circumstance exception, allow for a remote link to be established from the NYISO to the Generator Owner data for the purposes of verifying that VSS test. This link must be established within 30-days of Generator Owner receipt of the test results. For the purposes of this exception an extraordinary circumstance shall mean unavailability due to a non-recurring improbable event not experienced in the regular course of business. Any supplier who has been removed from the VSS program due to inadequate metering data may be reinstated as a VSS supplier once that supplier complies with all conditions outlined in Section 3.2 of this Manual.

Lagging MVAR capability testing will normally be performed during on-peak hours. The VSS Supplier must operate at maximum Lagging MVAR for at least one hour for the test to be acceptable.

The Leading MVAR testing will normally be performed during off-peak hours. The Leading MVAR test shall be scheduled with the corresponding TO, who will inform the NYISO. Prior to conducting the test, the VSS Supplier and the TO shall consult with each other regarding the conditions of the test. The VSS Supplier must operate at maximum Leading MVAR for at least one hour for the test to be acceptable. The megawatt output at the time of the test shall be recorded, and the AVR shall be in service at all times during the test.

A VSS Supplier may schedule additional MVAR tests during the Summer capability period, however; only one test at a time may be scheduled. When scheduling an additional Reactive Capability Test, the VSS Supplier must again follow the test procedures given below. The VSS Supplier will be placed at the end of the queue for scheduling requests when requesting additional tests during a given capability period.

3.6.2 Test Procedure for Generators

Reactive Power capability tests are to be carried out under normal operating conditions. Extreme measures that might overstate a unit's reactive capability must be avoided. For example, measurements should be made with the unit operating with normal hydrogen pressure (or other normal coolant conditions).

Both ~~Lagging~~leading and ~~Leading~~lagging MVAR capability are to be measured at the generator terminal (gross) and, if ~~metered data is~~ available, at the point of interconnection (net). If generator terminal (gross) metering is not available, then Lagging and Leading MVAR capability are to be measured at the point of interconnection (net). -If a ~~generator's~~ VSS sSupplier's gross metered data does not reflect its ability to absorb MVAr from the

power system, the net metered data at the point of interconnection may be submitted in addition to gross metered data only to demonstrate the Leading MVar capability of the VSS Supplier, and will not be used as the basis of Leading MVar compensation.

Effective at the beginning of the 2010 test period, Lagging and Leading tests must be performed at the real power levels described in Table 3.1. For both the Lagging and Leading MVar tests, the real power level within the defined range that is chosen shall be the exclusive decision of the generator.

Table 3.1 Real Power Level Requirements for Reactive Power Capability Testing

	Intermittent Power and Limited Control Run-of-River Hydro Resources		All Other Generators	
	Lagging	Leading	Lagging	Leading
ICAP Suppliers ¹ and Non-ICAP Suppliers with a Valid DMNC Test ²	≥ 90% of UCAP ³	≥ 10% of UCAP ³	≥ 90% of DMNC ⁴	≥ 10% of DMNC ⁴
All Other Non-ICAP Suppliers	≥ 90% of Generator Nameplate MW	≥ 10% of Generator Nameplate MW	≥ 90% of Generator Nameplate MW	≥ 10% of Generator Nameplate MW

1 *ICAP Supplier* refers to resources qualified to supply UCAP as defined in the *NYISO Services Tariff*.

2 DMNC tests cannot be used for Limited Control Run-of-River Hydro Resources that are not ICAP Suppliers.

3 *Unforced Capacity (UCAP)* refers to the rating assigned to ICAP Suppliers as defined in the *NYISO Services Tariff*. The UCAP value that is tested to must correspond to the Available UCAP recorded in the NYISO ICAP Automated Market System.

4 *DMNC* refers to the Dependable Maximum Net that is in effect at the time of the test. The DMNC value that is tested to must correspond to the DMNC recorded in the NYISO ICAP Automated Market System.

The verification of Gross Reactive Power Capability and Net Reactive Power Capability for facilities with multiple generators and/or common elements which are dependent upon one another for normal operation shall be based on the reactive power capability of the facility and not the sum of the capabilities of the individual generators.

The Transmission Owner is responsible for coordinating the test with the respective plant. Each Transmission Owner shall notify the NYISO at least one hour prior to the initiation of generator MVar testing. The NYISO in turn notifies any other affected Transmission Owners. Test procedures are set forth below:

1. The VSS Supplier must notify the NYISO and the Transmission Owner (TO), at least three (3) business days prior to the day that the test is to be performed if the Supplier is a generator sized 25MW or larger. Other VSS Suppliers must also notify the NYISO and TO of their plan to test, but a three-day notification is not required, though it is encouraged. The following information must be included in the notification of intent to perform a Reactive Capability test:

- VSS Supplier name (as listed in the NYISO MIS)
- VSS Supplier point identifier (PTID – a five digit number)
- Net operating capability of the unit (MW)
- VSS Supplier operator company name
- Transmission Owner area
- Test requested (lagging or leading)
- Date and time of the test start
- Name and telephone number of the person requesting the test

A generator that is normally scheduled in the DAM and is operating within 25 MW of its normal operating capability may perform the MVAr test without the 3-day prior notification. If a generator's normal operating capability is less than 25 MW, the 3-day prior notification is also not required but is still recommended.

2. Test approvals are subject to a NYISO reliability review and the NYISO reserves the right to cancel or terminate the test at any time. The TO may also request that the NYISO cancel or terminate the test at any time should local reliability criteria be violated. The NYISO will document all approvals, cancellations, and terminations including the party responsible and reason for implementing the cancellation or termination as described in Section 6 of the Outage Scheduling Manual.
3. On the day prior to the scheduled date of the Reactive Capability Test, generators with a normal MW operating capability of 100 MW or greater must bid energy into the Day-Ahead Market (DAM). The bid must be structured to ensure that the generator is scheduled at the appropriate MW level for the hours requested to perform the Reactive Capability Test. The VSS Supplier must notify the NYISO (notify NYISO Generation Scheduling at (518) 356-6050) by hour 14:00 of the prior business day that the unit has been scheduled in the DAM, and that the test will be conducted as scheduled. If the generator is not scheduled, then the Reactive Capability Test is cancelled. If the generator has a net operating capability of less than 100 MW or if the generator is a quick start unit that can be committed by the Real-Time Commitment (RTC), a DAM bid is not required. The VSS Supplier must still notify the NYISO and the TO, by hour 14:00 of the prior business day, of the intent to perform a Reactive Capability Test.
4. On the day of the scheduled Reactive Capability Test, the VSS Supplier, through the TO, must request permission from the NYISO System Operator to perform the test at least three (3) hours prior to the test start time. The generator must also bid energy into the Hour-Ahead Market (if not previously committed in the DAM) to ensure that the generator is scheduled at the appropriate MW level for the hours requested to perform the Reactive Capability Test. The NYISO System Operator will approve or deny the request, through the TO, at least two (2) hours prior to the scheduled test, allowing time for any desired Hour-Ahead Market bid adjustments. The NYISO will document all approvals, cancellations and terminations of the tests. The log will include the name of the party and reason for implementing the cancellation or termination.

5. Upon beginning the test, the VSS Supplier must notify the NYISO System Operator, through the TO, that the Reactive Capability Test has started.
6. The NYISO will log that the VSS Supplier is performing a Reactive Capability Test.
7. Upon completion of the test, the VSS Supplier must notify the NYISO System Operator, through the TO, that the test is complete. The NYISO will log the completion time and the name of the generator plant personnel reporting the test.

3.6.3 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.

3.6.4 Reporting Requirements

Attachment B of this manual illustrates the spreadsheet based test report forms that are to be used to document the results of Reactive Power capability tests and demonstrations. An electronic version of the test report forms is available on the NYISO Web site. Suppliers of VSS must complete the forms and submit the completed forms to the NYISO within ten (10) business days of the test or demonstration. The forms must include supporting performance data including gross and net MW and MVAR output, terminal or station bus voltage, and unit auxiliary load MW and MVAR. These data must be sampled at the beginning and end of the test or demonstration period and least once every five (5) minutes during the test or demonstration period. The test report forms must clearly indicate the start and end times of the test or demonstration period.

The completed test report forms must be submitted electronically (by email) to the NYISO at the following email address: vss_test_results@nyiso.com. If the lagging and leading MVAR capability tests or demonstrations are performed on different dates, then the results of the lagging and leading tests or demonstrations can be submitted separately.

The NYISO collects generator reactive capability data of VSS Suppliers. The NYISO provides these data to the operating division of the Generator's Transmission Owner (TO) within sixty (60) days of the end of the test period. This allows sufficient time for the NYISO to assemble the data with due consideration to Generator owner reporting requirements.

3.6.5 Allowance for Out-of-Period Reactive Capability Testing

There are four (4) 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, or

- A nuclear generating unit that has an AVR that is not functioning during the test period.

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 ten (10) 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 ten (10) 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 ten (10) business days of the completion of that test.

Nuclear Unit with Non-Functioning AVR

If the unit is able to successfully complete the test with a functioning AVR after the test period but before the end of the current year, full compensation will be allowed for the next payment year. The unit will be required to meet the follow-up requirement set forth below to continue receiving payments after the beginning of the test period. If that test results in reduced voltage support, the payments will be reduced for that entire year, including return of excess compensation for the months before the in-period test.

If the unit is able to successfully conduct an out-of-period test after the beginning of the year, the unit will receive monthly VSS payments at the level achieved in the test for all months following the conduct of the test. To receive payments at the levels achieved in the out-of-period test, the unit will voluntarily provide voltage support within operational limits without compensation in the months of the year prior to its out-of-period test. The unit will be required to meet the follow-up requirement set forth below to continue receiving payments after the beginning of the test period. If the units produces a lower level of MVAr than was achieved in the out-or-period test, the VSS payments will be reduced consistent with the results of the in-period test for the remaining months of the year; provided further, however, should a generator perform a subsequent in-period test that demonstrates a higher level of MVAr capability, the VSS payments will be based on the results of the later test for the remaining months of the year.

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 ten (10) business days of the completion of that test. This “in period” test will also qualify the resource for continued participation in the VSS in the next compensation year.

3.6.6 Exemption from Requirement to Absorb Reactive Power

The following three conditions must be met in order for the NYISO to grant an exemption from the requirement to absorb Reactive Power.

1. The ability of the resource to produce Reactive Power must be determined by the NYISO to be needed for reliable system operation.
2. The ability of the resource to absorb Reactive Power must be determined by the NYISO to not be necessary for reliable system operation.
3. The resource must be unable, due to system configuration, to absorb Reactive Power.

The NYISO will review a request for exemption with the Transmission Owner in whose Transmission District the Resource is located and determine whether the request will be granted. An exemption will not be granted over the objection of the Transmission Owner, except upon the approval of the President and Chief Executive Officer of the NYISO. Exemptions that are granted will be reviewed annually with the Transmission Owner in whose Transmission District the resource is located.

All requests for exemptions from absorbing Reactive Power must be made in writing to the Manager of Auxiliary Market Operations at the NYISO. These requests must include the specific resource(s) and the basis for requesting the exemption. Additional documentation may be required during the NYISO review. A request for exemption must be signed by an officer of the organization owning the resource (or equivalent signing authority) and can be submitted to the following e-mail box or address:

vss_test_results@nyiso.com

Manager, Auxiliary Market Operations
New York Independent System Operator, Inc.
10 Krey Boulevard
Rensselaer, NY 12144

Requests for exemptions from absorbing Reactive Power must be submitted prior to the end of the test period.

3.7 Voltage Support

The following procedures apply to VSS.

3.7.1 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 and Dispatching Operations* manuals (both of which are available from the NYISO Web site at the following URL: http://www.nyiso.com/public/markets_operations/documents/manuals_guides/index.jsp).

3.7.2 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, and provide notice as required by the *NYISO Outage Scheduling Manual* (available from the NYISO Web site at the following URL: http://www.nyiso.com/public/markets_operations/documents/manuals_guides/index.jsp) prior to removal from service for scheduled maintenance.
3. VSS suppliers are required to notify the NYISO of an AVR outage lasting longer than thirty (30) days by submitting a written notice and plans for a timely repair electronically to the following e-mail address:
vss_test_results@nyiso.com
Failure to notify the NYISO and submit plans for a timely repair may result in disqualification from the VSS program or reduced monthly VSS payments as outlined in Section 15.2 of the NYISO Market Services Tariff.
- 2.4. Notify the NYISO and Transmission Owner System Operator of the estimated time for completion of necessary AVR (or other) repairs, or scheduled maintenance.
- 3.5. Notify the NYISO and Transmission Owner System Operator when maintenance is complete and the resource's voltage support capability is fully restored.