MSWG

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Performance Criteria for Assessing Comparability of Non-Generator Dynamic VAR Sources

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LIPA Strawman for Non-Generator VAR Payment

- Objective:
  - Cross Sound Cable (CSC) paid for VAR service starting Summer 2006
- Payment based on comparability of dynamic voltage support service provided by CSC and generator sources
- Initial comparability determination based on standards similar to those defined in New England – standards that will apply only to non-generator VAR sources not in regulated rate base.
- No lost opportunity cost provided in initial implementation, nor requests to deviate from scheduled real power flows, minimizing software modification. However, LIPA will be reimbursed for average losses calculated at zero flow associated with providing service.
- No changes in rate determination - Rate to be paid calculated without consideration of CSC – but CSC paid generator rate for tested capability.
- Tariff changes to be filed later this year, but in time for Summer 2006 implementation

LIPA Strawman for Non-Generator VAR Payment (Cont.)

Capability Testing

- Original acceptance test data and/or historic performance used to validate VAR capability for Summer 2006
- Future testing based on protocols equivalent to generation and entered into standardized forms.

Comparability

- What are reliability needs served by dynamic performance characteristics of generator VAR sources?
- How are services provided by generators and certain non-generator dynamic VAR sources comparable?
- New England's approach to development of non-generator VAR performance criteria is well considered and a reasonable basis for initial determination of comparability
  - Criteria distinguishes dynamic and steady state non-generator VAR sources
  - Performance criteria identifies non-generator dynamic VAR sources offering VAR services comparable to dynamic VAR service provided by generation

New England Discussion on Reliability Contribution of Generation VAR Sources

- Discussion in New England of comparability of generation and non-generation VAR sources identified several key differences in the *reliability contribution* of generation and steady state transmission (non-generation) VAR sources:
  - Generators not directly involved in clearing a fault stayed connected and provided continuous VAR service during a fault, while steady state transmission VAR sources might not. Generators continued to provide (albeit reduced) VAR capability during transient voltage dips, while steady state transmission VAR sources might provide drastically reduced VAR capability if they performed at all.
  - Generators continued to provide VAR service during frequency excursions, while steady state transmission VAR sources might not.
  - Generators responded very quickly to transient changes in VAR needs, while steady state sources responded more slowly.

Comparability of Services Provided by Certain Non-Generator Dynamic VAR Sources

- It was noted that the technical characteristics of certain non-generator VAR sources allowed them to more closely match the reliability contribution of generators VAR sources although these characteristics varied from technology to technology.
- The challenge was to develop standardized, technology-neutral criteria to distinguish those technologies that provided these reliability services from those that did not.
- Established planning standards and design criteria addressing system stability provide a useful point of reference.

Minimum Transient Frequency Standard

- Facility should stay connected and operable during frequency excursion
- For example, WECC/NERC standards suggest that system should be designed so that it is “not below 59.6 Hz for 6 cycles or more at a load bus” if such excursions occur more than once every three years.
- Thus, a non-generator VAR facility should be able to remain continuously connected and operable during a frequency excursion of less than 6 cycles at below 59.6 Hz.
- In New England, generator tripping is permitted below 57 Hz (or higher frequencies if the excursion lasts longer than 3 seconds), thus to qualify as a non-generator dynamic VAR source, a transmission facility should not be required to remain connected under these conditions either. (Longer excursions have higher minimum frequency standards. See NPCC A-03 Standards for setting underfrequency trip protection for generators.)

Continuous Service During Transient Voltage Dip

- Facility should provide continuous VAR capability during transient voltage dip
- Initial discussion focused on quantifying transient voltages, for example:
  - WECC/NERC standards suggest that system should be designed so that transient voltage dip does not "exceed …30% at non-load buses." (or 20% for more than 40 cycles at load busses)
  - WECC/NERC also suggest the duration of these transient events. Thus, the non-generator dynamic VAR facility might require operability at down to 0.70 PU voltage for up to 40 cycles. Beyond that, the facility should be capable of steady state operation at the system steady state low voltage limit of 0.95 PU voltage.
- Later discussions settled on continued operability during Design Criteria Contingencies

Transient Response Speed

- New England initially discussed requiring a facility to respond 'in the dynamic timeframe' although there is some ambiguity as to what that means:
  - Switched capacitor banks typically cannot provide VAR capability within 15 cycles of being switched on, depending on their initial status.
  - Voltage source regulators such as DVAR and HVDC-light can provide VAR capability immediately.
  - WECC/NERC standards gives generators 6 cycles to respond to transient frequency excursions
  - One might use these data points to set a standard for non-generator response to transient voltage dip somewhere between 6 and 15 cycles.

- New England ultimately proposed instead to use a review of transient performance of the facility under key contingency conditions.

Relationship with New England Planning Standards

- New England ultimately decided on using the stability criteria found in its planning standards. To qualify as 'dynamic', non-generator VAR sources had to be operable for the typical contingencies identified in the Section 3.1 of their planning standards.
  - "The New England bulk power supply system shall remain stable during and following the most severe of the contingencies stated below with due regard to re-closing…"
    - Permanent three-phase fault with normal fault clearing
    - Simultaneous permanent ground faults on different phases of adjacent circuits
    - Permanent phase to ground fault with delayed fault clearing
    - Loss of any element without a fault
    - A permanent phase-to-ground fault in a circuit breaker
    - Simultaneous permanent loss of both poles of a DC bipolar facility w/o an AC fault
    - Salient SPS failures
    - Certain SPS circuit breaker failures

New York Planning Standards

- The New York State Reliability Council has similar stability criteria in its planning standards
  - "The NYS Bulk Power System must be planned with sufficient transmission capability to withstand the loss of specified, representative and reasonably foreseeable design criteria contingencies a projected customer demand and anticipated transfer levels." Design Criteria Contingencies include the following:
    - Permanent three-phase fault with normal fault clearing
    - Simultaneous permanent ground faults on different phases of adjacent circuits
    - Permanent phase to ground fault with delayed fault clearing
    - Loss of any element without a fault
    - A permanent phase-to-ground fault in a circuit breaker
    - Simultaneous permanent loss of both poles of a HVDC bipolar facility w/o an AC fault
    - Certain SPS circuit breaker failures

Non-Generation Dynamic VAR Source - Performance Criteria

- Initial determination of CSC as comparable 'dynamic' non-generator VAR source based on meeting the following standards:
  - Steady State Capability
    - Capable of continuous operation at 0.95 PU to 1.05 PU voltage
  - Frequency Standard
    - Remain connected and continuously operable under NPCC A-03 standards for setting underfrequency trip protection for generators.
  - Fault Ride-Through
    - Remain connected and continuously operable under NYSRC design criteria contingencies (occurring outside zone of protection of facility)
  - Speed
    - Passes review of transient performance of facility under design criteria contingencies.