



Phase Angle Regulator Task Force: Recommended Proposal

Aaron Berner
Manager, Interconnection Analysis
Planning Committee
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- Problem Statement / Issue Charge
 - Brought by PSEG Energy Resources & Trading, Nov. 2014
 - Objective: Investigate whether or not Phase Angle Regulator technology can be treated as Controllable AC Merchant Transmission under the PJM Tariff, and therefore be eligible for associated transmission rights.
- Six meetings, Mar 2015 – August 2015
- Single proposal recommendation

1.6B Controllable A.C. Merchant Transmission Facilities:

Transmission facilities that (1) employ technology which Transmission Provider reviews and verifies will permit control of the amount and/or direction of power flow on such facilities to such extent as to effectively enable the controllable facilities to be operated as if they were direct current transmission facilities, and (2) that are interconnected with the Transmission System pursuant to Part IV and Part VI of the Tariff.

- Transmission Injection Rights (TIR)
 - Capacity Transmission Injection Rights
 - The rights to schedule energy and capacity deliveries at a Point of Interconnection of a Merchant Transmission Facility with the Transmission System, similar to Capacity Interconnection Rights
 - Energy Transmission Injection Rights
 - The rights to schedule energy deliveries at a specified point on the Transmission System and have rights similar to those under Non-Firm Point-to-Point Transmission Service

- Transmission Withdrawal Rights (TWR)
 - Firm Transmission Withdrawal Rights
 - The rights to schedule energy and capacity withdrawals from a Point of Interconnection of a Merchant Transmission Facility with rights similar to those under Firm Point-to-Point Transmission Service
 - Non-Firm Transmission Withdrawal Rights
 - The rights to schedule energy withdrawals from a specified point on the Transmission System and have rights similar to those under Non-Firm Point-to-Point Transmission Service

- Number of taps and frequency of change
- Design capability vs. rights to be obtained
- Zero flow through facility
- Deviation charges during operation

(This is not all inclusive and is only meant to represent the issues surfaced during rights discussions with the group)

- PJM examined the effects of one or multiple PARs at locations on the system
 - Base case and contingency studies completed
- Consistent with injections and withdrawals for other types of technology, increased transfer requirements developed increased opposition to flows (larger reinforcement requirements)
- PJM identified no significant sensitivity to affect PAR flows other than flows in opposition to scheduled PAR flow
 - This is consistent with all types of technology and represents conditions when the flows from the facility under study are in opposition to the remaining flows along an interface (e.g.: Facility under study flow into PJM and all other flows out of PJM, and vice versa)

- System tested to determine if multiple PARs in a location could result in degradation of existing rights
- No negative impacts identified to existing rights during power flow analysis

- PAR step size (MW)
 - No sensitivity to step size identified
 - Steps in excess of 20MWs not desirable
- PAR transfer in excess of rights awarded
 - PAR flow can be impacted by local network and resources
 - Customer must ensure design of facility will maintain control considering future potential system changes
 - PAR flow in excess of rights awarded may result in curtailment of facility

- All resources in PJM must respond consistent with requirements in the PJM Manuals
- Calculated ramp requirements
- Calculated deviation from dispatch order(s)

- PAR must maintain same capabilities as are required for all resources in PJM

- PAR must be tested for firm or non-firm transfer consistent with how other proposed resources are studied and based on conditions in the area of the requested point of injection / withdrawal
 - Thermal
 - Short Circuit
 - Stability
 - Harmonics
 - SSTI
 - Operational considerations
 - Other tests as required

Note that this does not differ from the evaluation requirements of other Merchant Transmission Facilities

- PJM discussed studies with Affected Systems
 - As with other facilities which connect outside of PJM, customer must enter adjacent area "queue"
 - Studies must be coordinated to ensure impacts from each side of the facility as well as requirements to be placed on the facility are discussed prior to final design
 - Basic reinforcements are identified during System Impact Study phase
 - More detailed studies performed at Facilities Study phase (harmonics, SSTI, etc.)
 - Operating guides should be minimized through reinforcement of the system(s)

- Cost allocation to future baselines will be consistent with the requirements imposed on all facilities which connect to areas outside of PJM
- Cost allocation towards Network Upgrades in New Service Queue Process consistent with the requirements imposed on all facilities which connect to areas outside of PJM

- Facility must be able to operate to maintain the scheduled flows through automatic controls
- Provisions for manual control of the facility must be made available when called upon by PJM

- Current Tariff language does not exclude PARs
- Merchant Transmission cost allocation for baseline reliability upgrades applies without need for changes

- M14E currently undergoing complete revision
- Propose to enter a section briefly discussing that PARs can be granted rights
 - Automatic control
 - Step size not recommended to exceed 20MWs and will be studied based on proposed location for interconnection of each facility on a case by case basis to determine impacts