Poll Comments and Education

Phase Angle Regulator Task Force

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Follow-up on Comments Received

PJM reached out to respondents who provided comments in an effort to further understand those comments. Following is information relating to those discussions

- Seek better understanding of how neighbors study merchant transmission (MTX) projects
  - PJM is only entity with MTX projects specifically designated in the queue process
  - Other entities handle these types of projects on an ad hoc basis
    - One neighboring entity discussing inclusion of MTX projects in queue

Follow-up on Comments Received

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- “No” response related to a need to have further internal discussions in order to communicate the information provided at stakeholder meetings to others in the respondents organization – indicating additional time needed before polling was needed
- “No” response related to a belief that other stakeholders had questions which needed to be answered

Follow-up on Comments Received

PJM reached out to respondents who provided comments in an effort to further understand those comments. Following is information relating to those discussions

- Requested more education on how PARs work
  - PJM believes that additional education on PAR functions should be defined by requested information from stakeholders
- Concerned that other existing PARs do not have this capability
  - Other PARs installed on the system were not constructed to have the controllability which will be required in granting injection or withdrawal rights rights
  - Existing transmission assets will not be allowed to enter queue to obtain these rights

Follow-up on Comments Received

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- Concerned that the PAR would not be continuously adjustable
  - Manufacturer indicates that controls can be set up to automatically adjust the PAR tap setting in order to maintain the control set point (MW) flow
- Concerned that PAR does not have the capability to reduce flow to zero MWs
  - Manufacturer indicates that zero flow through facility is achievable and that oversizing the phases would be necessary to achieve zero and full flow control capability

Follow-up on Comments Received

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- Concerns raised about interactions with other PARs existing on system
  - PJM in the process of running analysis to examine interactions with the intent to come back in August with additional information
  - May require studies to be performed by outside consultants during the queue study process (similar to harmonics and SSTI studies for HVDC facilities)

Follow-up on Comments Received

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- Concerns raised that PAR would "run out of angle", essentially prohibiting the device from achieving control required
  - If zero output cannot be achieved then the facility would need to be taken out of service under conditions when the facilities inability to "zero" the output could be seen as potentially harmful
  - If full rated output cannot be achieved then the facility would lose rights to be able to schedule that output in the future
    - loss of rights by existing merchant transmission and generation projects may occur under current rules in the Tariff and manuals

Follow-up on Comments Received

PJM reached out to respondents who provided comments in an effort to further understand those comments. Following is information relating to those discussions

- Request that PJM include PAR in comparison to VFT and HVDC facilities (see information later in this presentation)
- Requested additional information about how rights are currently granted to the HVDC and VFT facilities (see information later in this presentation)
- Can interim rights be granted to these facilities? (see information later in this presentation)

Follow-up on Comments Received – Technology Comparisons

CHARACTERISTICS	PHASE ANGLE REGULATORS (PAR)	DIRECT CURRENT (DC)	Variable Frequency Transformer (VFT)
Flow Control Capability	Power flow capability that can be designed as a unidirectional or bidirectional system	Power flow capability that can be designed as a unidirectional or bidirectional system	Power flow capability that can be designed as a unidirectional or bidirectional system
Precision	Flows can generally be calibrated within 3-4% of desired target flow	Flows can be controlled to levels very close to target flow	Flows can be controlled to levels very close to target flow
Availability	Inspections are required on a 2 to 3 year cycle.	DC equipment must be taken out of service for several days to one week per year for maintenance Generally provides control of flow somewhat independent of the condition of the surrounding grid.	Manufacturer indicates lower maintenance requirements as compared to HVDC
Set Point After N-1	Flows can be controlled to levels very close to target flow	HVDC remains as set after most N-1 events	Flows can be controlled to levels very close to target flow

* PJM reviewing existing operational information from installed devices to expand comparisons where possible

Follow-up on Comments Received – How Are Rights Awarded?

- PJM does not determine the rights to be awarded to a customers facility, only the system requirements necessary to grant those rights requested by the customer
  - PJM and Transmission Owner studies determine which criteria violations would occur based on the requested quantity of rights from customer

E.G.: If a customer requests to install an HVDC facility capable of 500MWs, PJM studies based on the assumption that the customer will install a facility capable of this output, this is also true of a new generator, Long Term Firm Transmission Service request, etc.

(Historically, some customers have requested fewer rights than a facility is capable of obtaining)

Follow-up on Comments Received – Can Interim Rights be Awarded?

- PJM performs interim deliverability studies to determine if any facility or request for service can come into service before the original study conditions and assumptions are satisfied, no lesser treatment would be awarded to PARs

E.G.: If a customers facility is studied on a case which anticipates a certain topology (defined by year of the base line case used for the study) and the request for service is before that topology was anticipated then the customers facility must be analyzed for interim deliverability. Interim deliverability studies are also required when network upgrades are not completed (which were required due to criteria violations associated with the customers facility).