PJM Package Updates

Glen Boyle, Performance Compliance

Reactive Power Compensation Task Force

September 28, 2022

Reactive Capability Testing vs. Event Assessment

Reactive capability (i.e., D-curve) set through both **testing and event assessment**.

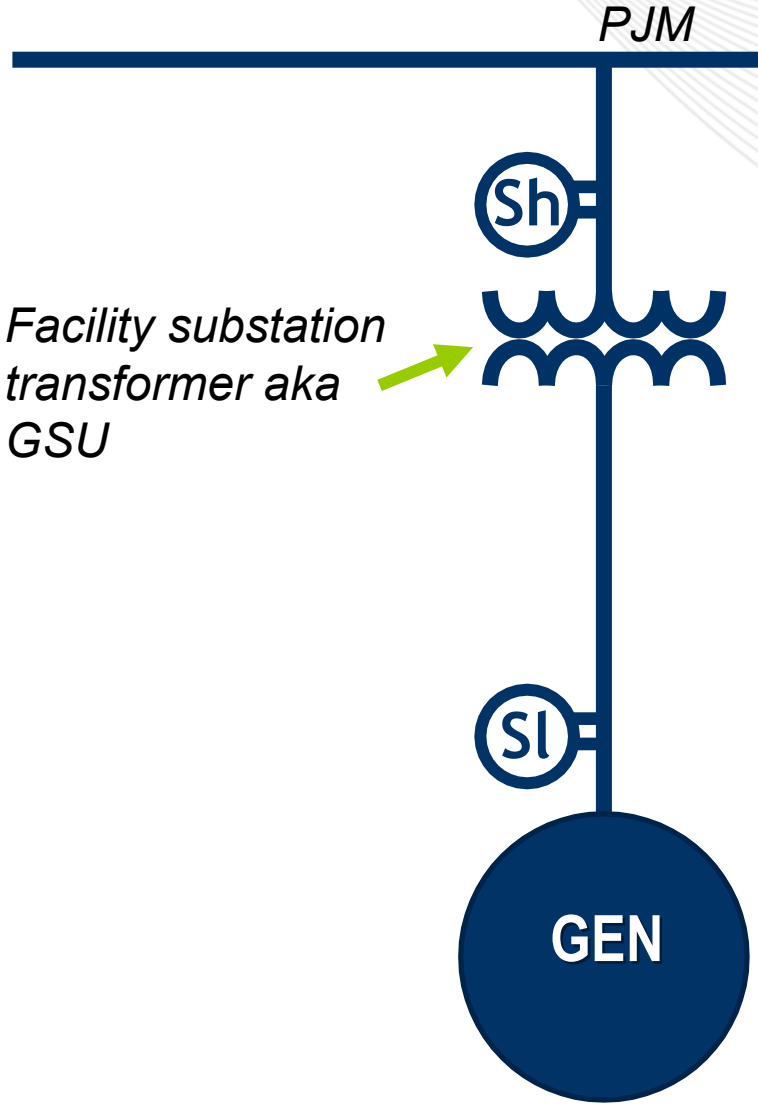
- The D-curve sets the *MVAR_Capability* value that is used for compensation for a unit (=*FlatRate* MVAR_Capability)*
- With empirical demonstration of capability through ordinary operations, no testing is needed. Many units would be in this group.
- When full reactive capability is not exercised in ordinary operations (e.g., no reactive events), capability is set through testing. Many units would be in this group, too. Testing can be used to set initial capability for a new generator.

Reactive events are triggered by unusually high or low PJM voltage at the generator, which leads to event assessment.

- Reactive event assessment can increase or decrease D-curve capability, which would increase or decrease compensation.

Measuring Reactive Output

Design Component 5
Delivery Point for Compensation and Related Purposes (e.g. Capability Testing)



- Measure MVAR capability **at the high-side of the facility substation transformer(s)**.
- Applicable reference bus for measuring MVAR_Capability (i.e., points Q1-Q4) is at **Sh.**
- Utilize PJM State Estimator data

Reactive Events

	PJM Default Generator Voltage Schedules							
Voltage Level (kV)	765	500	345	230	161	138	115	69
Schedule (kV)	760.0	525.0	350.0	235.0	164.0	139.5	117.0	70.0
Bandwidth (+/- kV)	+/-10.0	+/- 8.0	+/- 7.0	+/- 4.0	+/- 4.0	+/- 3.5	+/- 3.0	+/- 2.0

Event = when any regulated bus voltages are outside voltage schedules for 5 minutes

- *PJM default or bus specific*
- *Example (red box above): 230kV voltage is above 239 kV or below 231 kV for 5 consecutive minutes*

1. Measure MW and MVAR at POI.
2. Determine **expected MVAR** output magnitude by referencing D-curve capability corresponding to actual MW.
3. If **actual MVAR** magnitude < 90% of **expected MVAR**, then fail and derate (lower capability compensation going forward).
   - *Failed units lose capability compensation for one month.*
4. If **actual MVAR** magnitude >110% of **expected MVAR**, then uprate (higher capability compensation going forward).

Reactive Capability Derates and Uprates

Design Component 11
Performance incentive/penalty

- Across each failed 5-minute event interval, average the difference between actual MVAR and expected MVAR magnitudes.
- Subtract (derate) or add (uprate) this average difference to each point on the side of the D-curve corresponding to the event.
  - I.e., for events that require VAR injection, only change the VAR injection capability, and vice versa.

Performance

	Actual kV	Actual MW	Expected MVAR	Actual MVAR	Performance	
0:00	525	300	N/A	20	N/A	
0:05	524	300	N/A	30	N/A	
0:10	523	300	N/A	40	N/A	
0:15	522	300	N/A	50	N/A	
0:20	521	300	N/A	60	N/A	
0:25	520	300	N/A	70	N/A	
0:30	515	300	180	80	N/A	
0:35	516	300	180	100	Fail	75 MVAR average shortfall
0:40	517	300	180	150	Fail	
0:45	518	300	180	200	Pass	
0:50	519	300	180	200	Pass	
0:55	520	300	N/A	200	N/A	

Revised D-curve

MW Points	Qmin	Qmax	New Qmax	
50	-250	250	175	
100	-240	240	165	Subtract 75 MVAR from all the Q injection values ("Qmaxes")
150	-230	230	155	
200	-220	220	145	
250	-210	210	135	
300	-200	200	125	
350	-190	190	115	
375	-180	180	105	

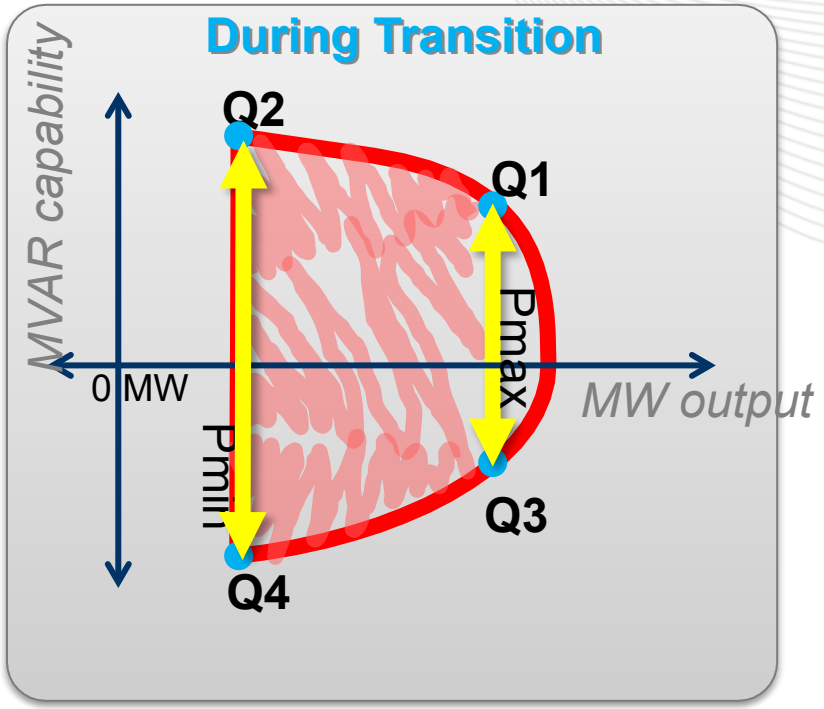
New Compensated Capability:

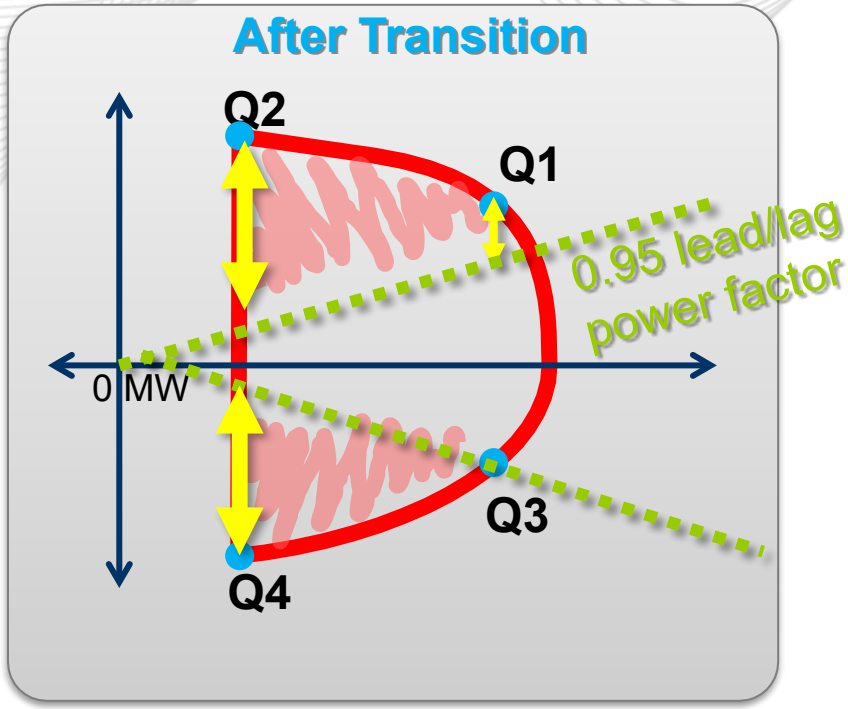
Qmin_Avg	Qmax_Avg	Total
-220	145	365

https://www.pjm.com/-/media/committees-groups/task-forces/rpctf/2022/20220801/item-03c---examples-of-capability-and-performance-calculation-for-pjm-proposal.ashx

- To allow implementation time for performance assessment and re-rate process
  - New reactive power compensation mechanisms should be applied 18-24 months following acceptance of PJM's filing
  - New reactive power compensation mechanism should not impact generating units that have existing and effective rates on file with FERC

Package G-PJM-Capability Above Standard Obligation





- Same as Package E during transition period.
- After transition period, same as Package E, except **compensates only capability above standard obligation (i.e., above 0.95 lead/lag power factor)**.

- Transition period is:
  - Option I: 5 years
  - Option II: after 90% of existing Schedule 2 filed rates have rolled off (e.g., only 29 or fewer remain)

Contact

Facilitator:
Danielle Croop,
Danielle.Croop@pjm.com

Secretary:
Risa Holland,
Risa.Holland@pjm.com

SME/Presenter:
Glen Boyle, Glen.Boyle@pjm.com

Member Hotline

(610) 666 – 8980

(866) 400 – 8980

custsvc@pjm.com