Draft Reactive Rate for Package E

Andrew Levitt

Market Design & Economics

PJM RPCTF

Solution matrix language: *"MVAR Rate will be based on the PJM average reactive rate as of 1/1/22.*

- *Total Reactive Compensation (approx. $367 million) divided by*
- *System MVAR capability based on*
  - *Nominal plant **eDART Reportable MW** ratings of all units*
  - *95% Power Factor at Pmax*
  - *A rectangular D-curve [same min and max capability]"*
- → **$2,822/MVAR/year**
  - 2021 reactive compensation was $367.0 m
  - Current system VAR capability based on above method is 130,048 MVAR
- Same rate for all resources
- In line with rates in ISO-NE ($2,190/MVAR/year[1]) and NYISO ($2,919.13/MVAR/year[2])

Note: Rate is still draft and subject to change

1 *ISO New England Tariff Schedule 2*
2 *https://www.nyiso.com/documents/20142/18145934/2021-OATT-MST-Schedule%202-VSS-Rates-Final.pdf/bda65a42-603b-3b47-4cec-d09c157c50df*

- Intent of Package E rate proposal is to take the ratio of:
    1. Status quo total annual reactive compensation of PJM fleet, to
    2. Status quo reactive capability

- Actual reactive capability is constantly changing, and in some cases consists of multiple capability curves ("D curves").

- Package E therefore proposes use of a pro forma reactive capability of the fleet that is based on a recent snapshot of aggregate maximum power capability ("eDart Reportable MW").

- 0.95 leading/lagging power factor is the Interconnection Service Agreement capability requirement for resources measured at the high-side of the generator step-up (GSU) transformer (i.e., non-synchronous machines).

  – *The GSU high-side is equivalent to the delivery point at which VARs benefit PJM.*

- Therefore, Package E proposes that the pro-forma capability for use in calculating the reactive rate be based on 0.95 leading/lagging capability relative to maximum power capability.

- Generators have different D-curve shapes—some are wider at Pmin (more "D"), some are thinner (more "<"). Many are rectangular (e.g., figure at right).

- Therefore, Package E proposes a rectangular pro-forma reactive capability.

D-Curve

MVAR capability

MW output

Pmin

Pmax

Pmin

Q2   Q1

Q4   Q3
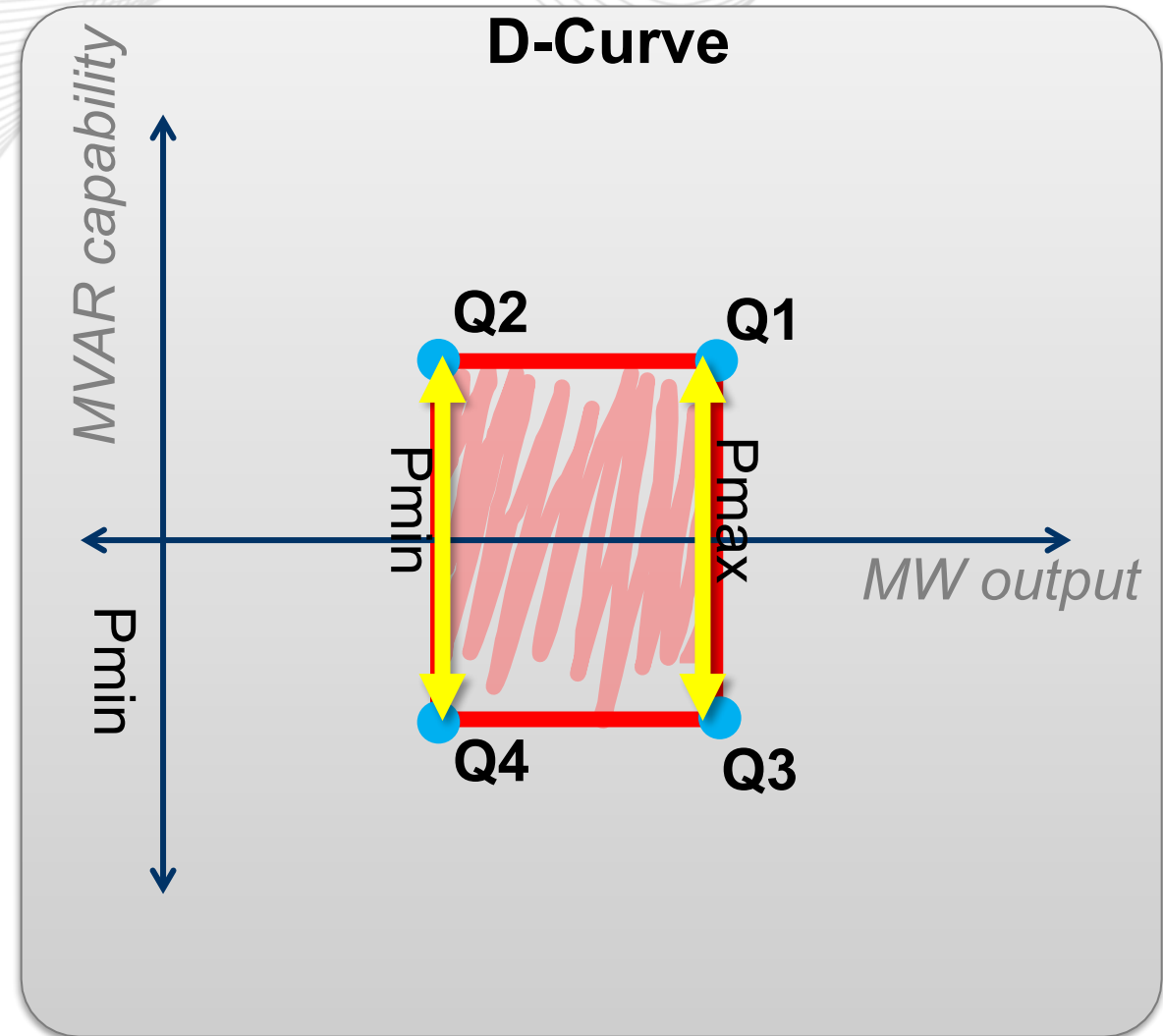
- Monitoring Analytics 2021 State of the Market annual report lists total 2021 reactive capability (i.e., Schedule 2) compensation of $367.0 million.

- PJM eDART system reports current aggregate maximum power (i.e., "eDART Reportable MW") is 197,832 MW.

Power systems engineering math:

- P = power (MW)
- Q = reactive power (MVAR)
- S = apparent power (MVA)
- $S^2 = P2^2 + Q^2$

Inputs

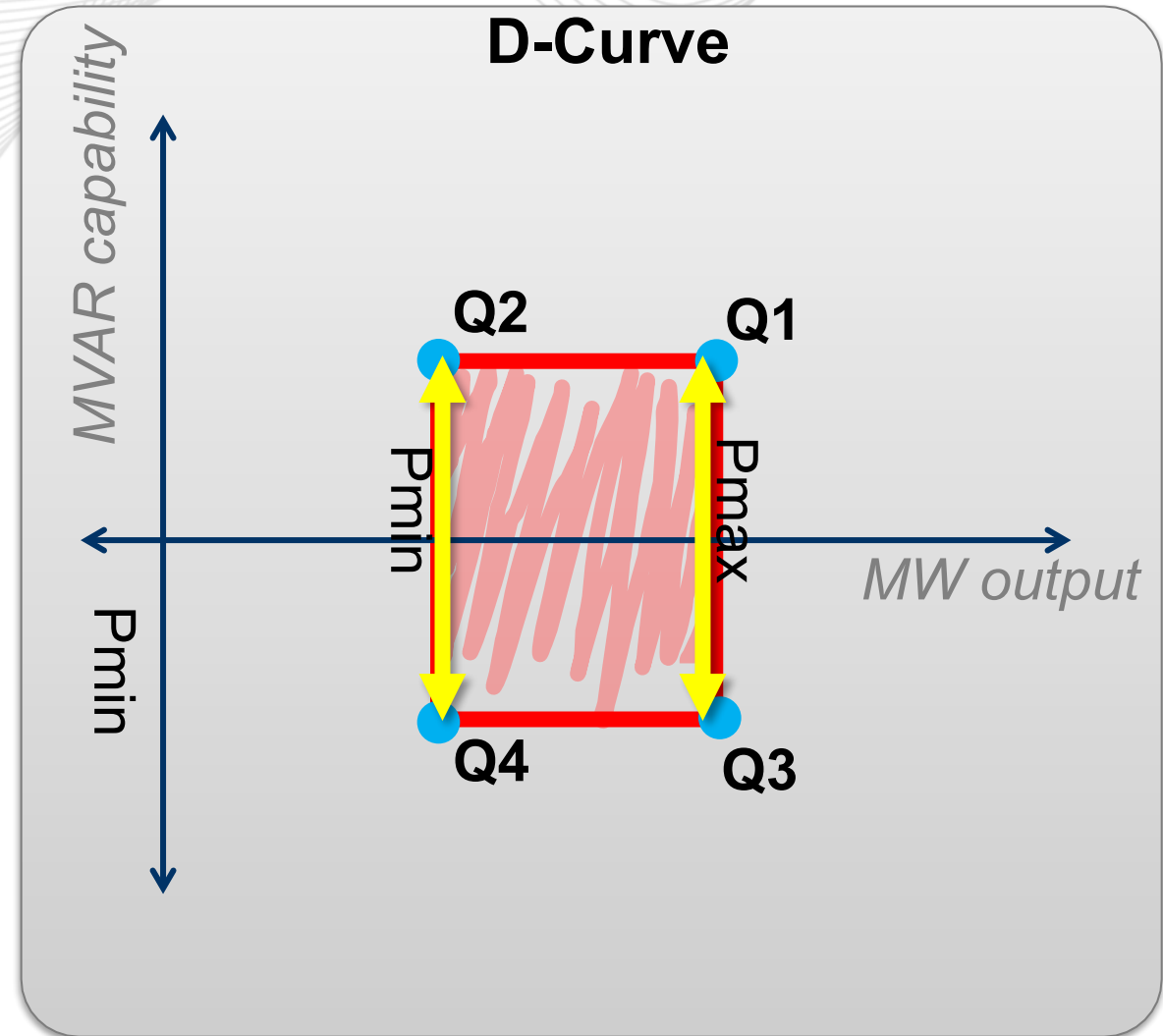- Power factor = P/S = 0.95
- P = 197,832

Results

- Q1 → 65,024.23
- Q2 = Q1
- Q3 = Q4 = -Q1

Capability metric =
AVG(Q1,Q2) – AVG(Q3,Q4) =
130,048 MVAR (lead + lag)

D-Curve

- A = 2021 annual compensation = $367.0m/year

- B = Capability metric = 130,048 MVAR

- Rate = A/B

Draft reactive rate = $2,822/MVAR/yr