POTOMAC ECONOMICS

Smaller Load Zone Analysis

CMWG

Aug 21, 2023

Background

- Competitive load zones last defined in 2003
  - Significant load growth in North and South zones
  - Changing congestion patterns
- IMM State of the Market recommendation starting in 2020 to revaluate load zones based on key congestion patterns
  - Minimize intra-zonal congestion
  - Provide better incentives for demand response

Methodology – Congestion Component per Substation

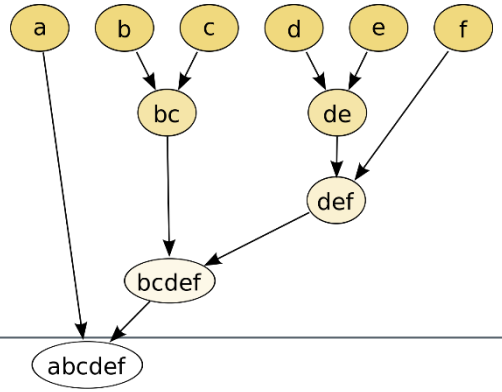
- Starting with electrical bus LMPs, subtract the System Lambda and just use the congestion component
  - Input dataset time range from June 2020 to May 2023
- Using MW injections (the same values currently used for electrical bus weighting in Load Zone calculations) as weight, determine a weighted average congestion component per substation per SCED execution
  - Exclude substations that fall into NOIE Load Zones
- With SCED interval duration as a time-weight, aggregate the substation congestion component to seasonal averages per substation
  - Season bounds: Dec-Feb in Winter, Mar-May in Spring, Jun-Aug in Summer, and Sep-Nov in Fall
- For annual looks, both a simple average and root mean square of the seasonal values were used

Methodology – Clustering

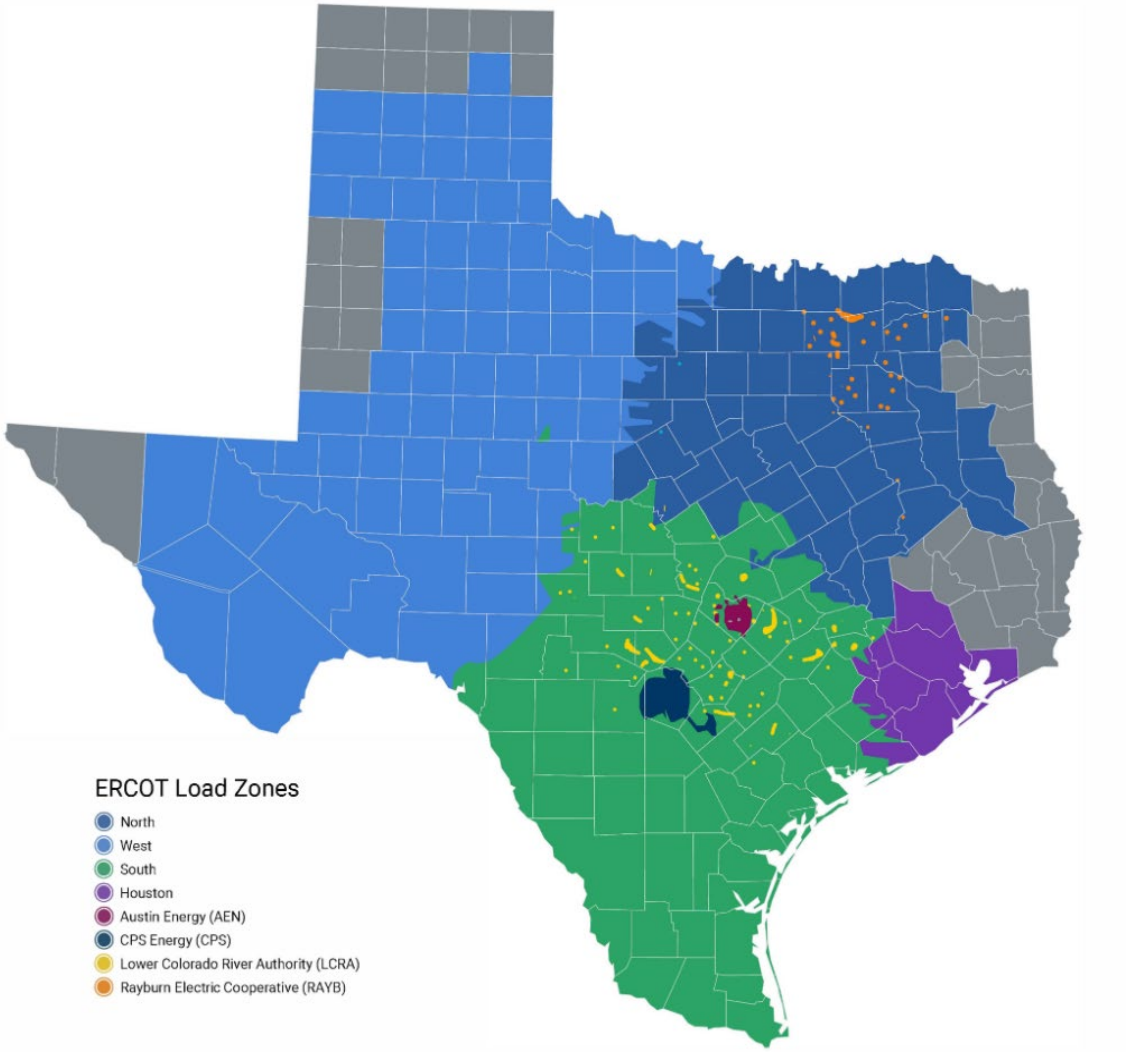
- Convert the latitude and longitude of each substation into x-y coordinates
- Distance between substations computed as:

$$Max[\sqrt{(y_a - y_b)^2 + (x_a - x_b)^2}, 0.00001]^2 * \sqrt{Max(|CC_a - CC_b|, 0.001)}$$

  where (x_a, y_a) and CC_a are the coordinates and congestion component for Substation *a*, and (x_b, y_b) and CC_b are the coordinates and congestion component for Substation *b*
  - The coordinate difference is squared and the congestion component difference is square rooted to give geographical distance more weight such that substations with similar congestion component magnitudes located at opposite ends of Texas are not seen as "close"
- Applied the following clustering process
  - Distance from one substation to another is computed for all substations
  - Substation pairs with least distance are grouped together
  - New coordinates and congestion component average computed for the groups
  - New distances computed between the formed groups
  - Repeat process until only 1 group remains



Current load zone map



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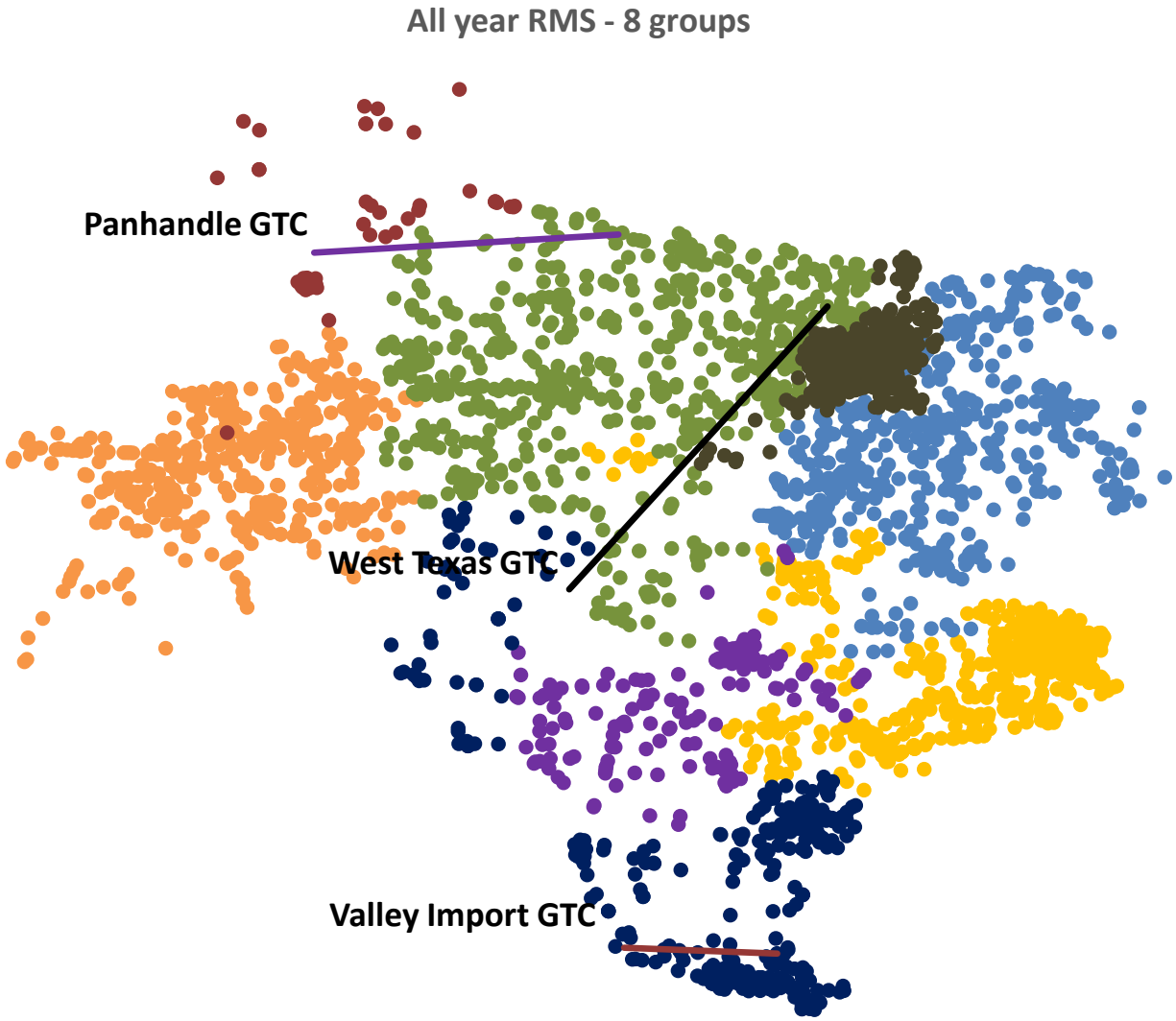
Level 1 – All year Root Mean Square (RMS)



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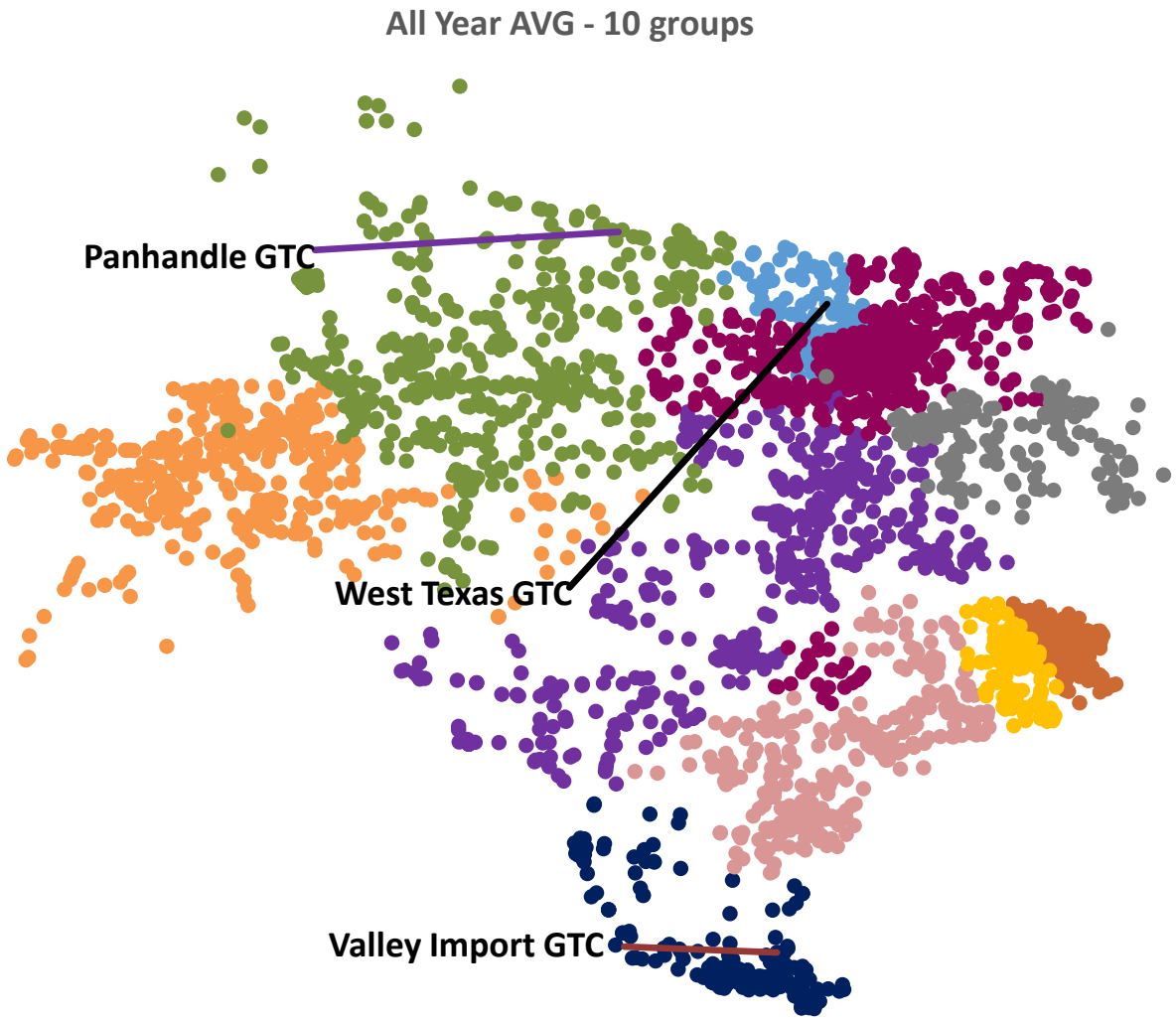
Level 1 – All year Average



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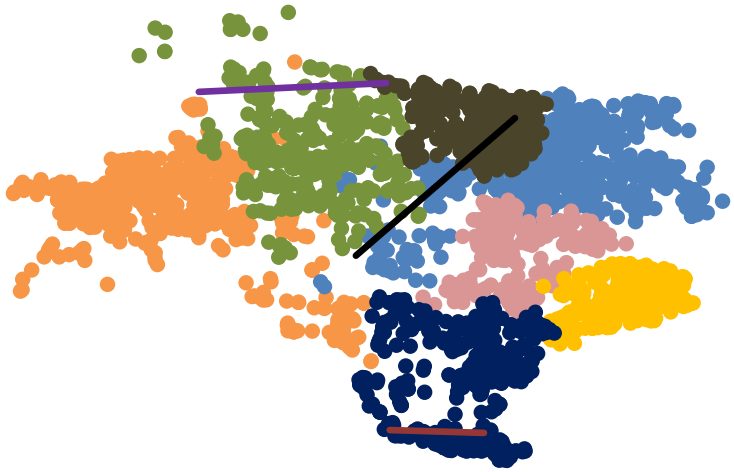
Level 1 – All seasons

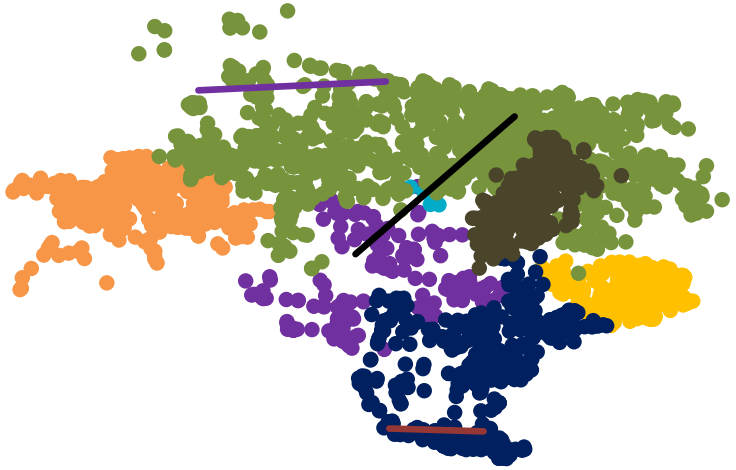
Spring - 7 groups



Summer - 7 groups

Fall - 8 groups

Winter - 7 groups



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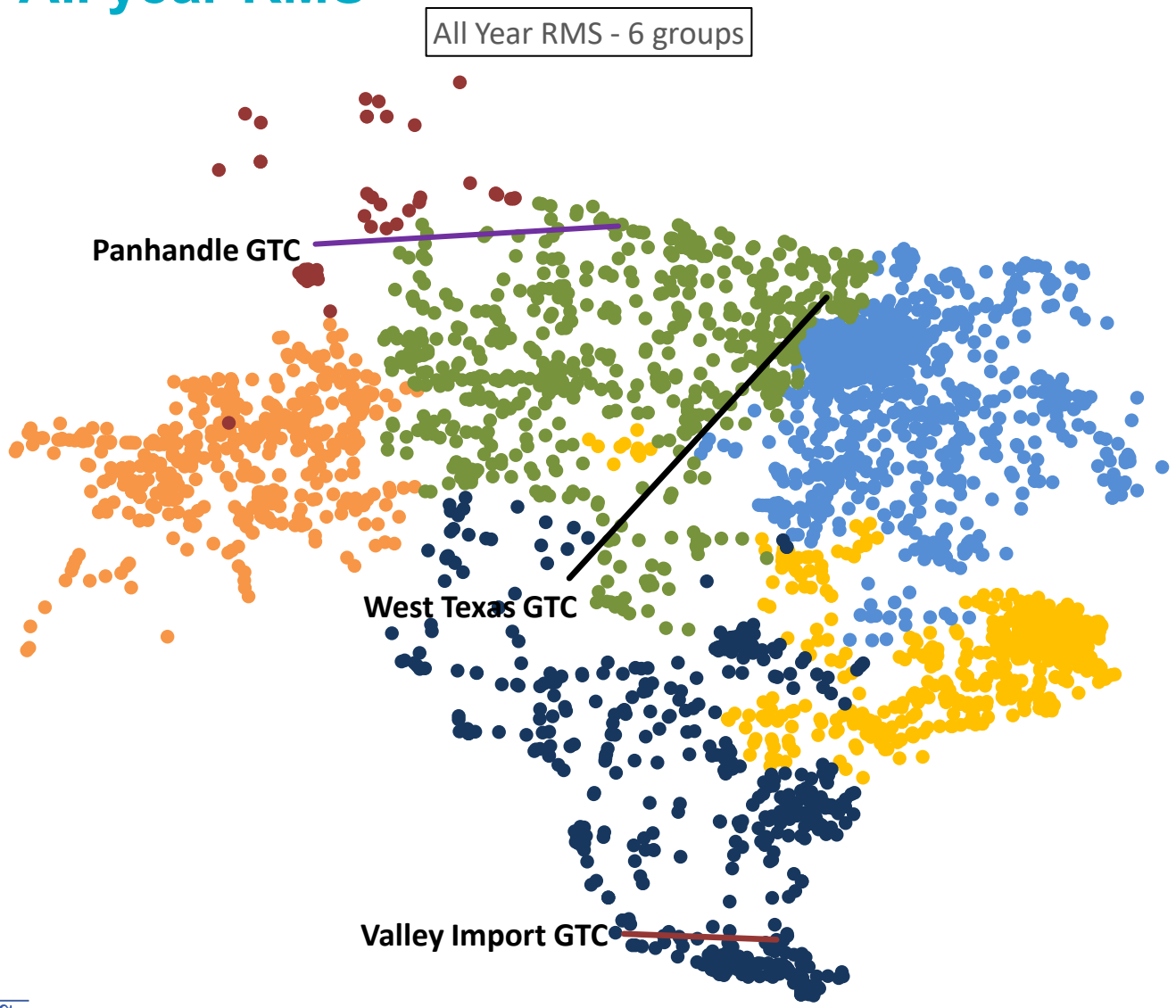
Level 2 – All year RMS



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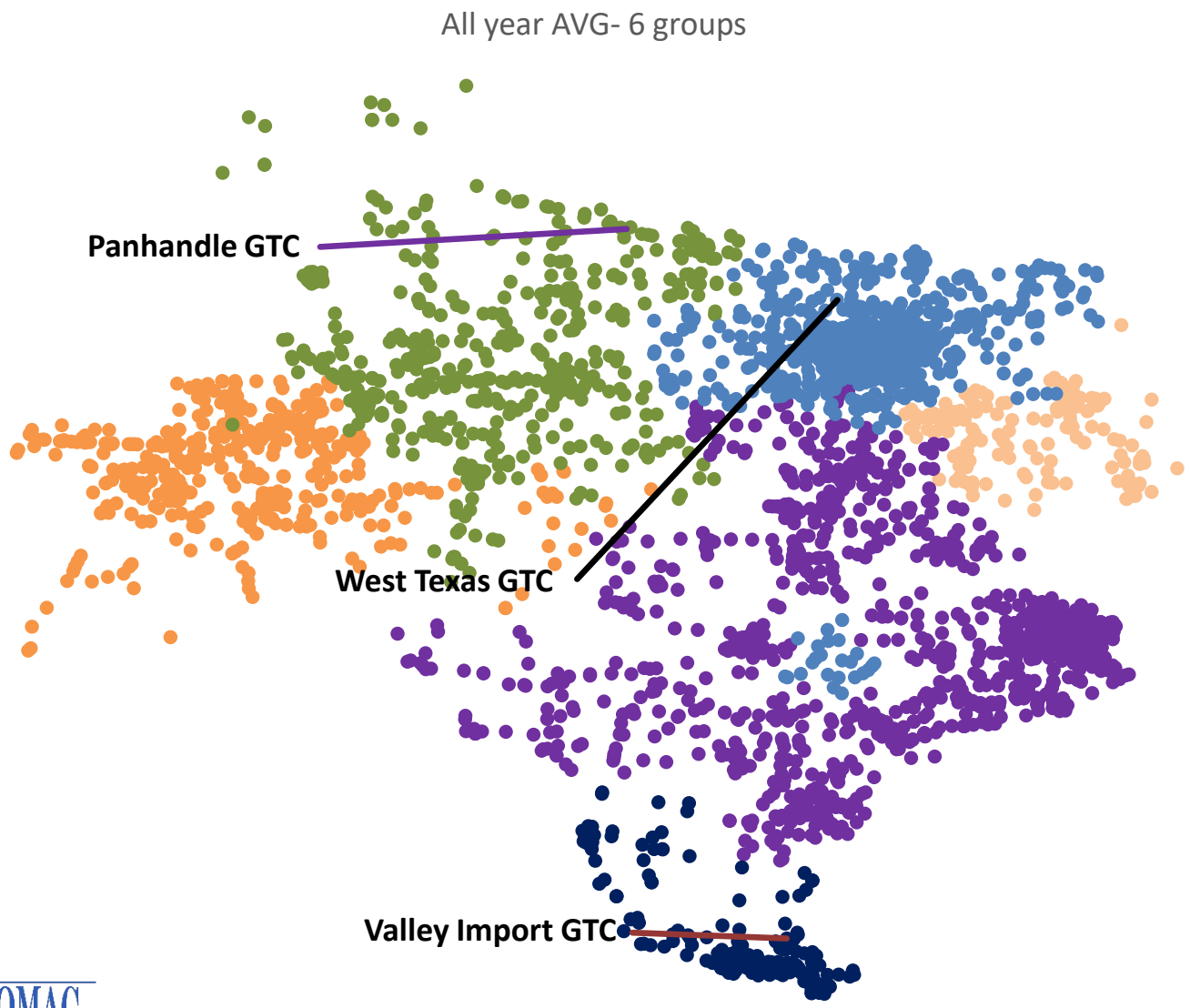
Level 2 – All year Average



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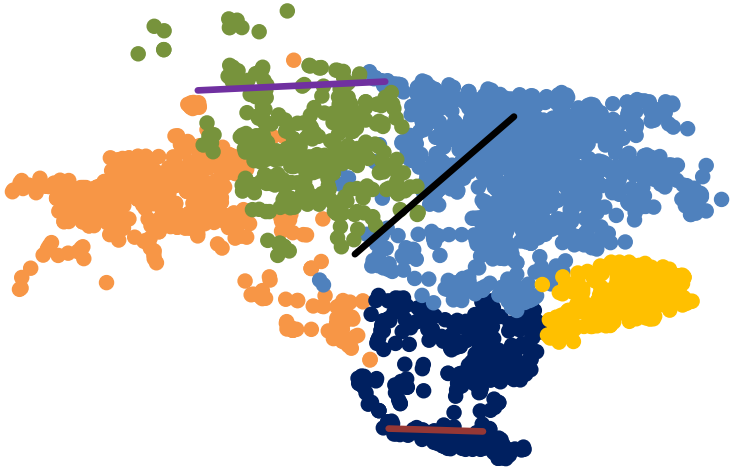
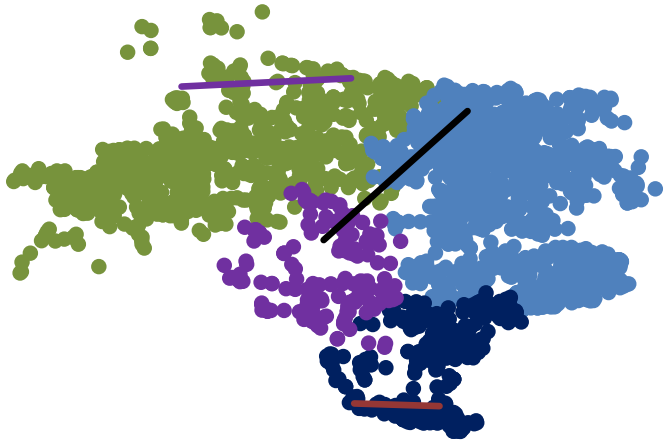
Level 2 – All seasons

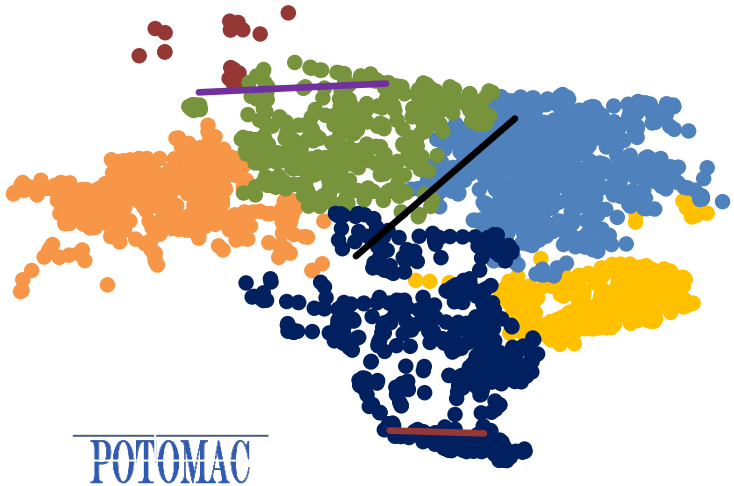
Spring - 5 groups



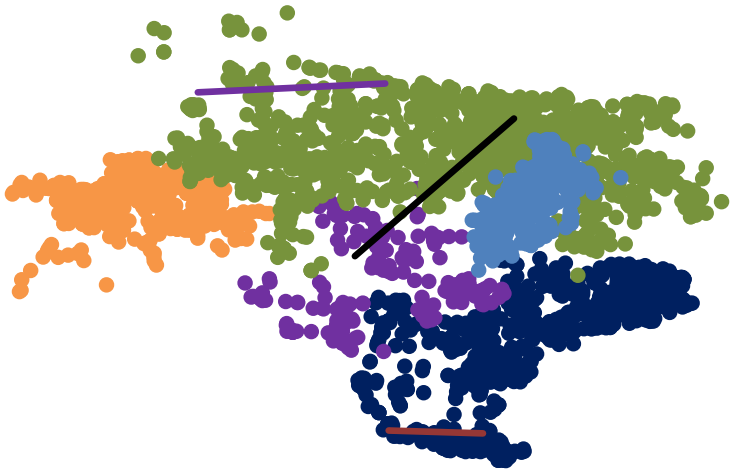
Summer - 4 groups



Fall - 6 groups



Winter - 5 groups



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Next Steps

- Soliciting proposed modifications to this analysis or additional analysis requests
  - Eventual consensus on a load bus grouping would be useful in addition to input on naming
  - Load Zone changes will require Board approval and an effective day 4 years in the future