Lawrence Berkeley National Laboratory

Behavior Analytics

decision science, econometrics & machine learning for evidence-based & big-data-driven results

Behavior Analytics Webinar Series

Uses for Smart Meter Data

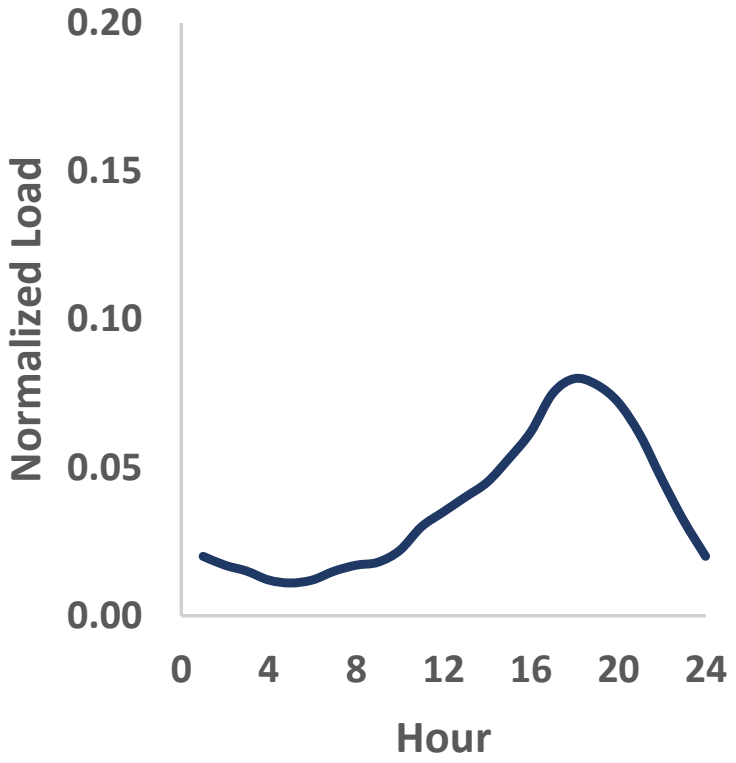
Topic #2: Advanced Customer Segmentation

Peter Cappers & Annika Todd

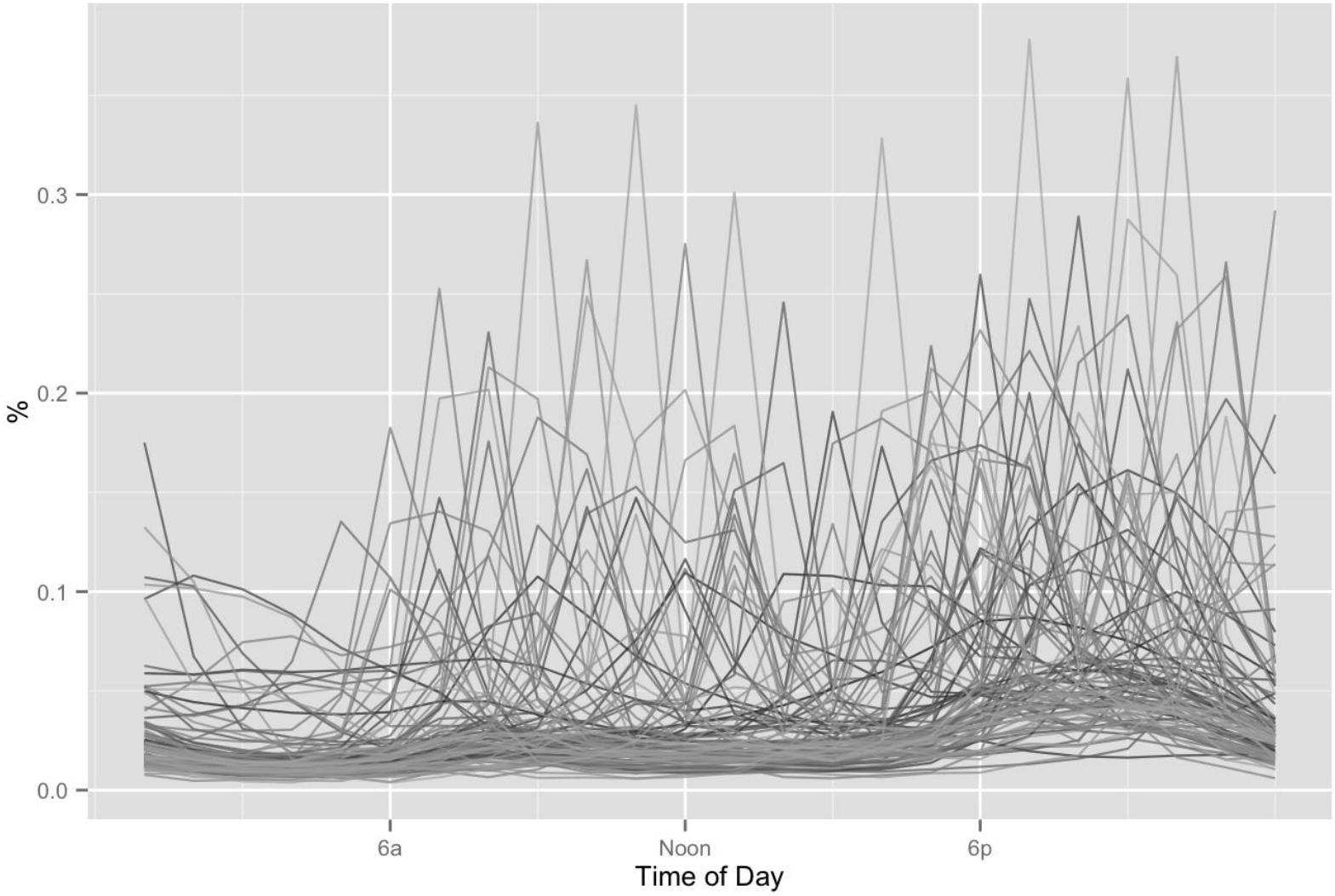
November 29, 2018

Research team also includes: C. Anna Spurlock, Ling Jin, Sam Borgeson, Dan Fredman

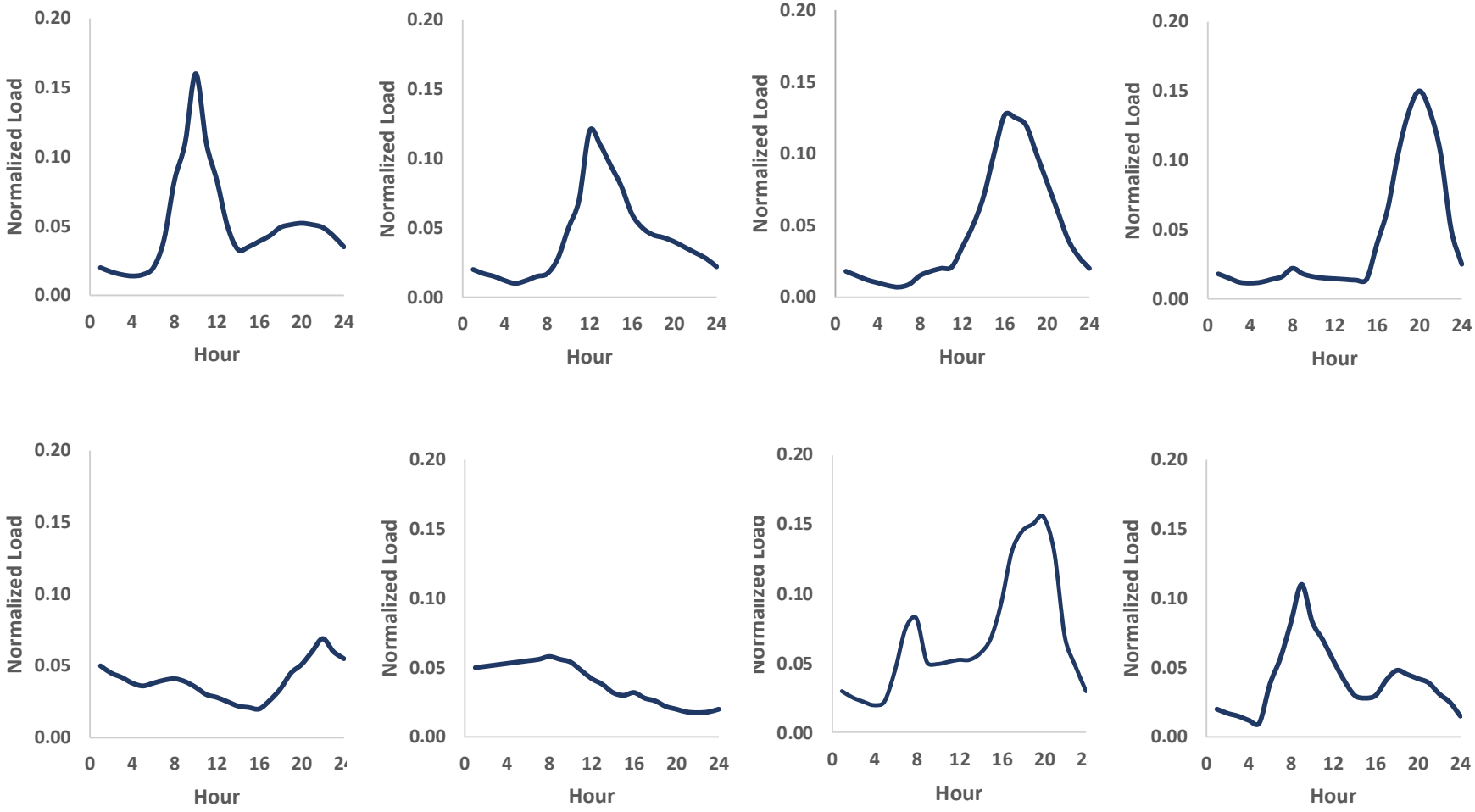
Are All Residential Customers the Same?



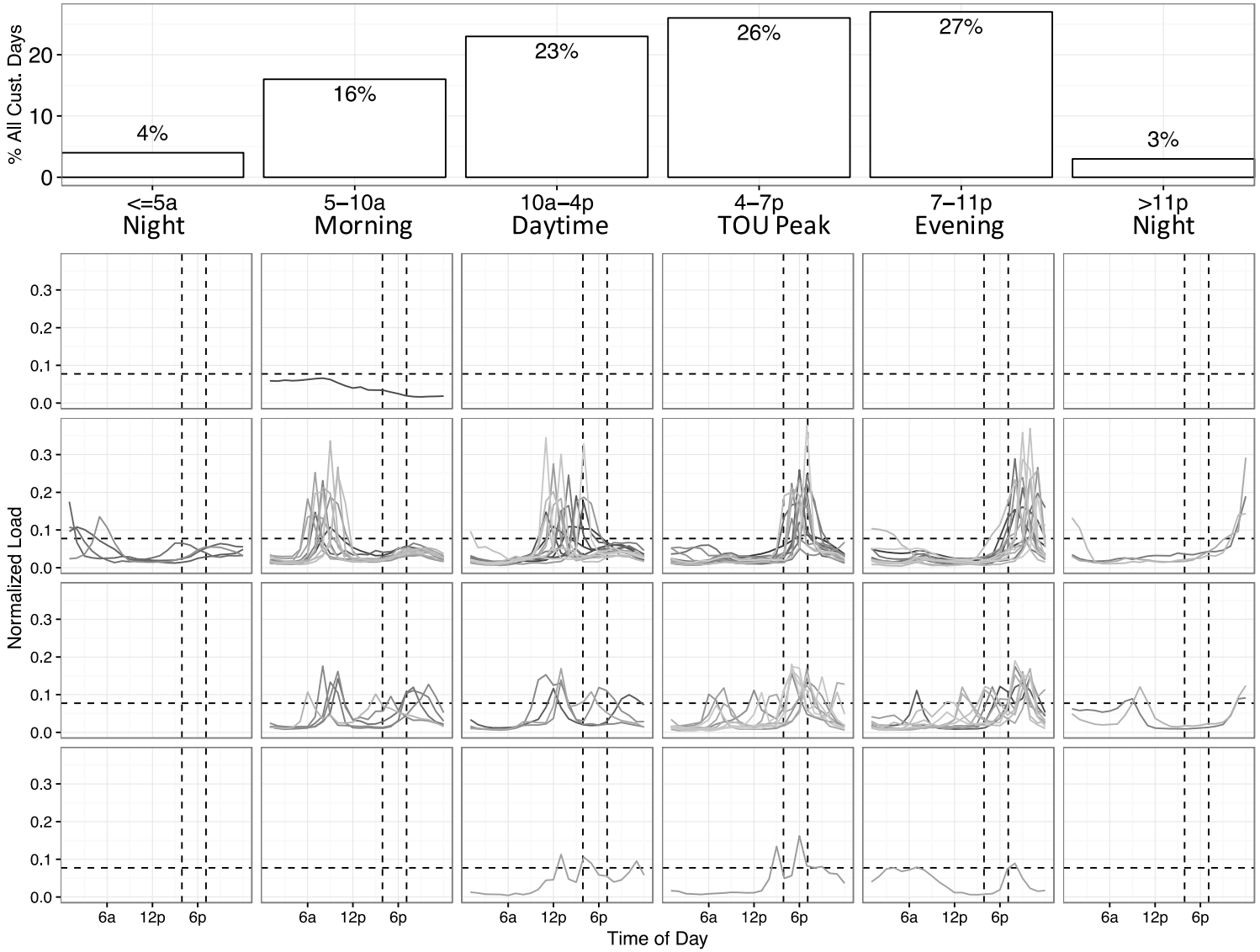
Wide Variety of Load Shapes Exist Across Customers Within the Same Class

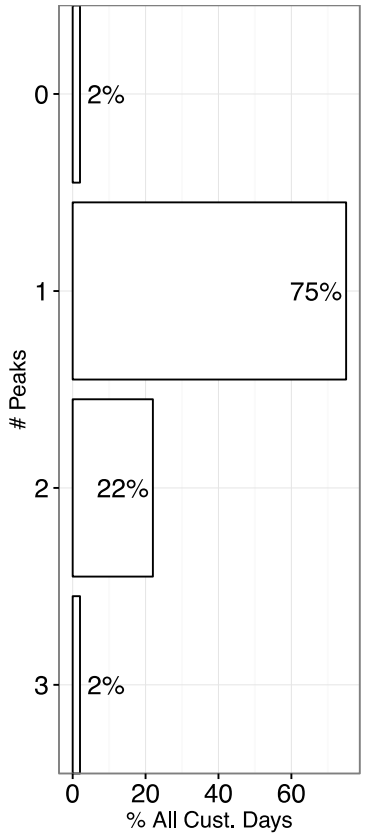


Common Customer Load Shapes



Group Load Shapes Based on When and How Many Customer Load Peaks Occur

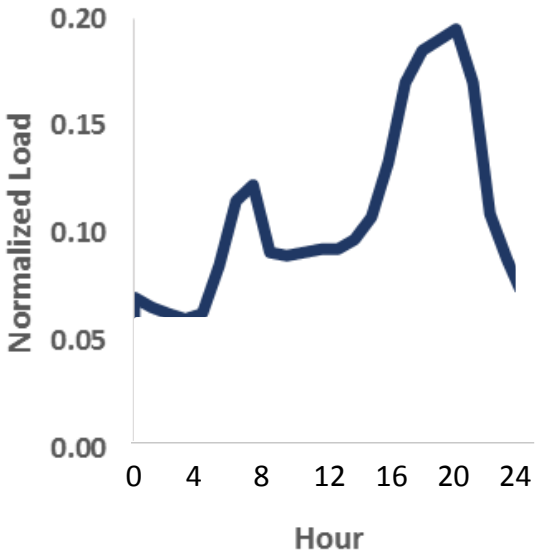




Load Shape Characteristics that Could Affect Participation and Response

Load Shape: 24 hour usage for household #63

On one summer day



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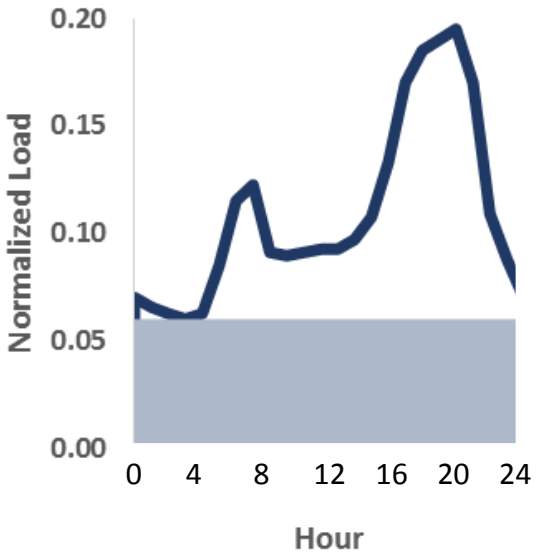

1. Baseload usage: Daily minimum usage

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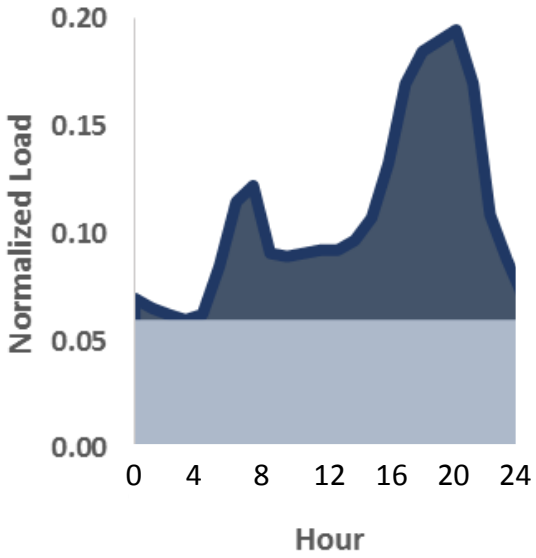


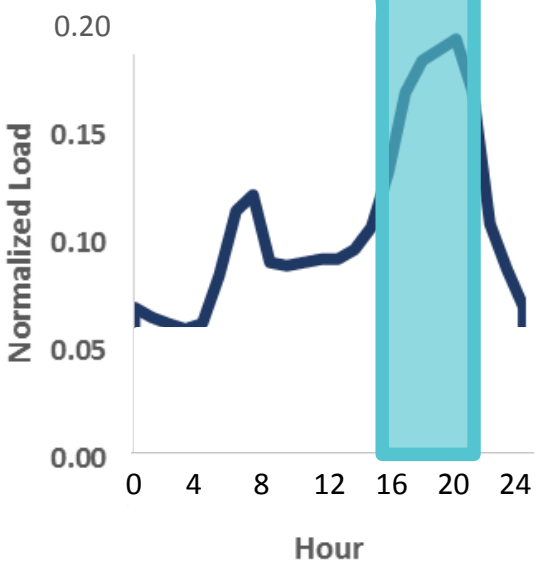
2. Discretionary usage: Difference between usage and base load

1. Baseload usage: Daily minimum usage

Load Shape Characteristics that Could Affect Participation and Response

Block period usage: average usage over a block of hours

3. Peak



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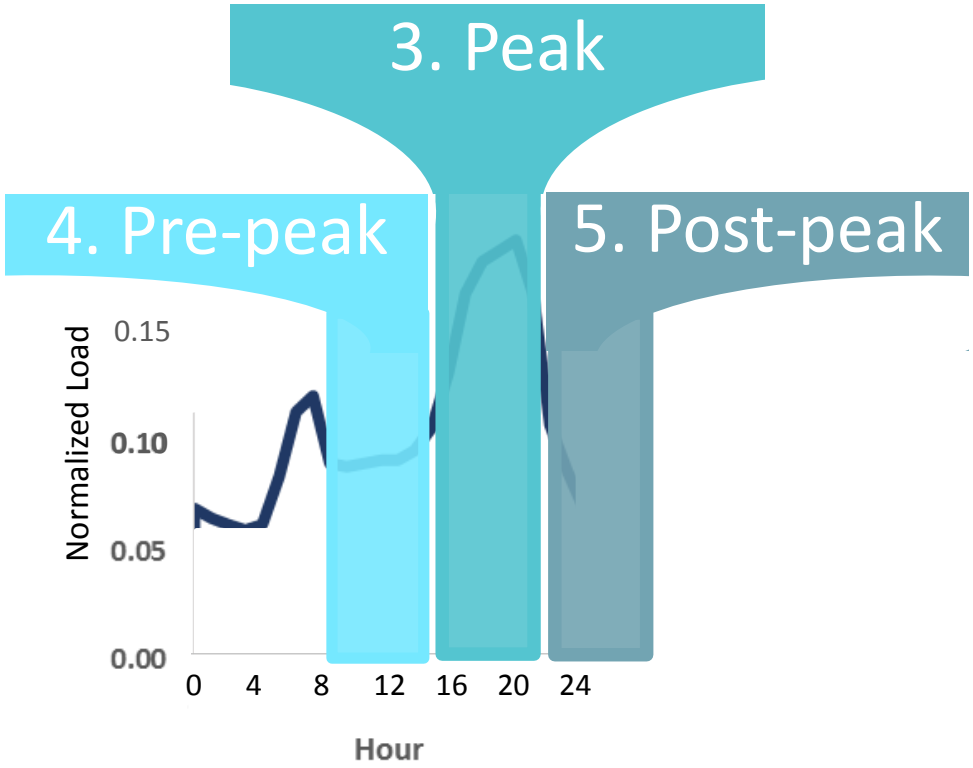
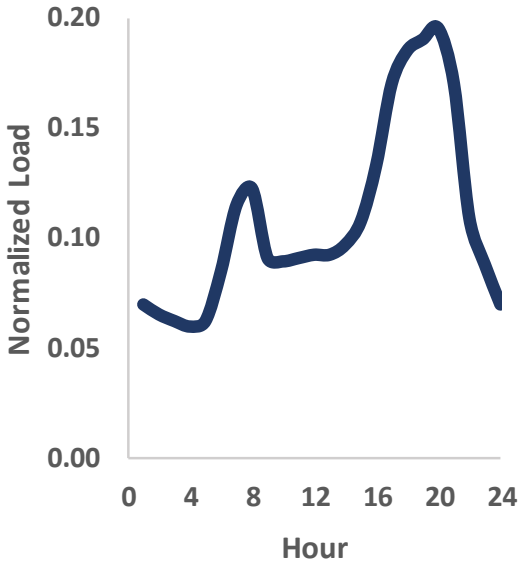


Load Shape Characteristics that Could Affect Participation and Response

Load Shape: 24 hour usage for household #63

On one summer….

Wednesday



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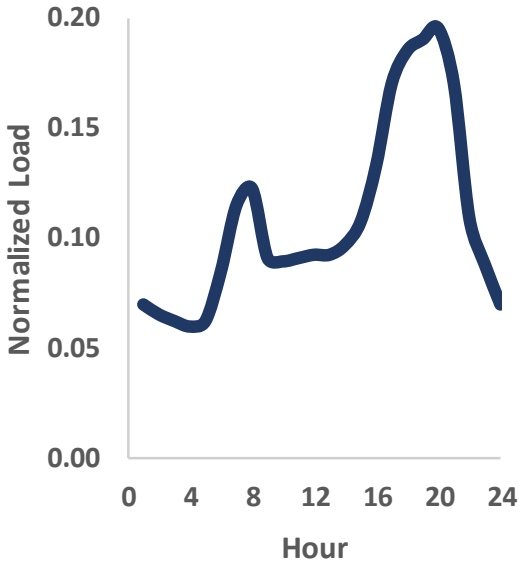
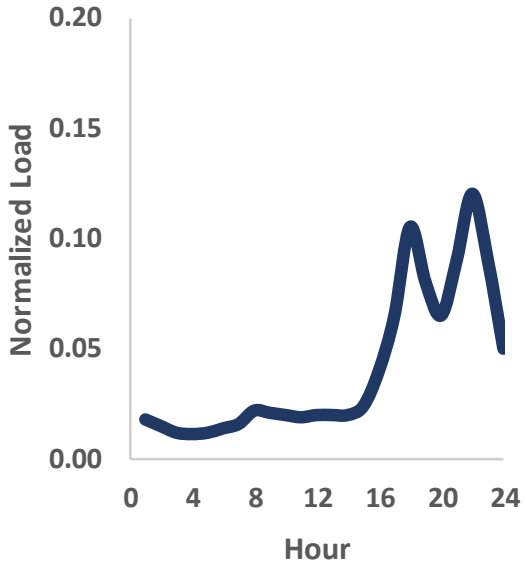


Thursday



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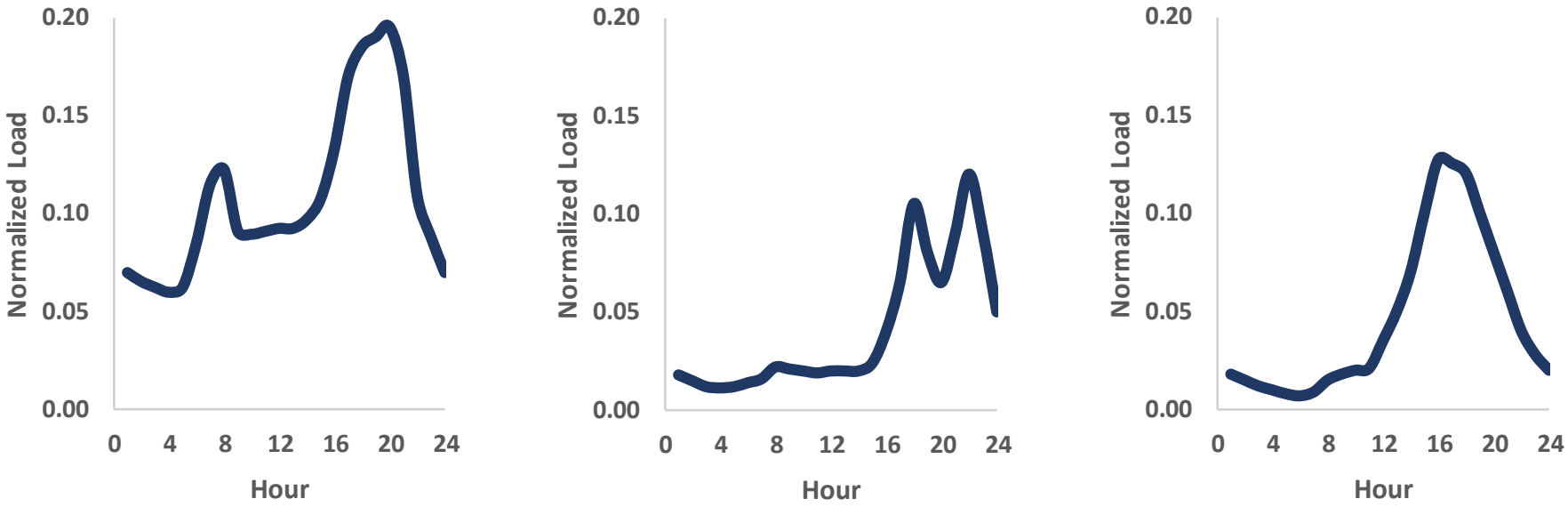
On one summer….

Wednesday **Thursday** **Friday**



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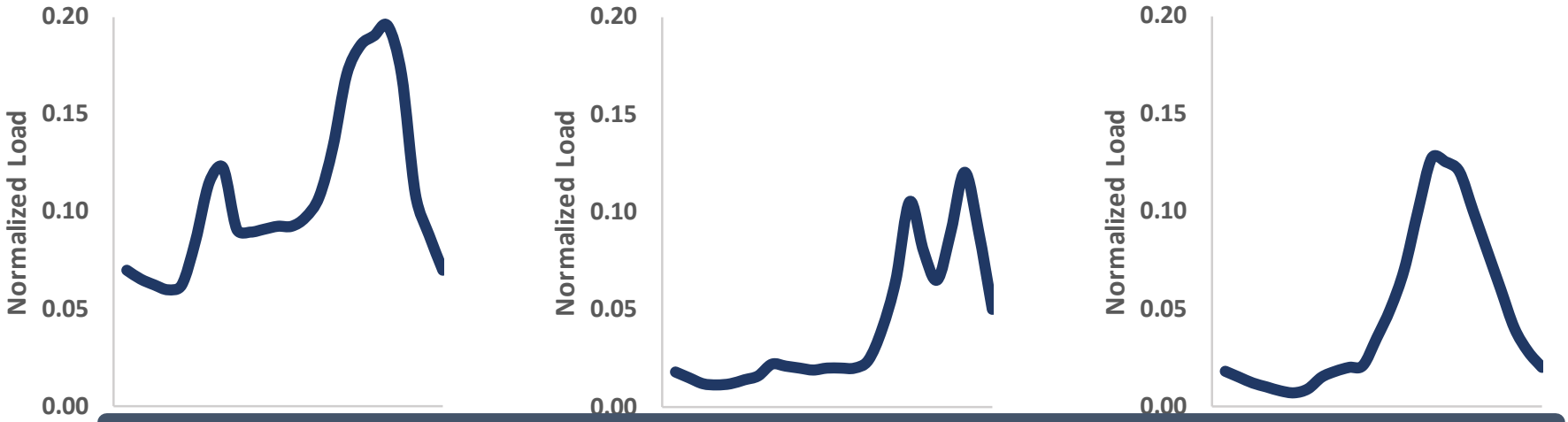

← 6. Variability in **load shapes** across days →

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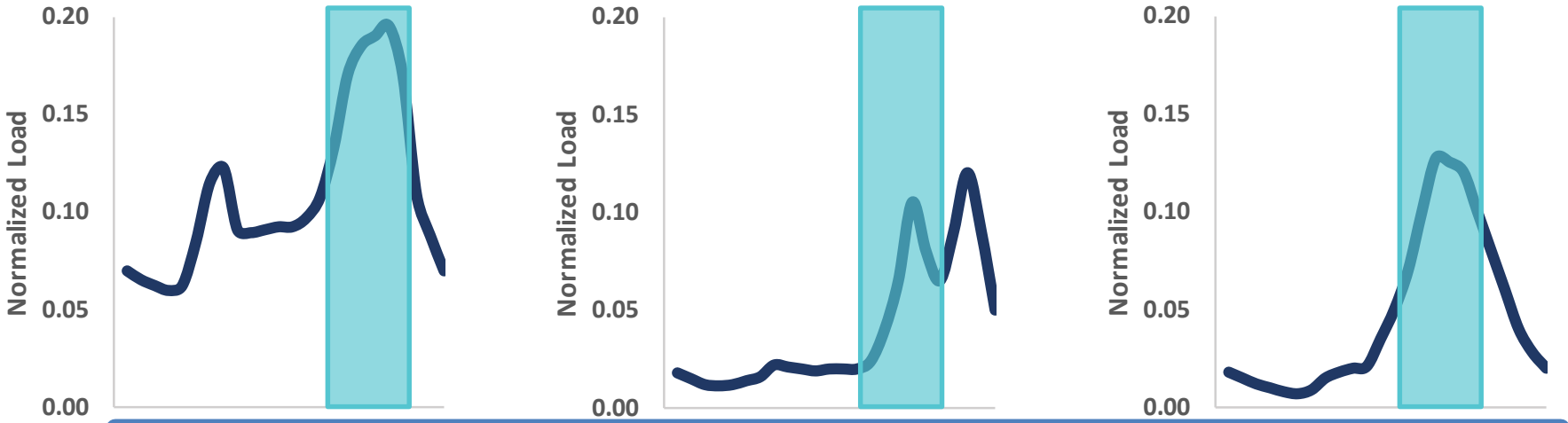

← Variability in **block period usage** across days →

7. Peak

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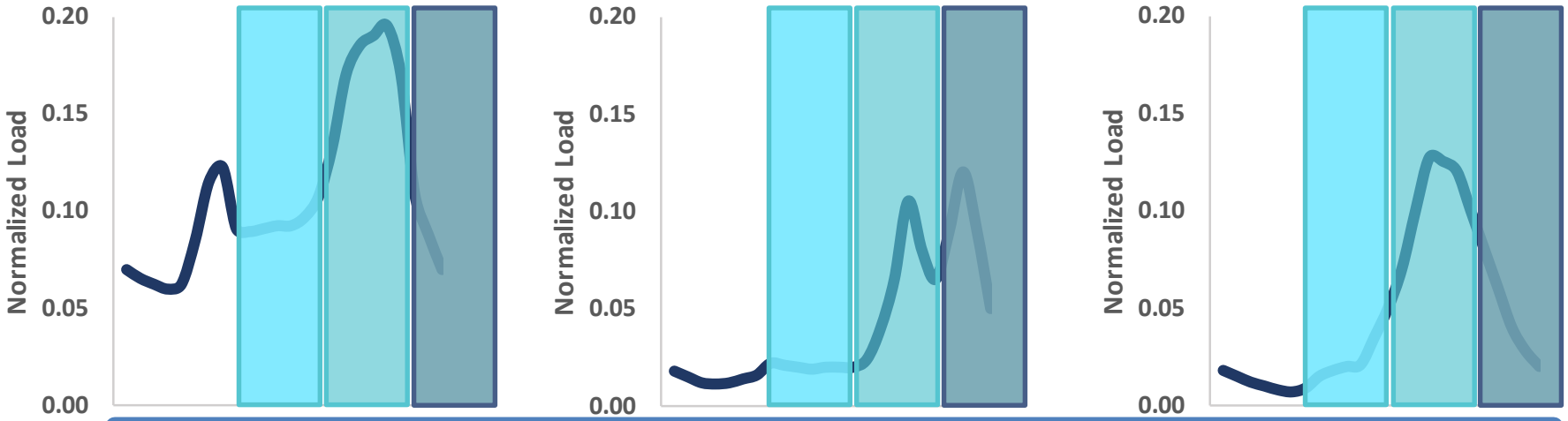

← Variability in **block period usage** across days →

8. Pre-peak | 7. Peak | 9. Post-peak

Use Characteristics to Cluster Customers Together

- Apply metrics to relevant smart meter dataset
- Cluster customers based on these characteristics
- Assess the level of each characteristic for each cluster relative to the other clusters

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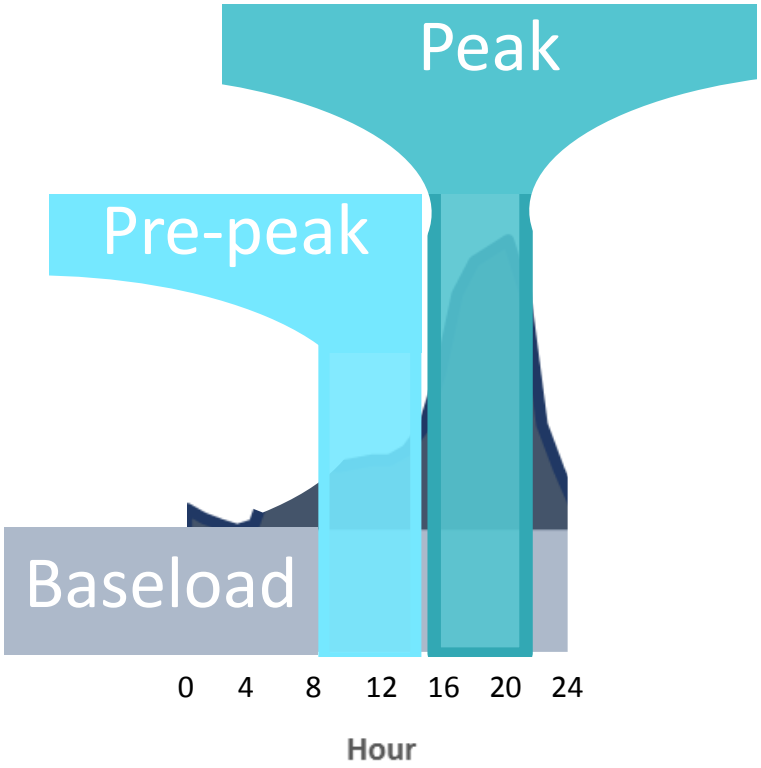
Real world example:

→ We found the characteristics of load shapes that mattered to form cluster groups…..

Load Shape Characteristics that we found are important for clustering households into groups



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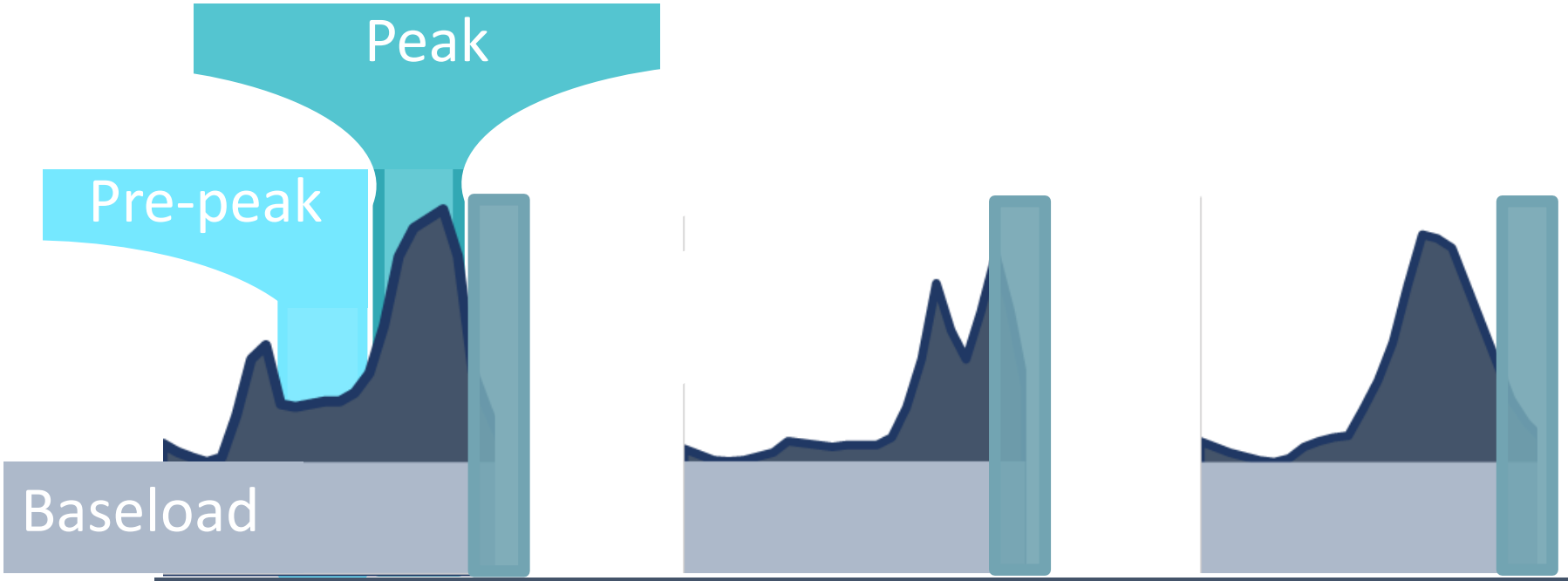
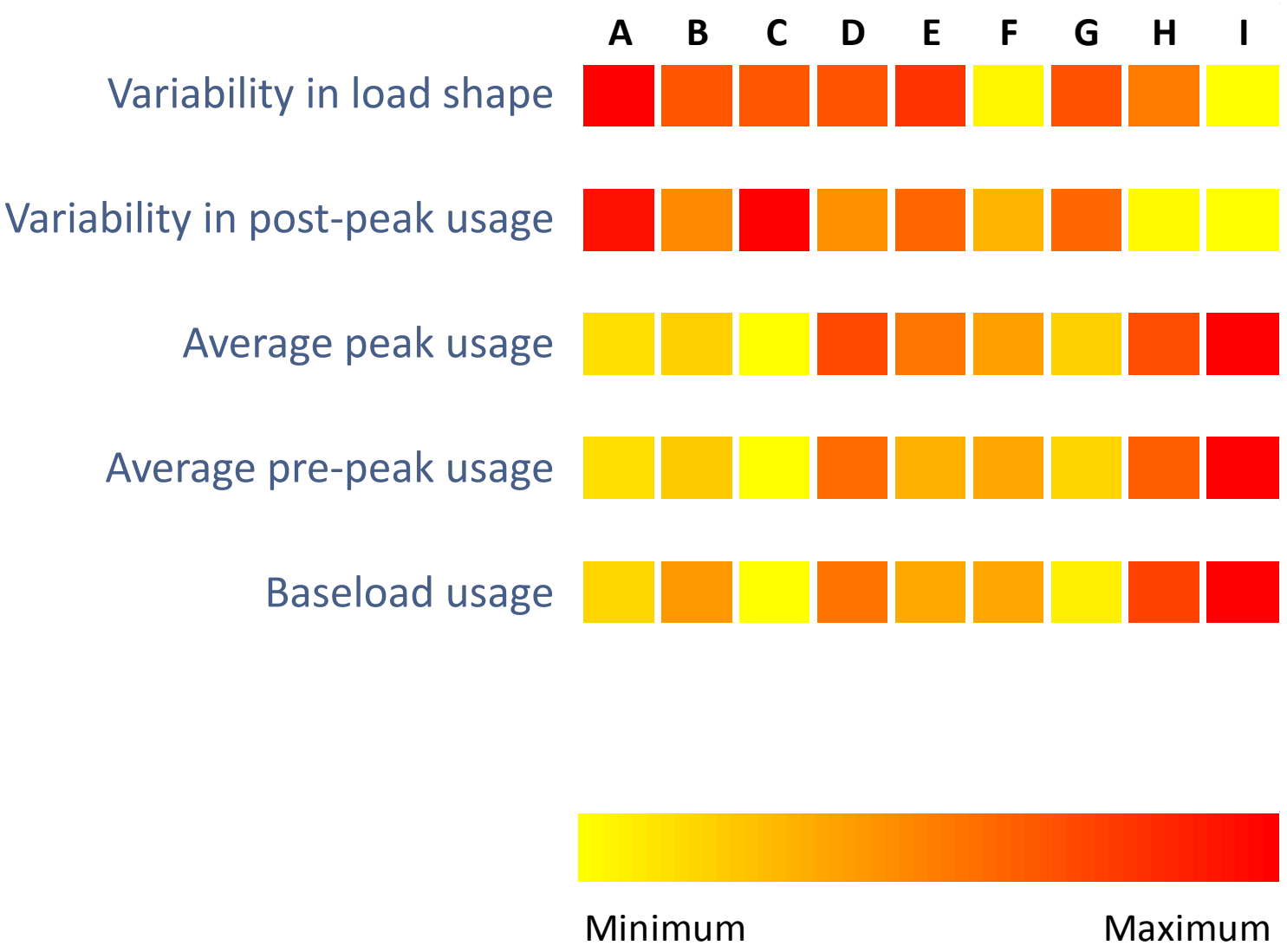


← Variability in **load shapes** across days →

← Variability in **post-peak hours** across days →

Comparing Load Shape Metrics Across Customer Cluster Groups



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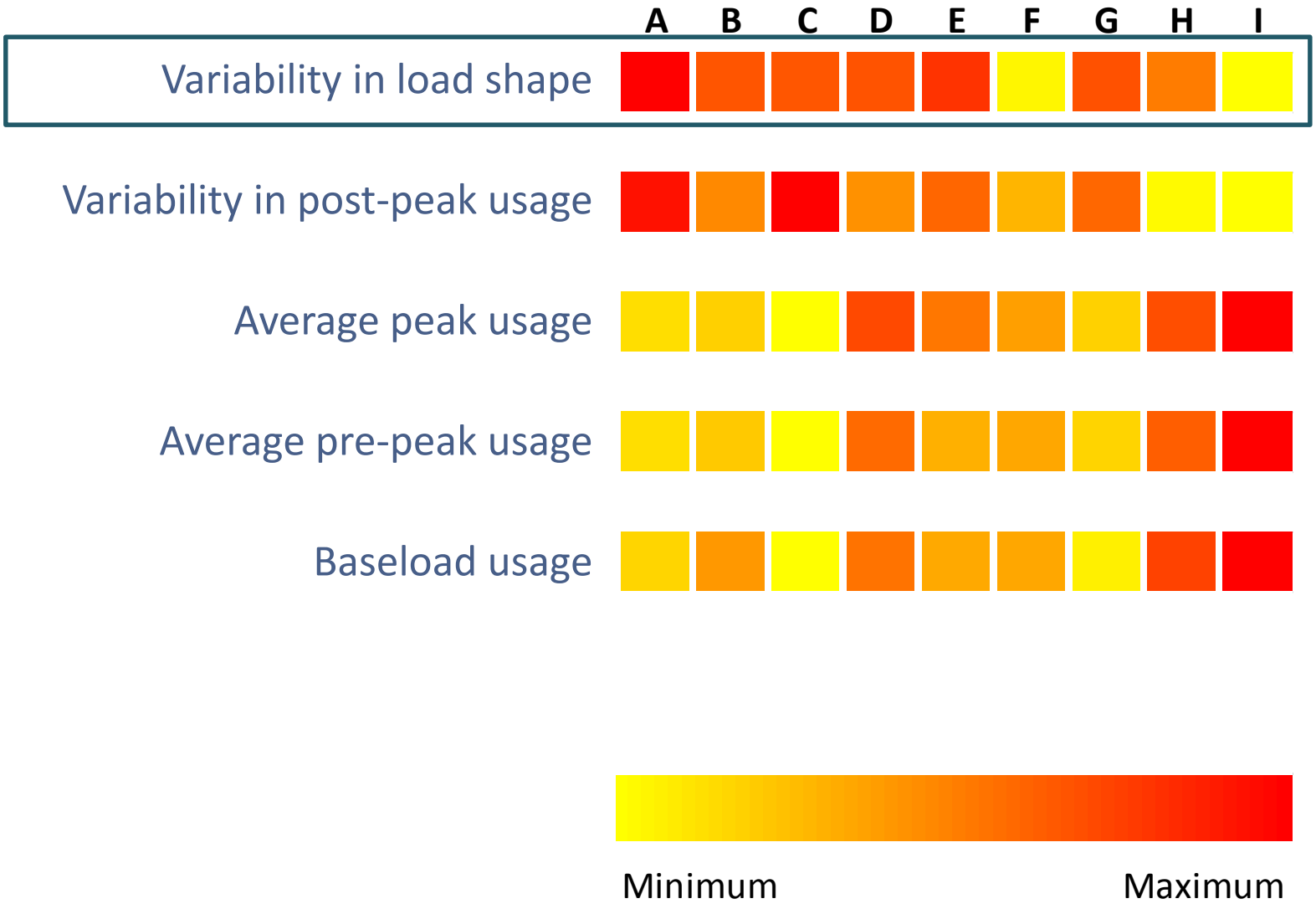

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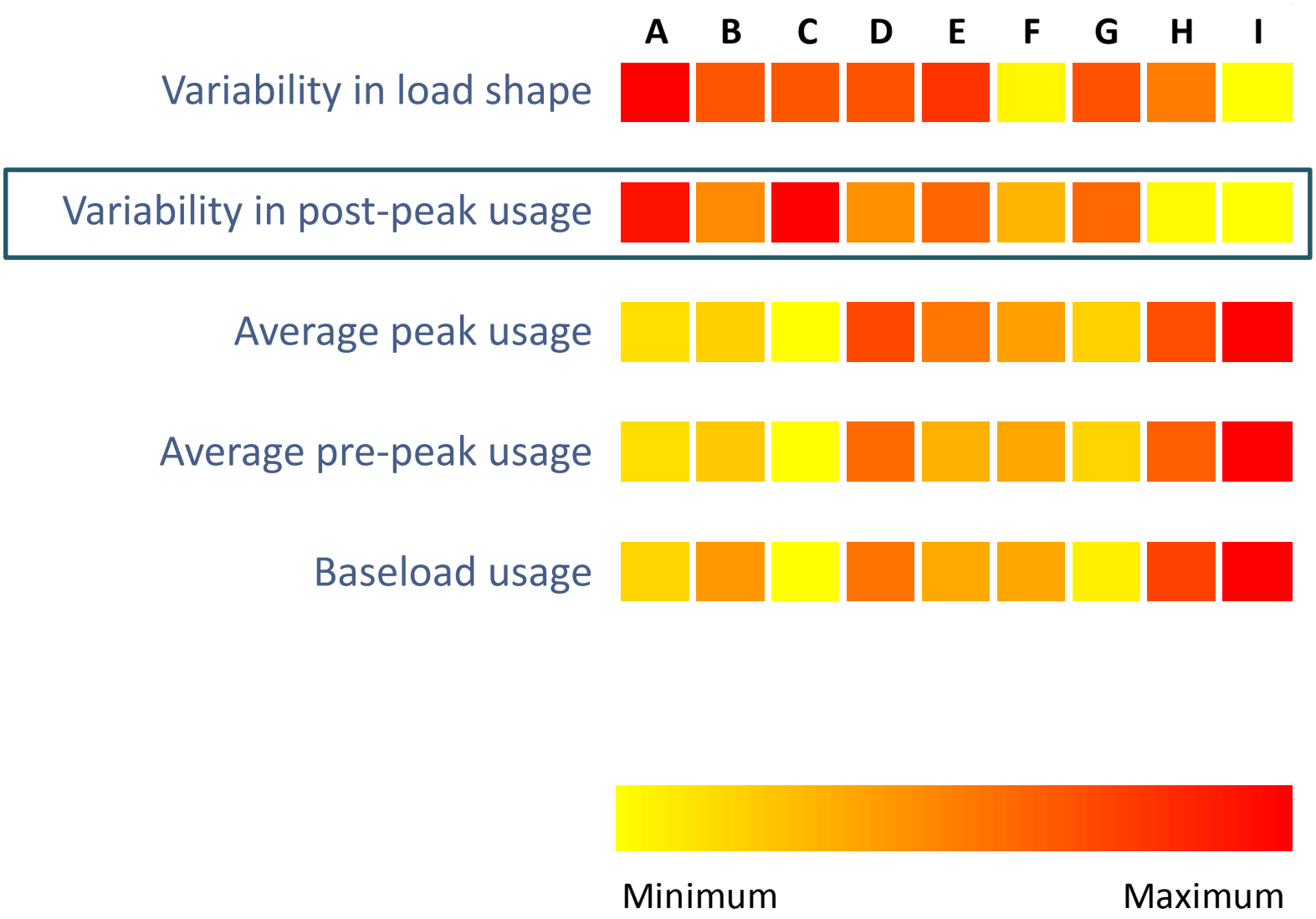

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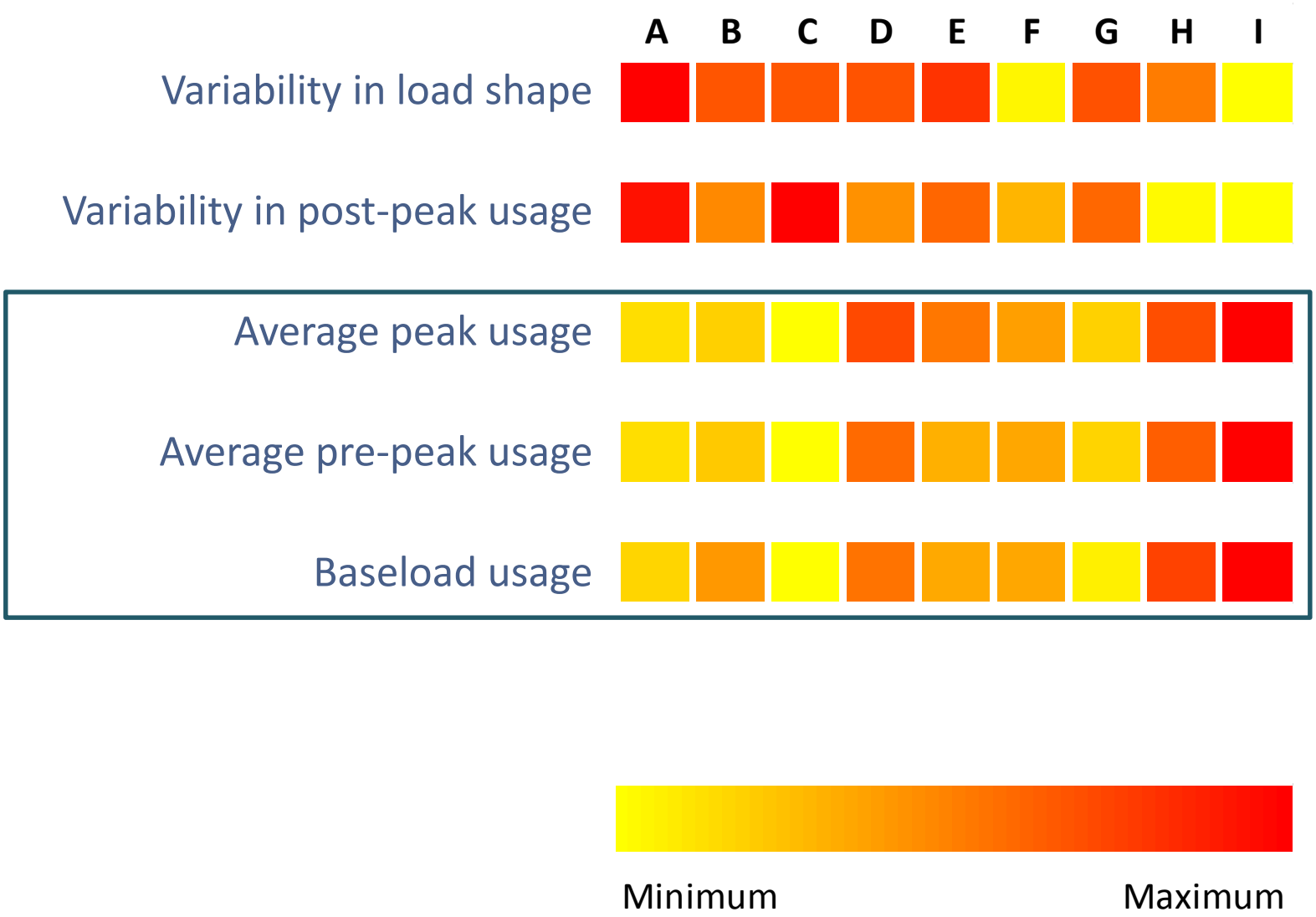

Applications of Customer Cluster Grouping for Rate or Program Offerings

Rate or Program Target Marketing

- **Existing load profile characteristics**
  - **High savings potential**: Customers who have a large amount of load in the various key points in the day (i.e., peak and pre-peak periods) could potentially change it in response to a rate or program
  - **Low baseload usage**: Customers who have minimal baseload have more load that is discretionary and thus more load that could be altered in response to a rate or program

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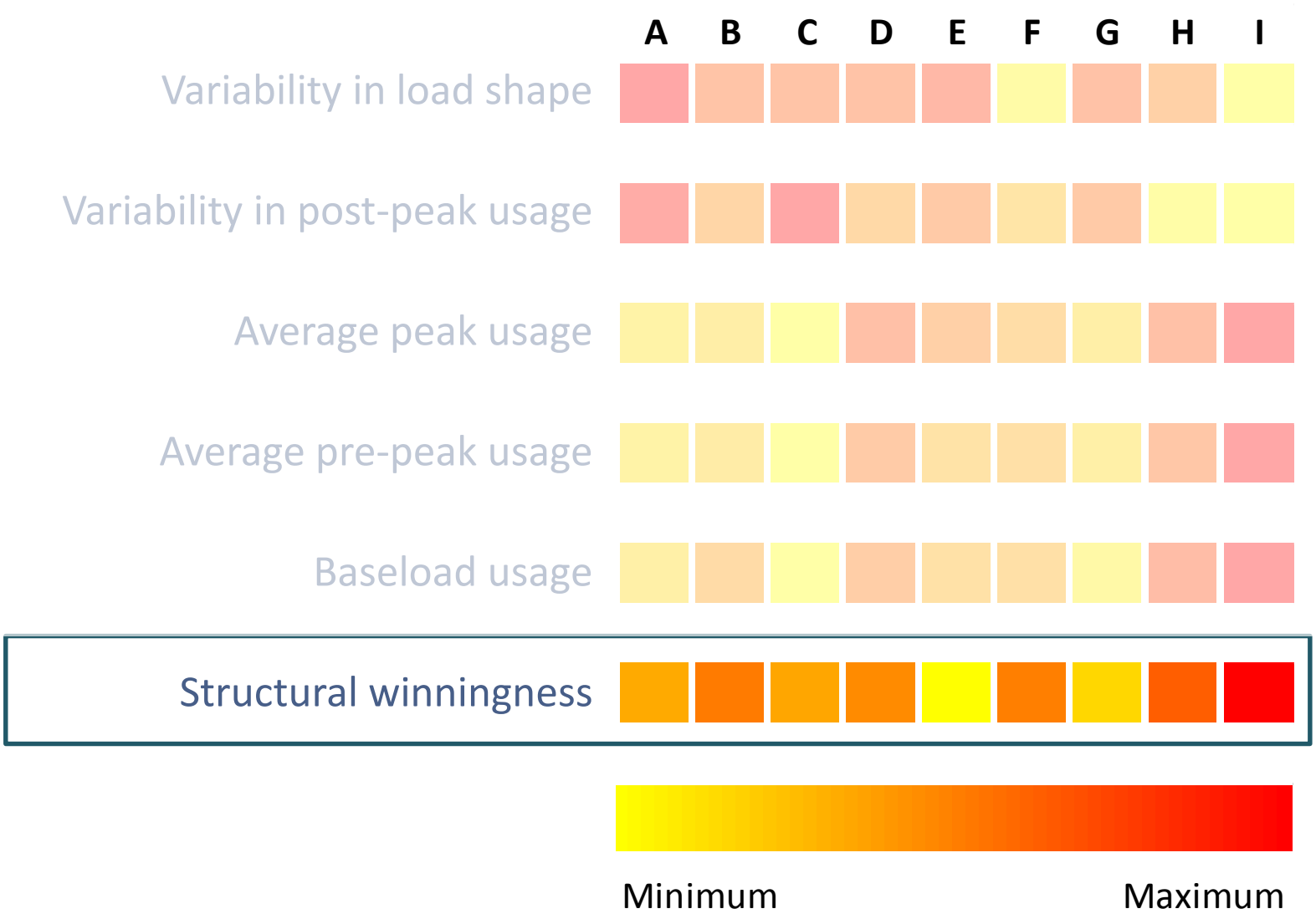
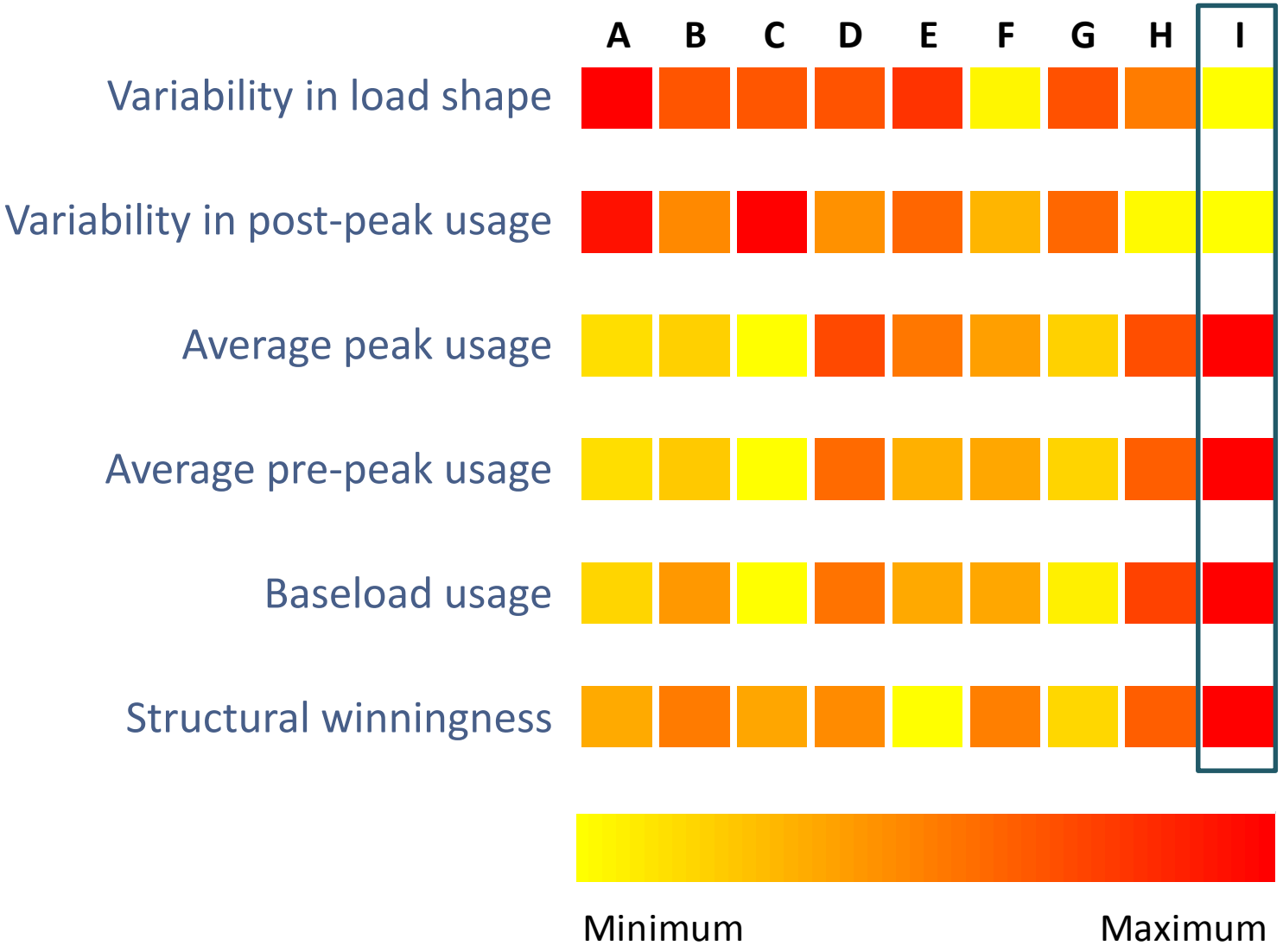
  - **Low baseload usage**: Customers who have minimal baseload have more load that is discretionary and thus more load that could be altered in response to a rate or program
- **Derived rate/program specific load profile characteristics**
  - **Structural winningness**: Customers who are financially better off just by participating in the rate or program

Comparing Load Shape Metrics Across Customer Cluster Groups



Comparing Characteristics Across Customer Cluster Groups



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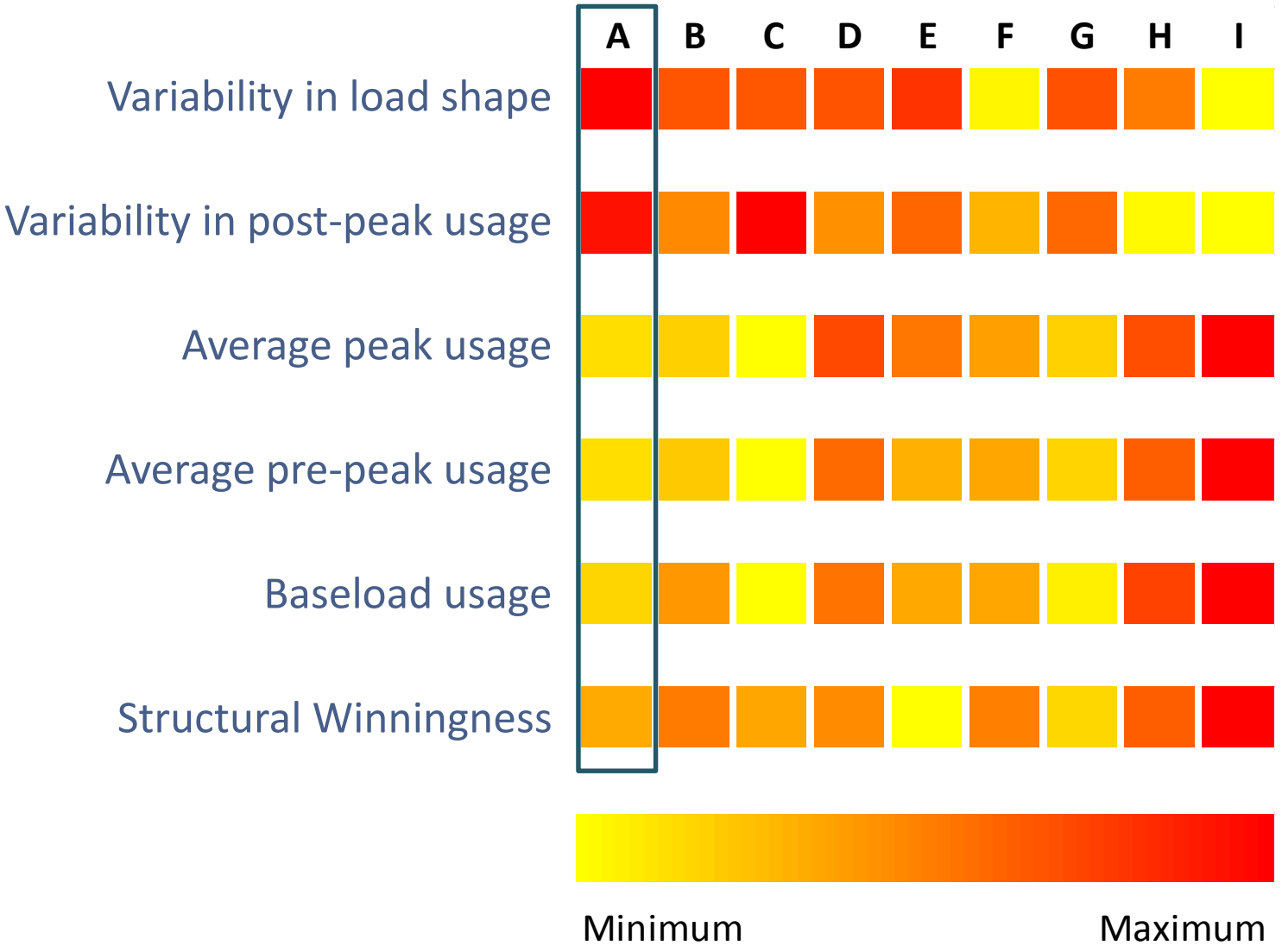
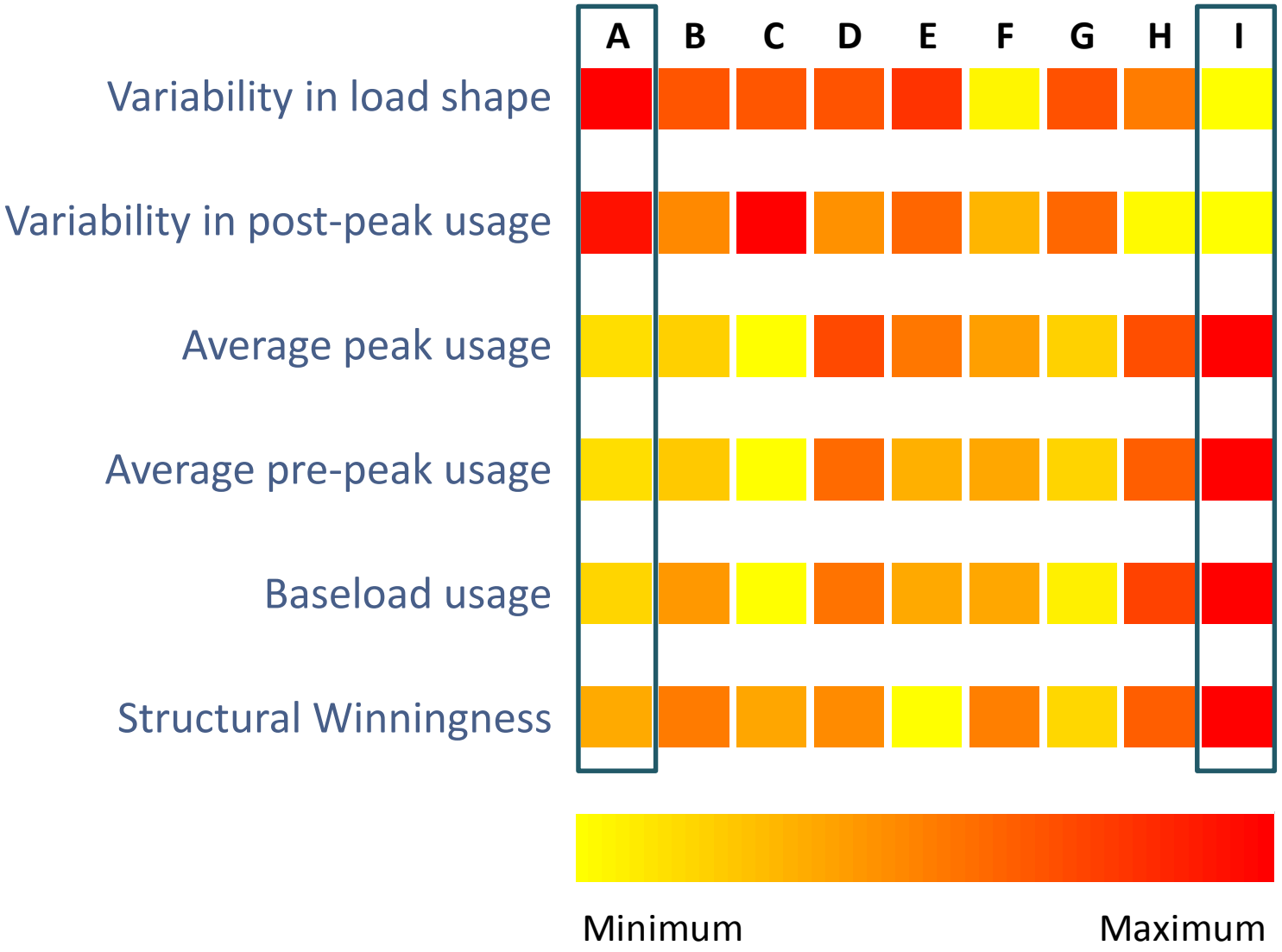


Comparing Characteristics – Cliffhanger!!! What is the ground truth?



Conclusions

- By analyzing existing smart meter data, a utility can:
  - Better understand the diversity of customers in its service territory
  - Identify load shape characteristics that may be more conducive than others for participation in some rate or program

Berkeley Lab - *Behavior Analytics*

Providing insights that enable evidence-based, data-driven decisions

Next webinar in this series:

Dec 13th @ 1:30 EST / 10:30 PST

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