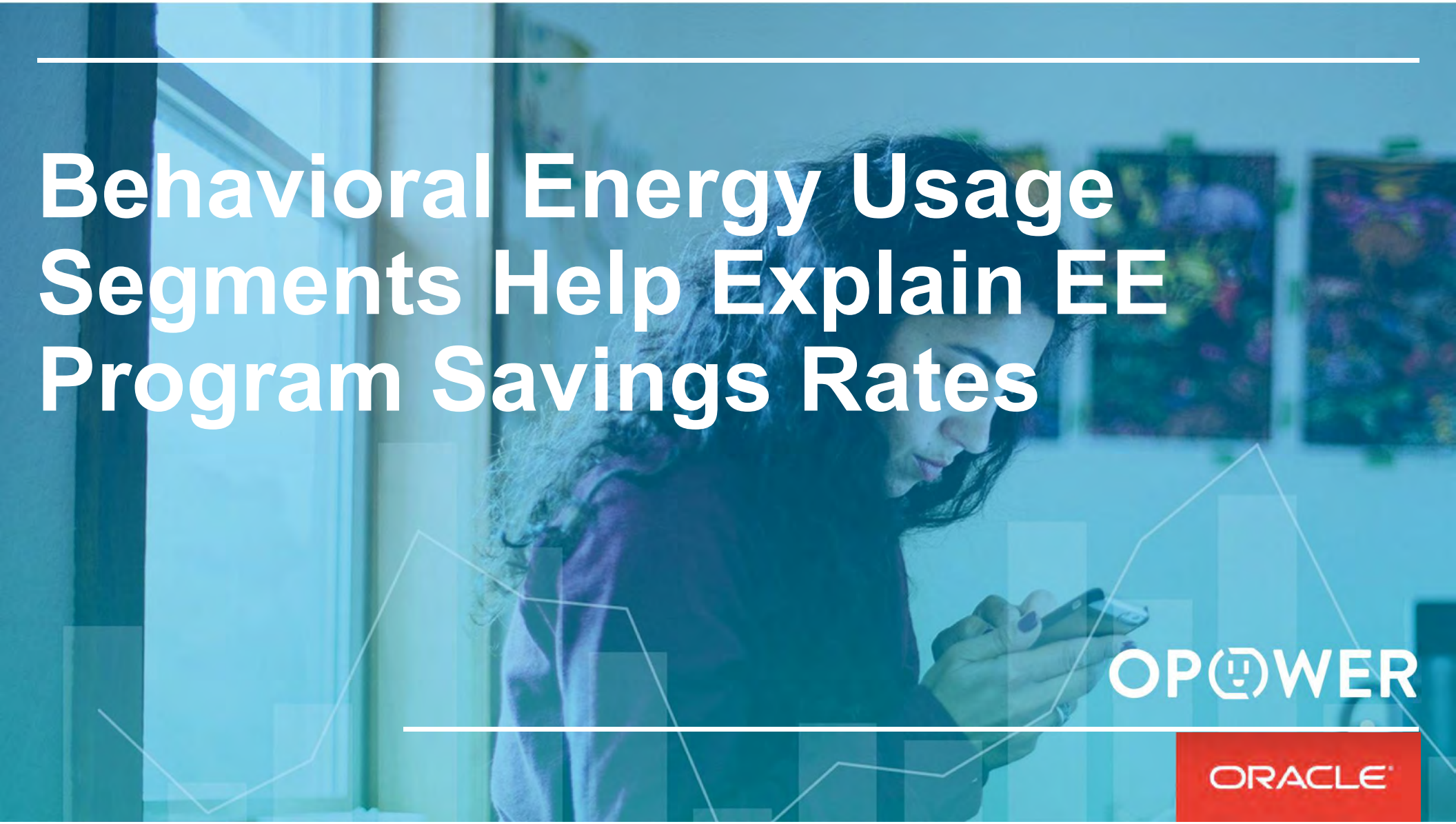
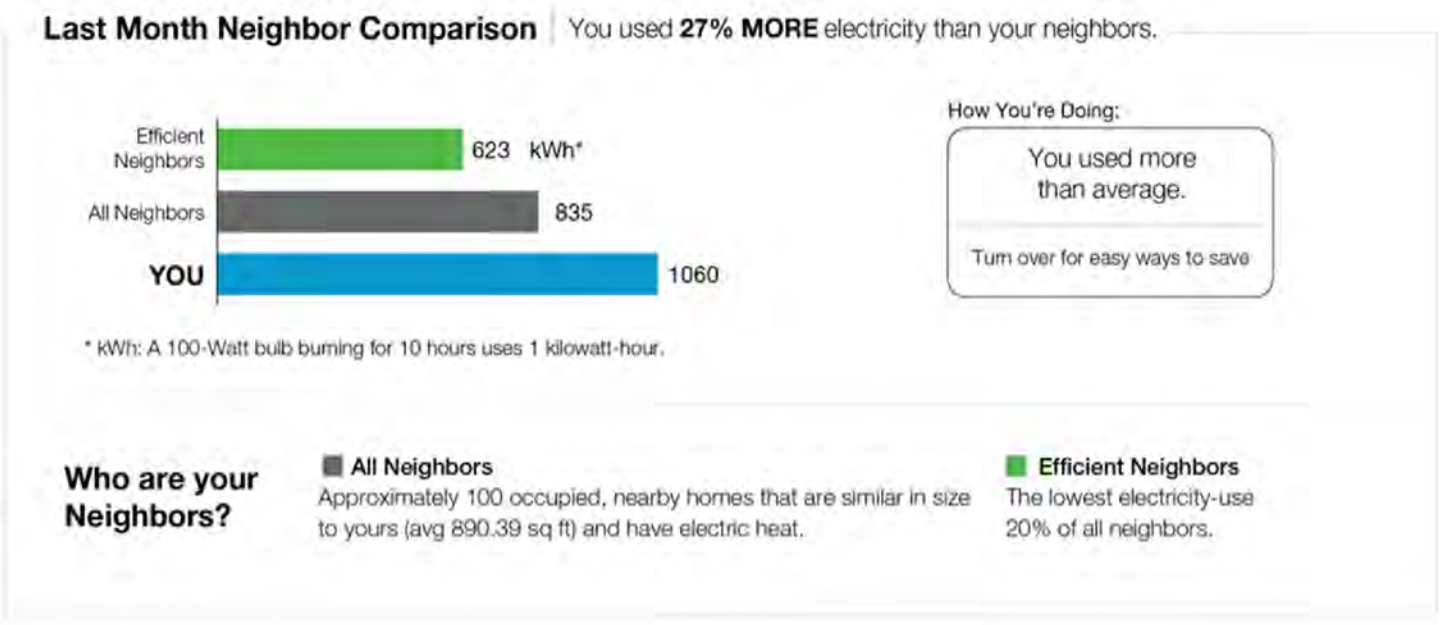
Behavioral Energy Usage Segments Help Explain EE Program Savings Rates



Agenda

1. Opower background
2. Machine learning to segment households by energy usage
3. EE savings behavioral insights

Opower's Home Energy Report



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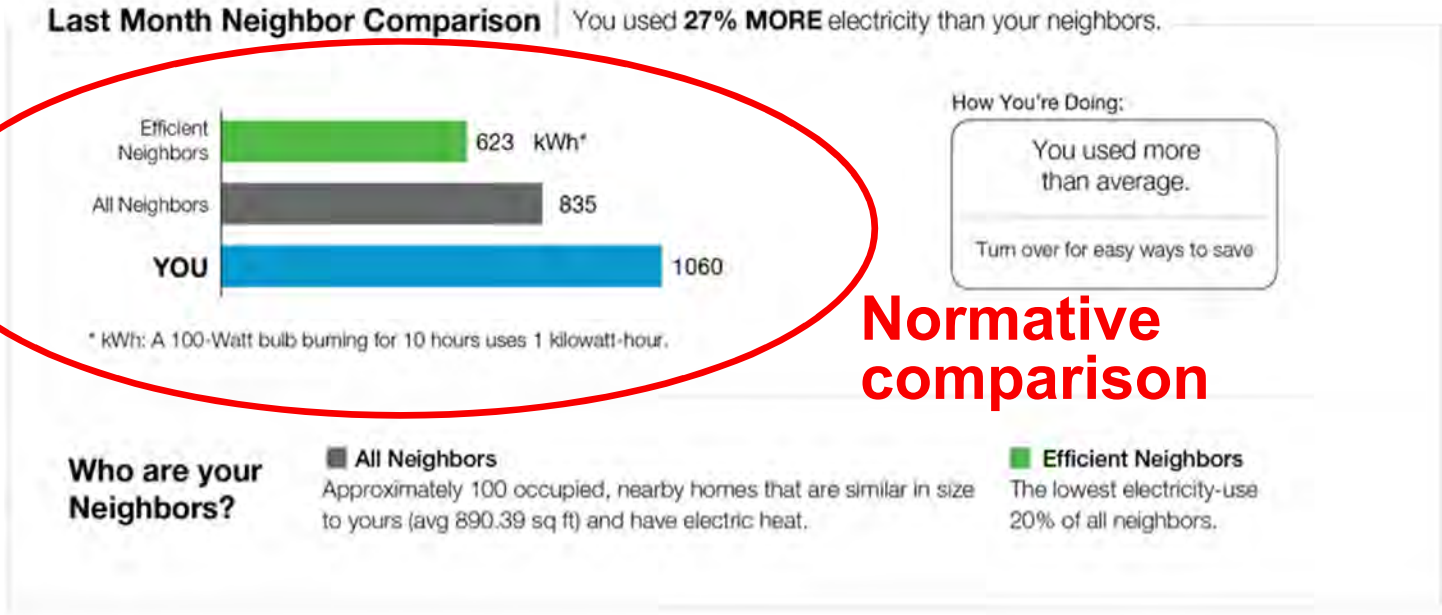
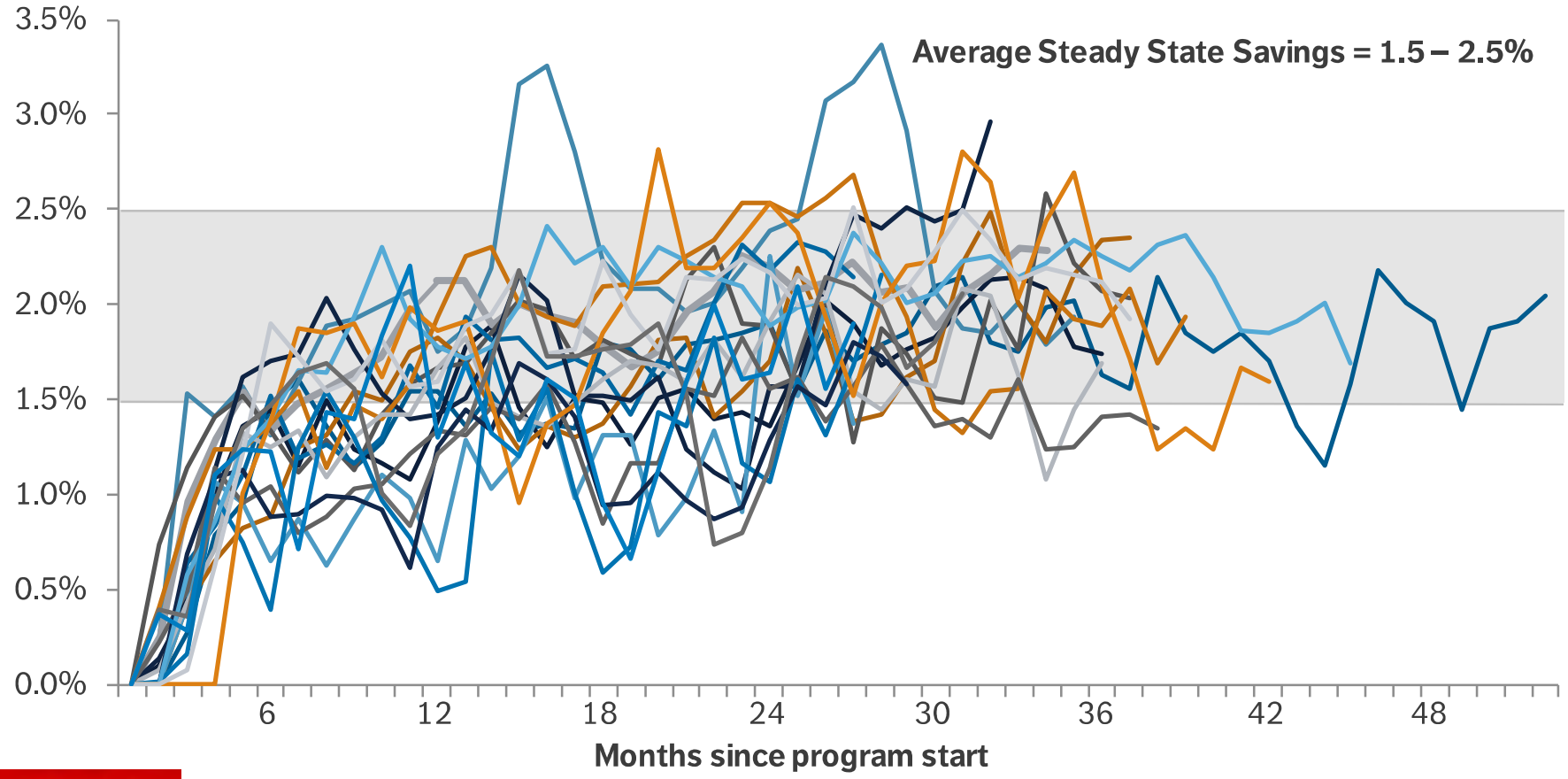
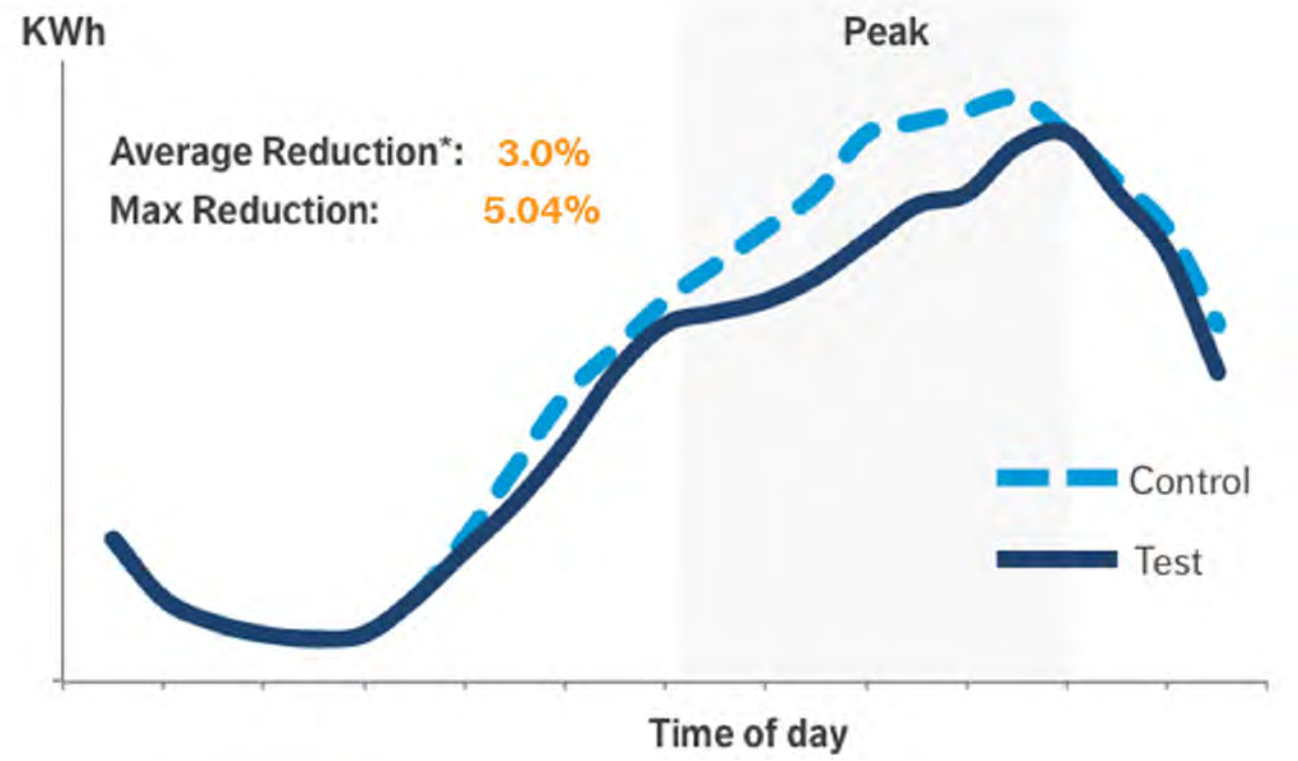


Generates predictable and verified electricity savings



Behavioral Demand Response product reduces peak usage, without a device or price



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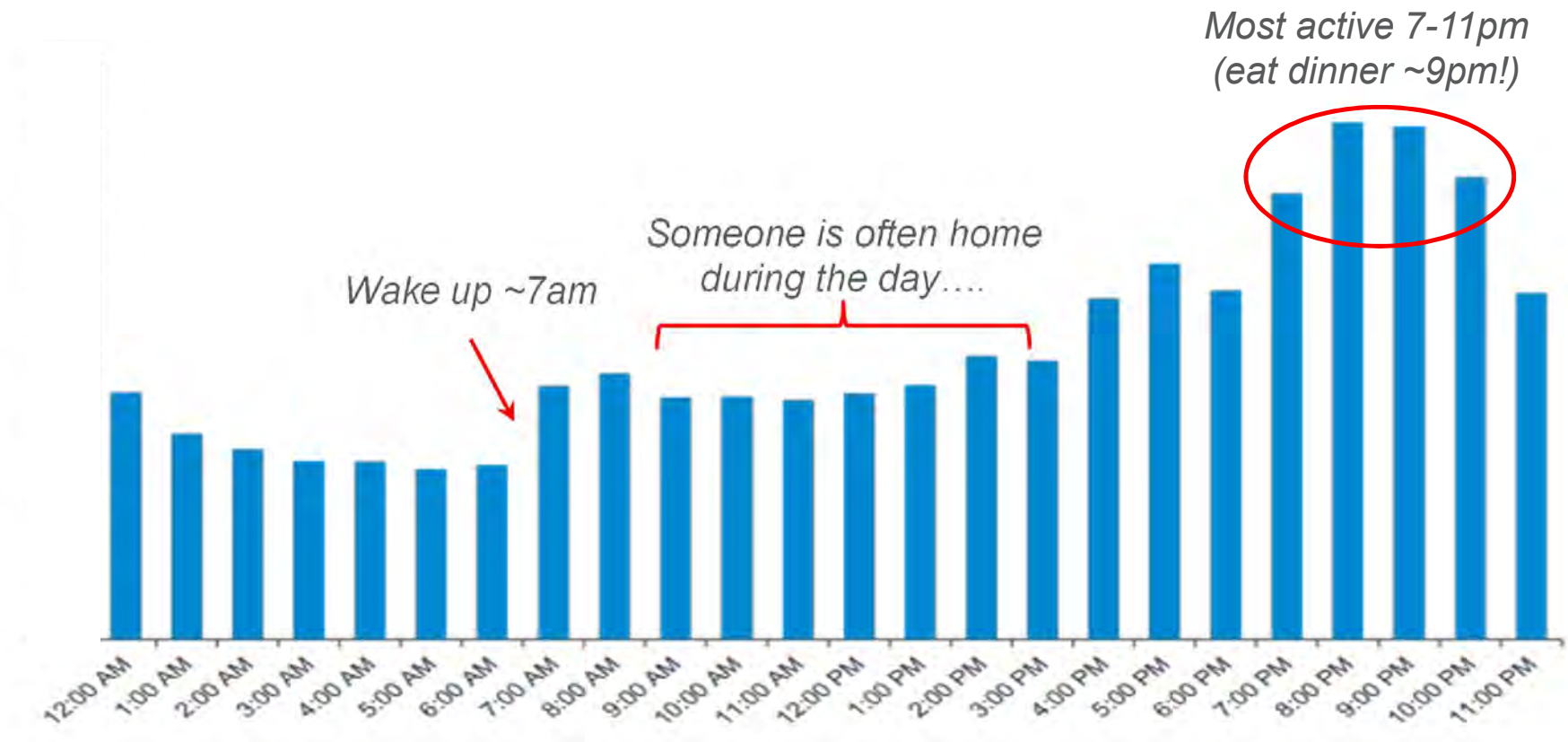
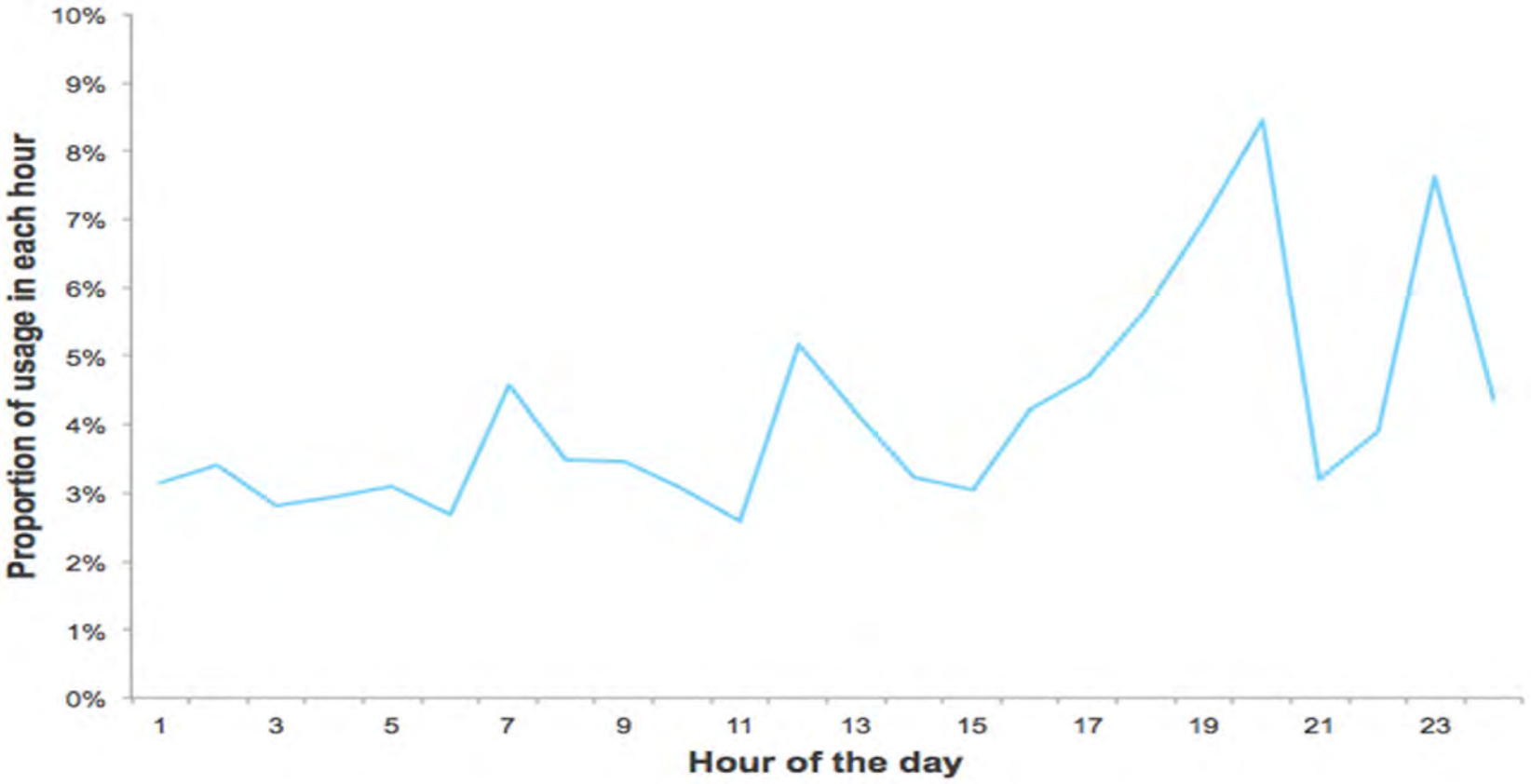
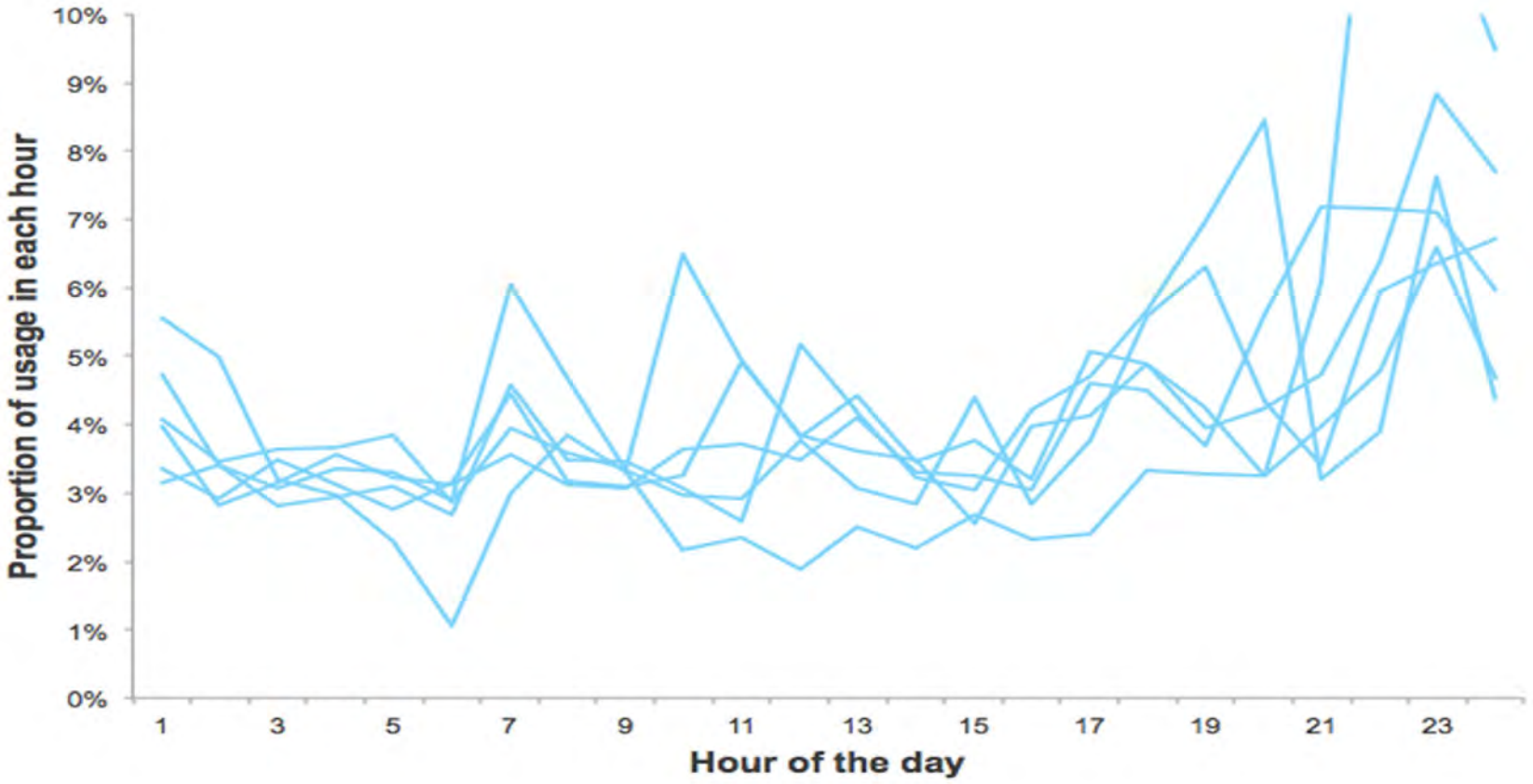
Hourly data opens a window into how Matt lives



But, one day of data only tells us so much about a customer



And every day isn't exactly the same, so there's a lot of noise in the data



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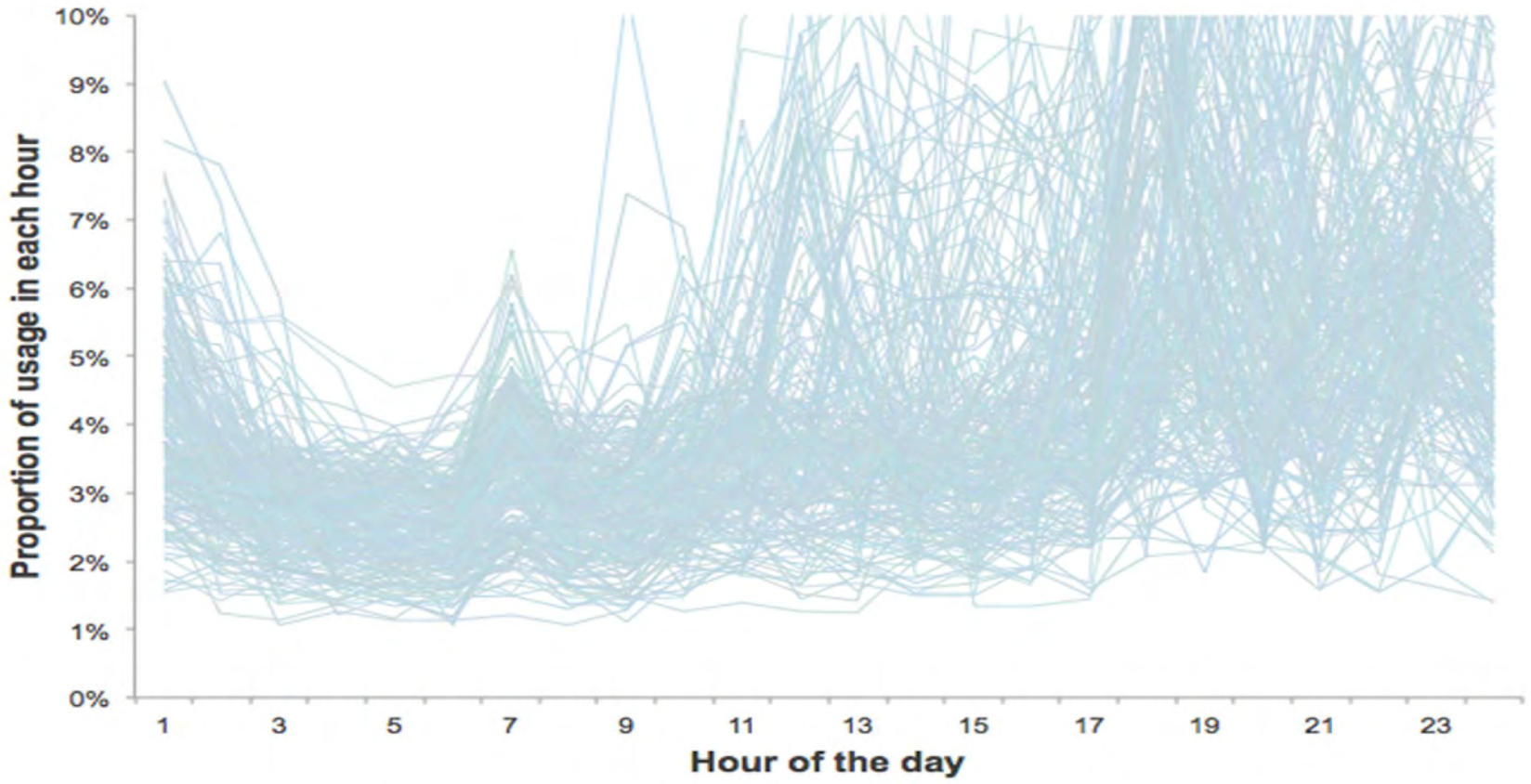

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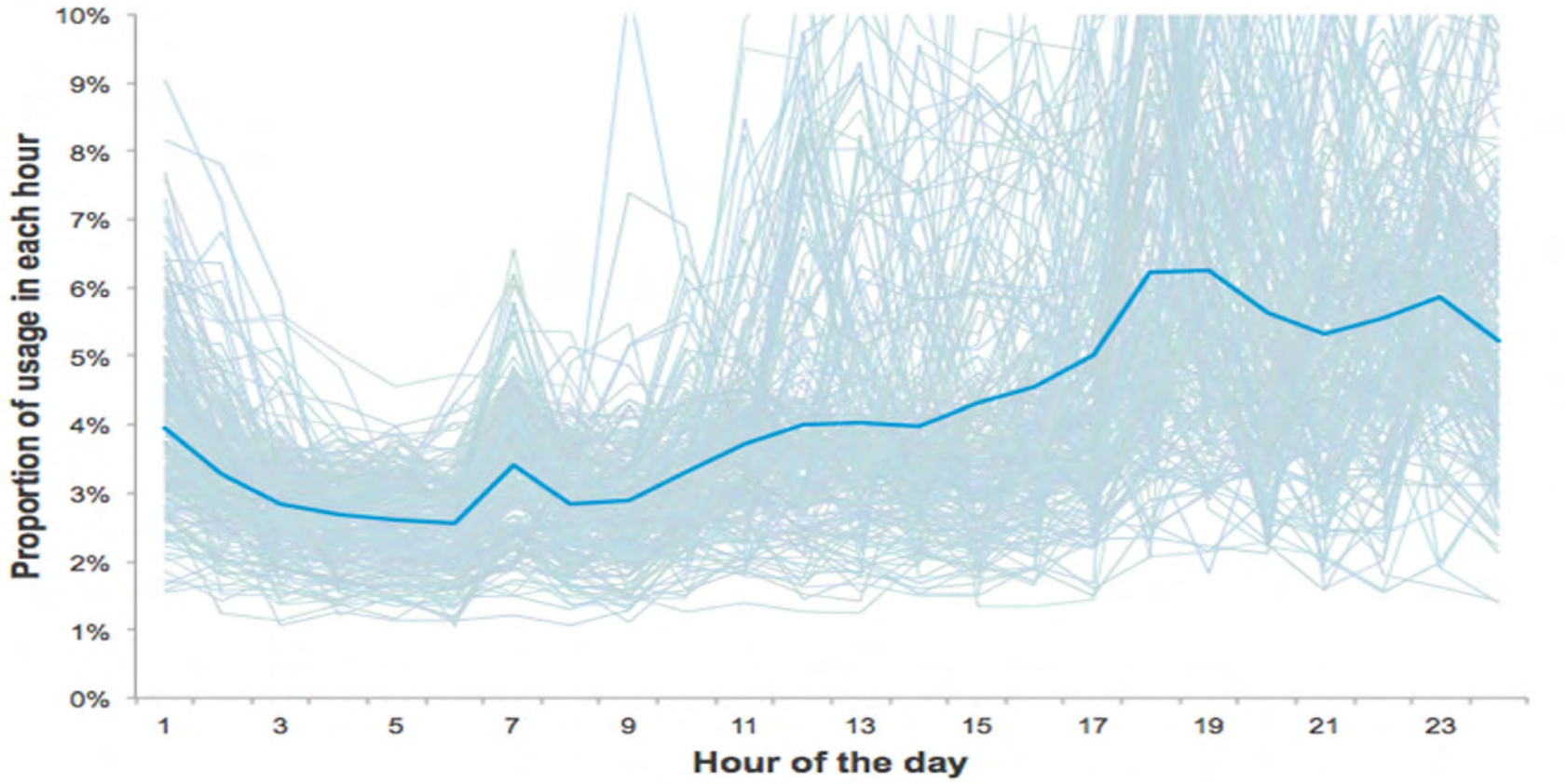
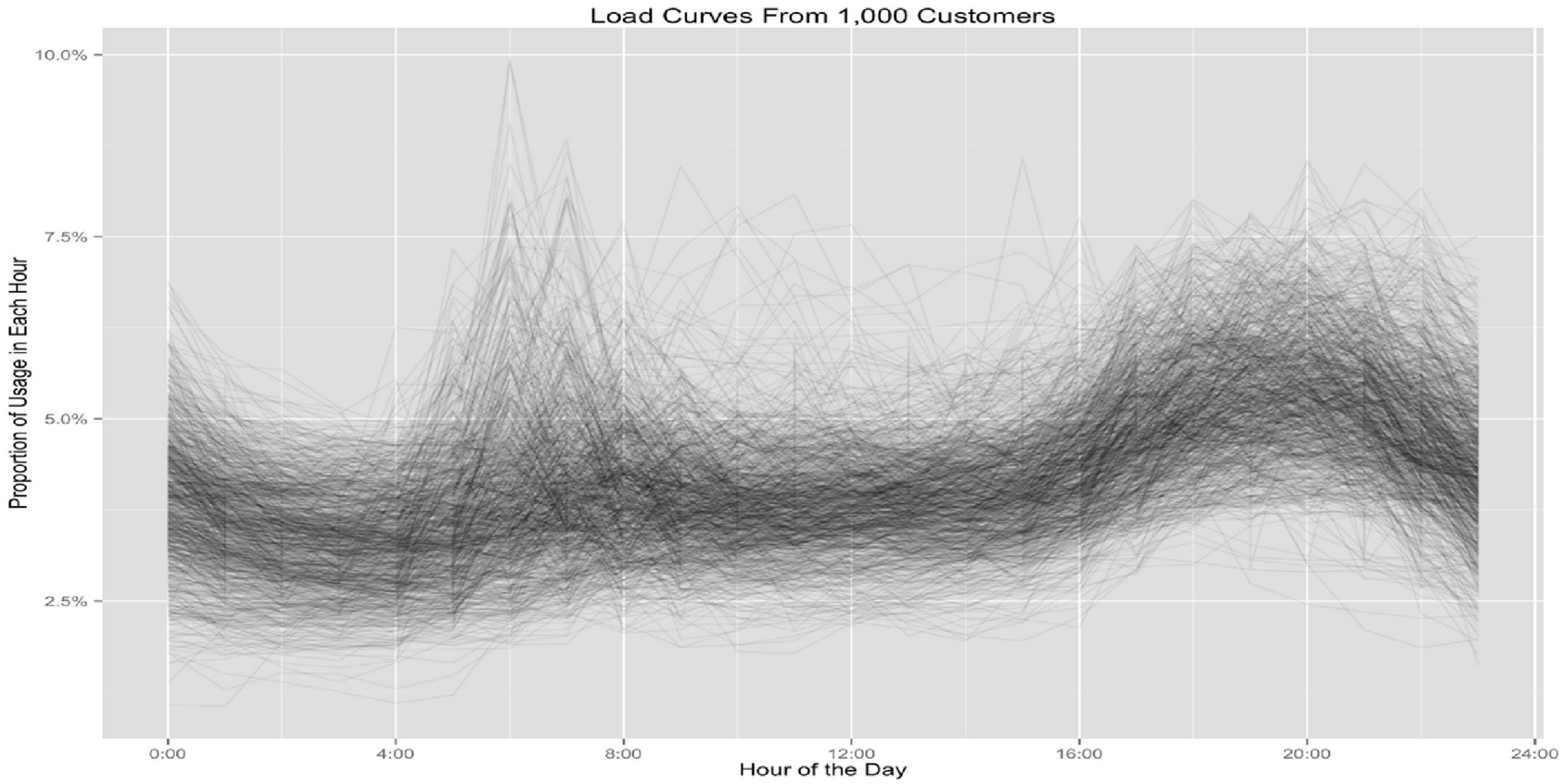
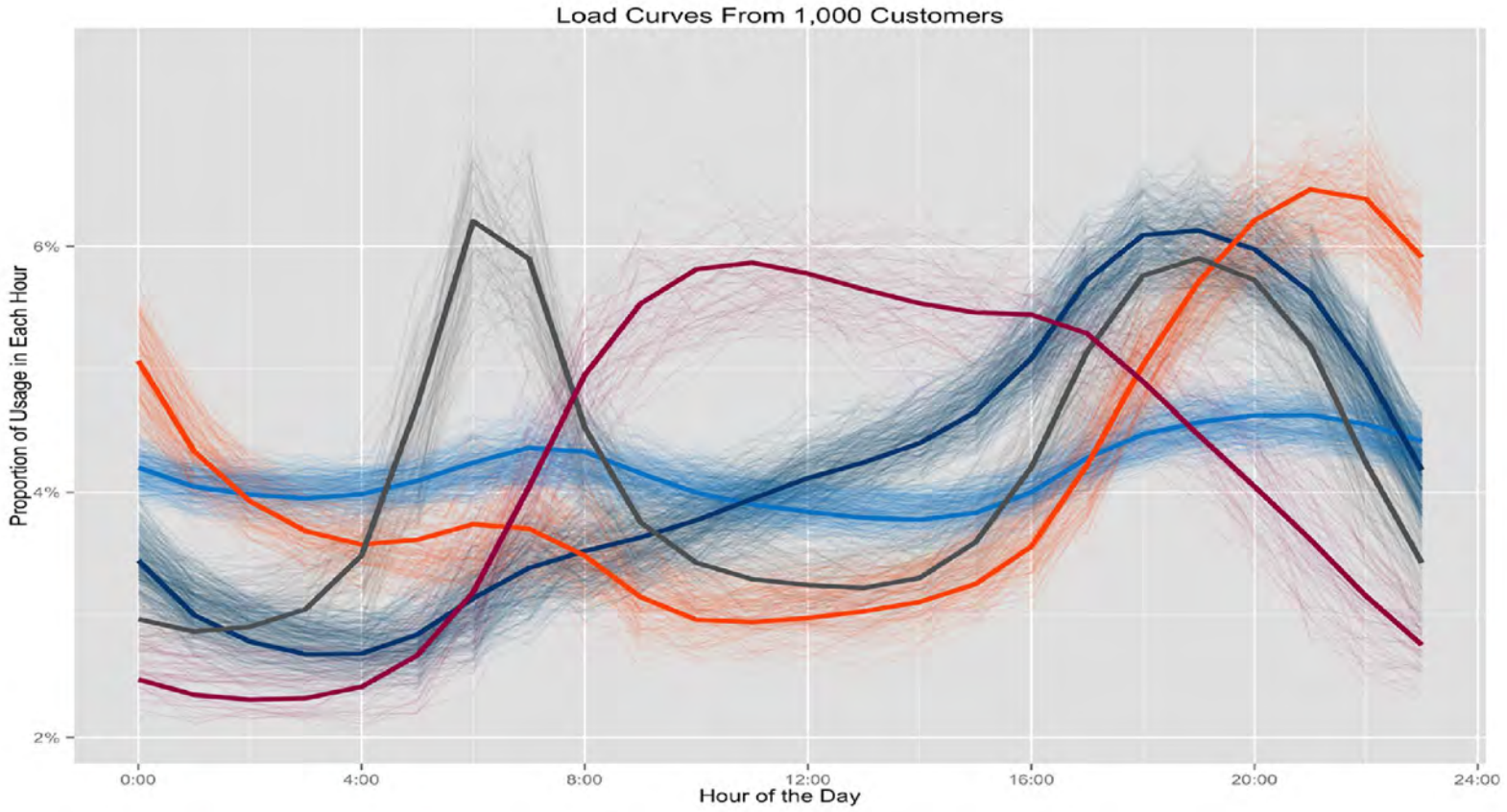


When we look at all customers, how do we make this meaningful?

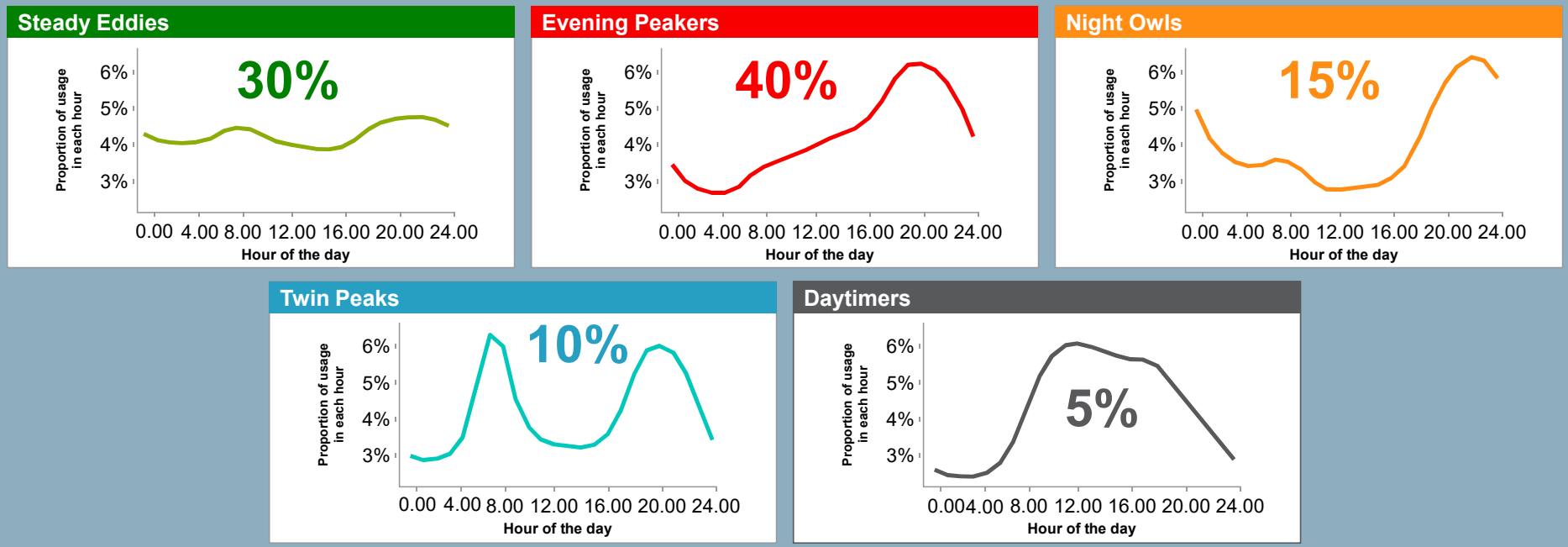


By finding signal in the noise



Smith et al 2012. A Simple Way to Use Interval Data to Segment Residential Customers for Energy Efficiency and Demand Response Program Targeting. ACEEE.

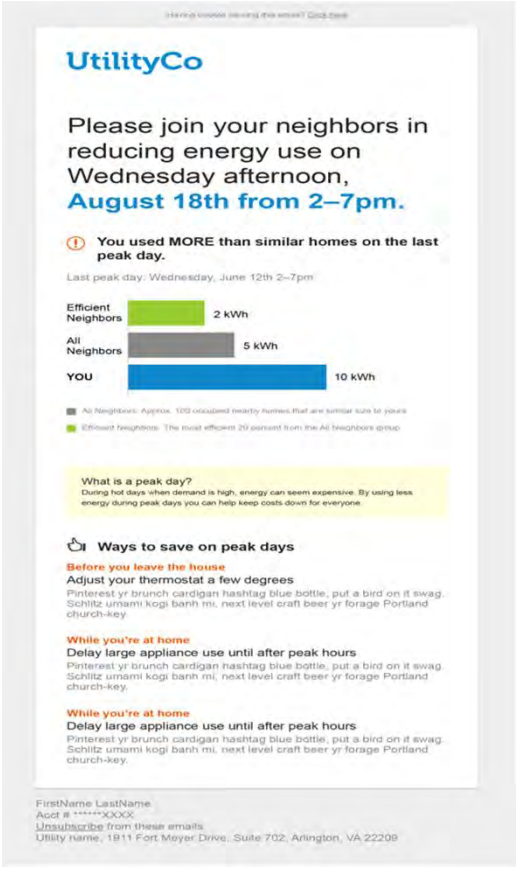
AMI load archetypes allow us to segment customers by their behavior



Knowing this enables us do better segmentation and targeting for programs

This is an alert from UtilityCo:

Tomorrow, Wednesday, August 18th is a peak day.
From 2:00 PM to 7:00 PM join UtilityCo customers by reducing your electric use. Simple ways to save on peak days include postponing dishwashing and other large appliance use until the peak day is over.
Thank you for helping us save!
To opt out of phone alerts, press 9.
You may also reach us at 1-800-800-8000.



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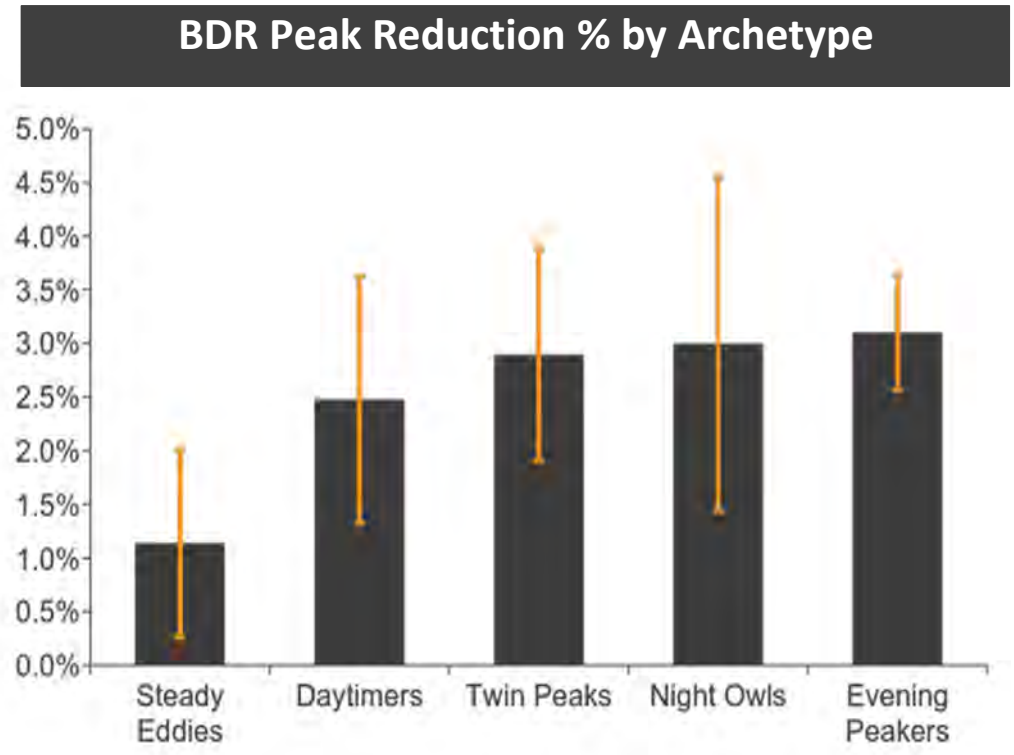

Average peak savings results normalized by average energy usage

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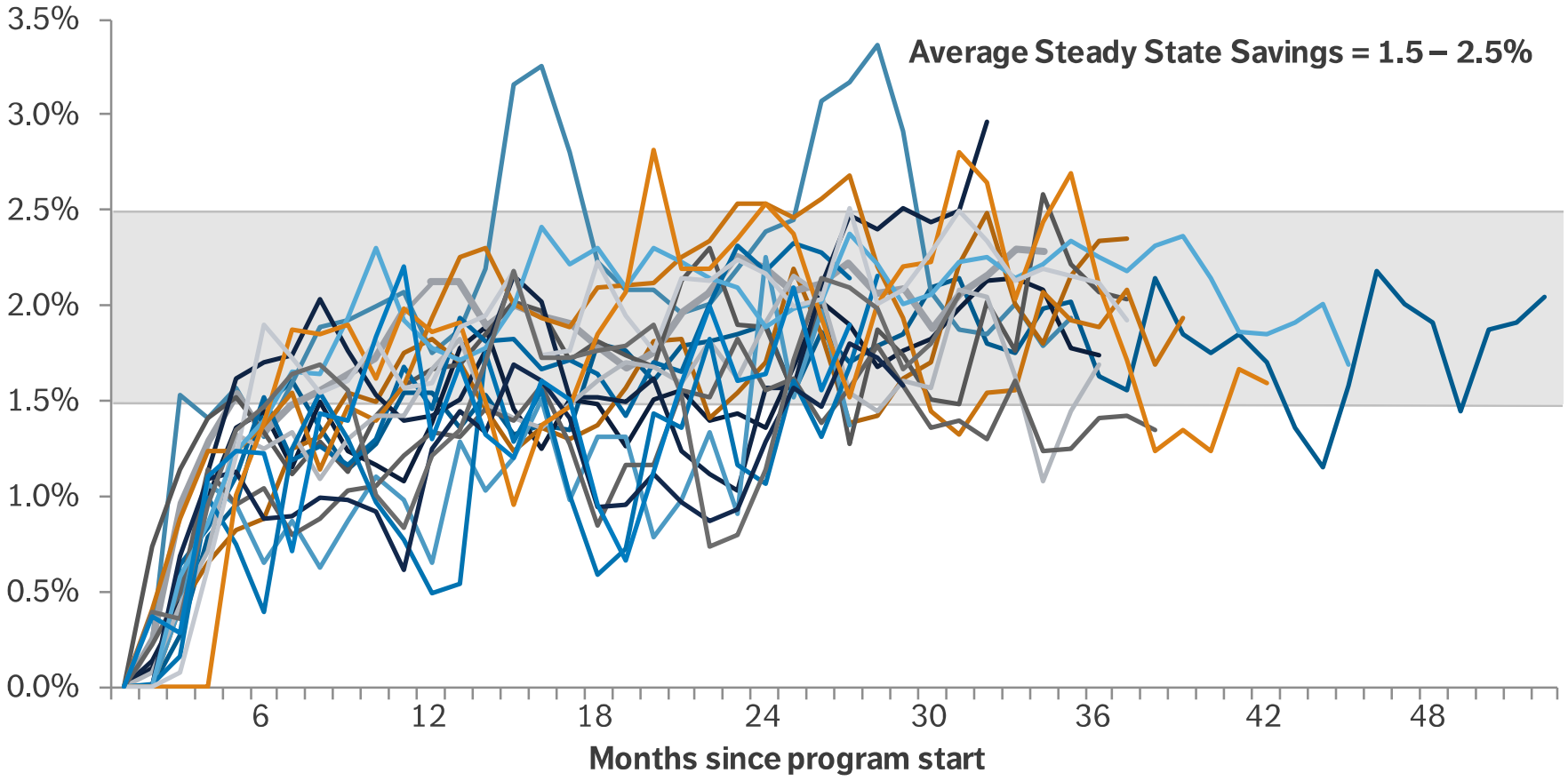
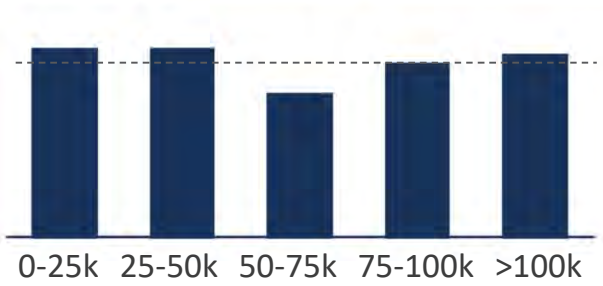
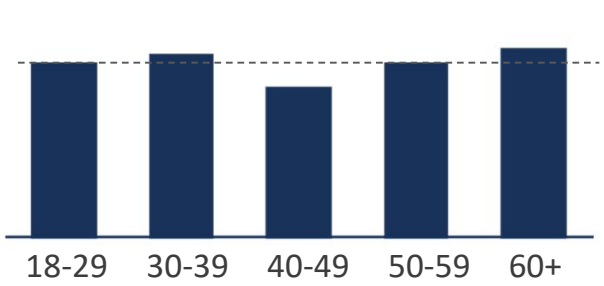


What types of customers save the most?

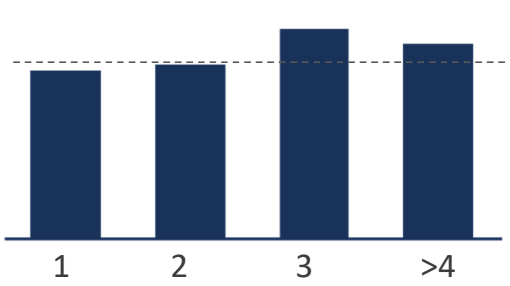
Energy savings by income



Energy savings by age

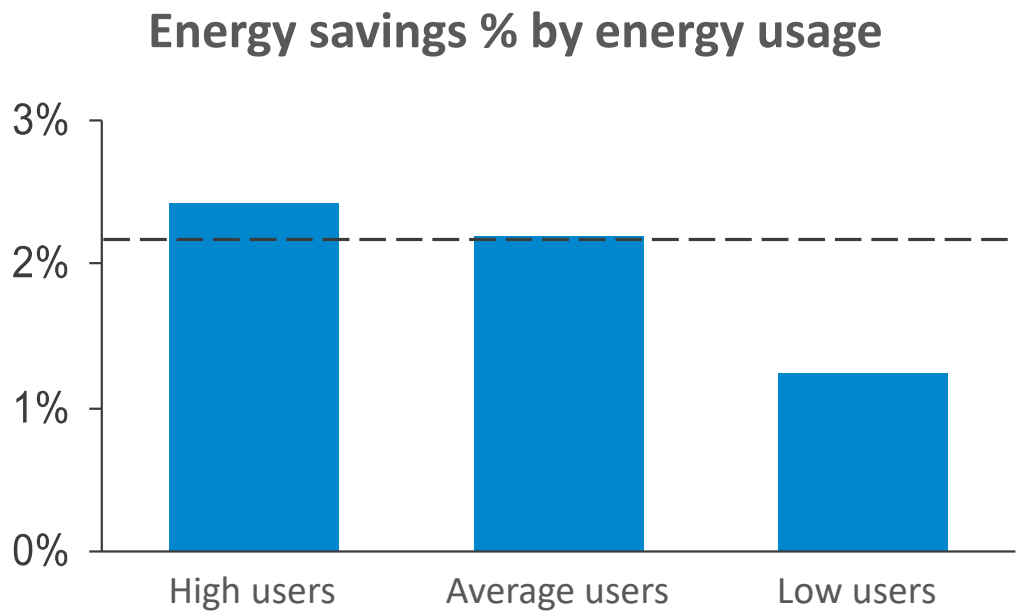


Energy savings by # of residents

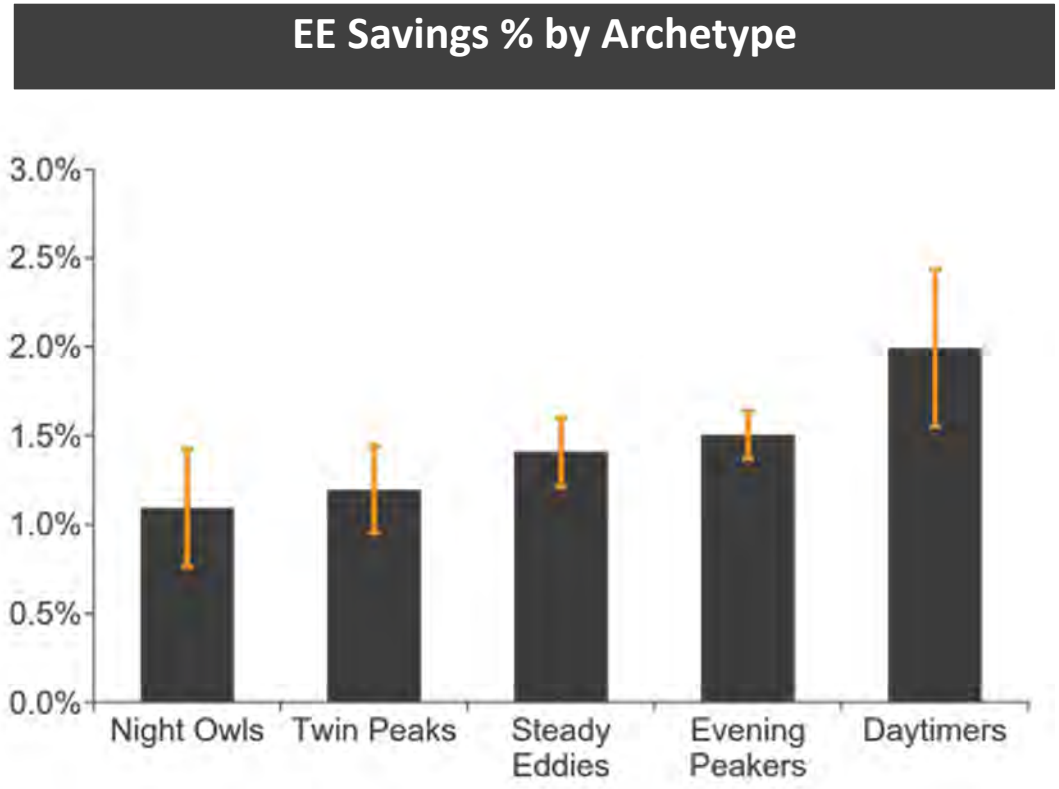


Demographics and household characteristics do not predict EE savings

To date, the only factor predictive of savings has been how much energy customers use



…but, surprisingly, load profile archetypes also predict savings

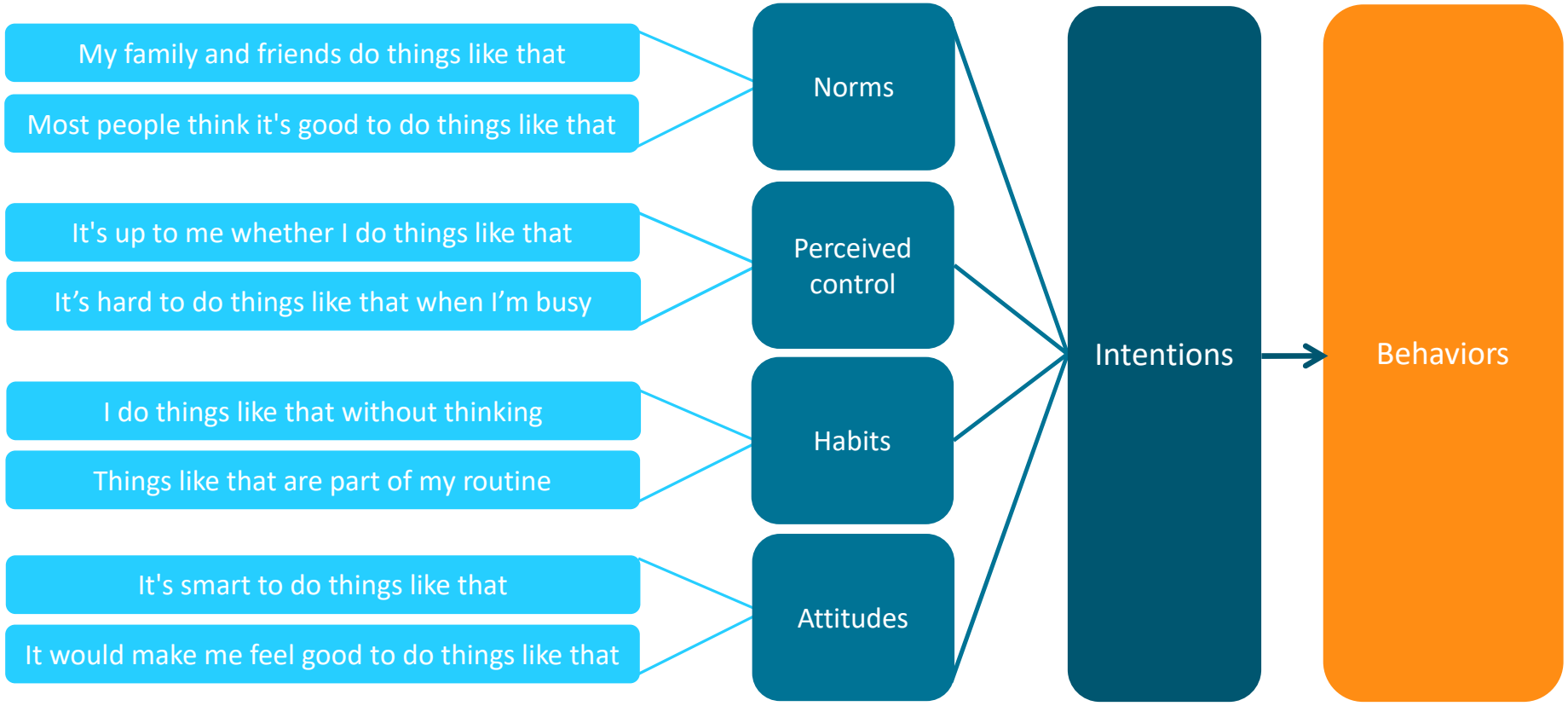


Average savings results normalized by average energy usage

WHY do customers with different archetypes save at different rates?

- Surveyed 600 AMI customers at one utility to investigate behavioral motivations
- Applied the Theory of Planned Behavior
  - What beliefs do customers hold about energy efficiency that could motivate intention to save energy?
    - Norms
    - Control
    - Habits
    - Attitudes
  - Do customers intend to modify their behavior to save energy?
    - Self-reported intention to save energy

Theory of Planned Behavior Model



Which customer attribute is most strongly correlated with energy savings beliefs and intentions?

- Demographic characteristics
  - Education
  - Income
- Household characteristics
  - Living square footage
  - Heat type
  - AC type
- Program participation
  - Receives Opower Home Energy Reports
- Energy Usage
  - Average annual usage
  - Average winter usage
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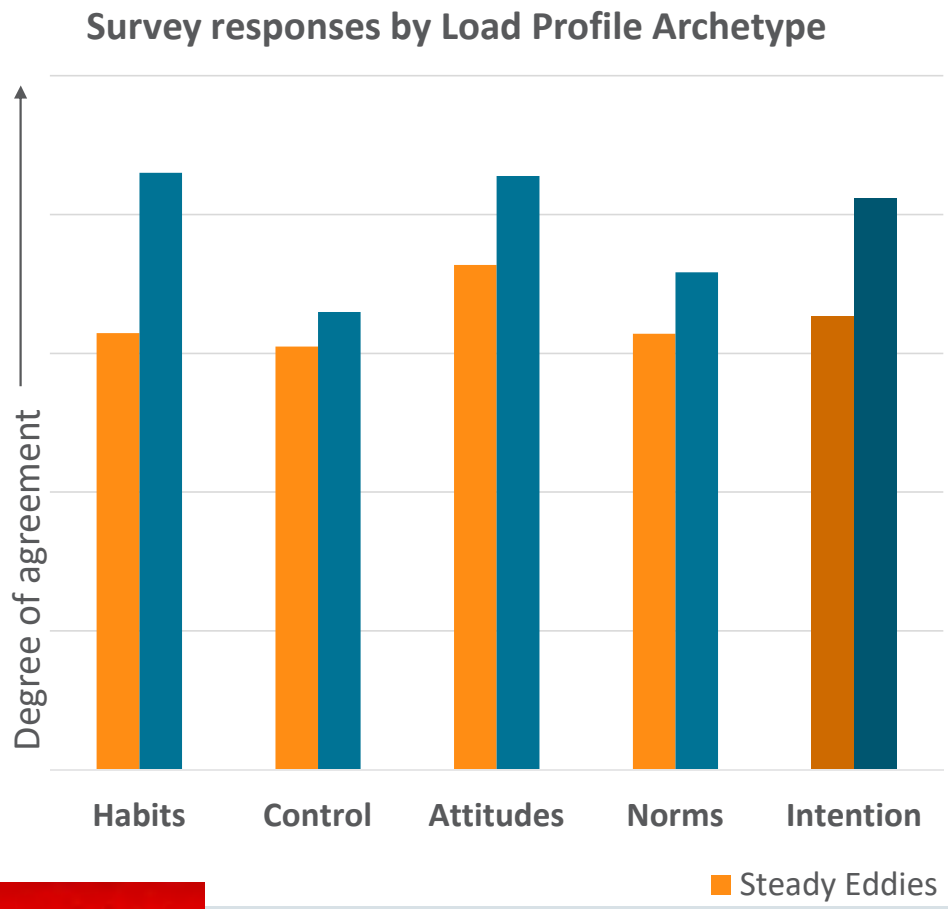
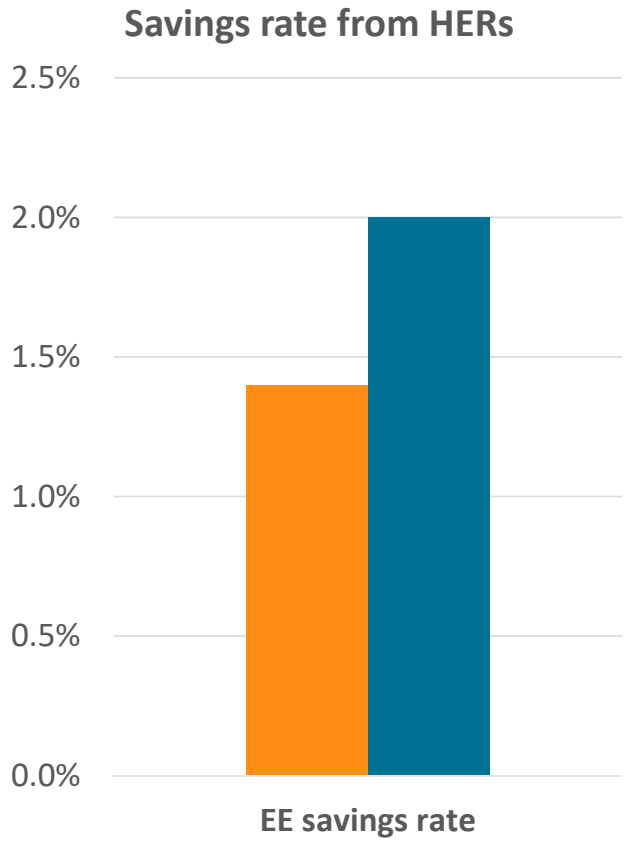
  - Average winter usage
  - **Load Profile Archetype**

Survey responses and energy savings tell a coherent story





Means in both charts adjusted for covariates

Could we boost energy savings by tailoring messaging to behavioral segments?

- Option 1: Segment based on behavioral survey responses
  - PRO: Precise, customer-level knowledge of attitudes
  - CON: Prohibitively expensive to measure directly

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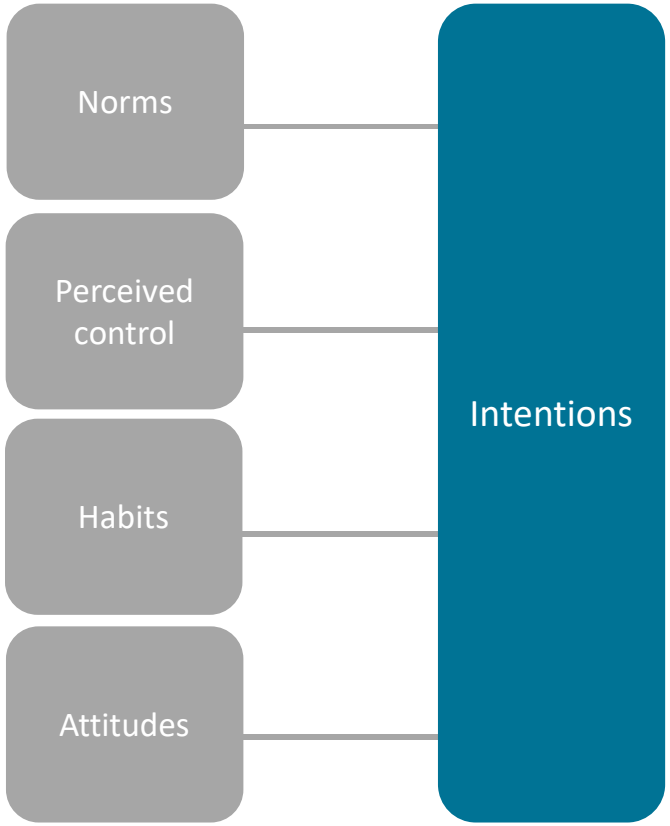
- Option 1: Segment based on behavioral survey responses
  - PRO: Precise, customer-level knowledge of attitudes
  - CON: Prohibitively expensive to measure directly
- Option 2: Segment based on Load Profile Archetypes
  - PRO: Inexpensive to calculate for AMI customers
  - CON: Blunt tool aimed at attitudes by proxy

Daytimers



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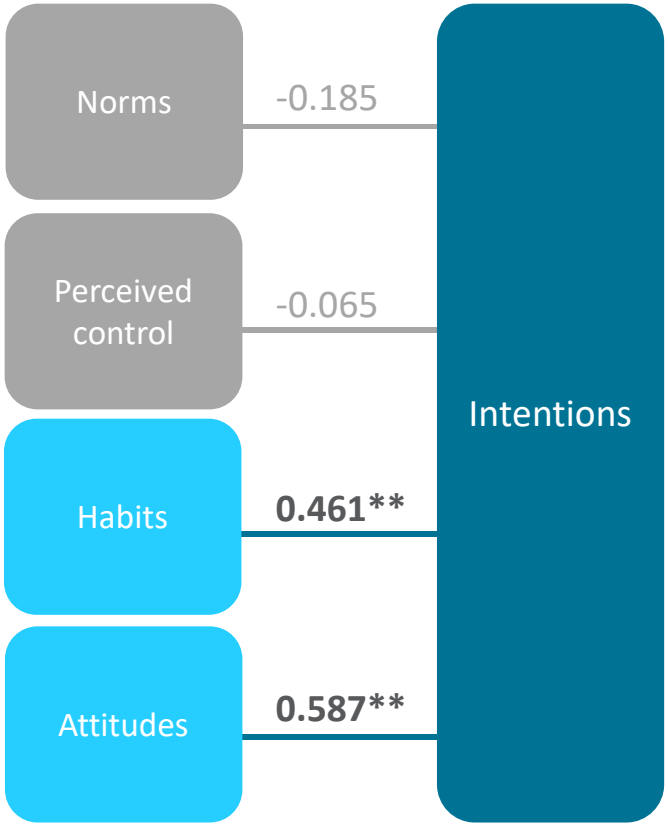
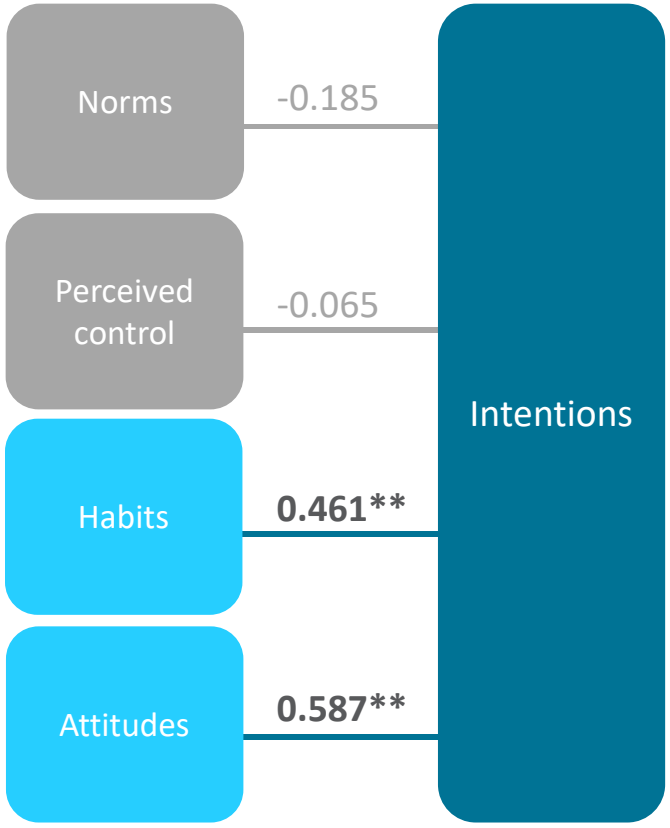


- For Daytimers, strong **Habits** and **Attitudes** are most predictive of intention to save
- Could Daytimers' strong 2.0% EE savings rate be boosted further by sending messaging tailored to these dimensions?

Daytimers



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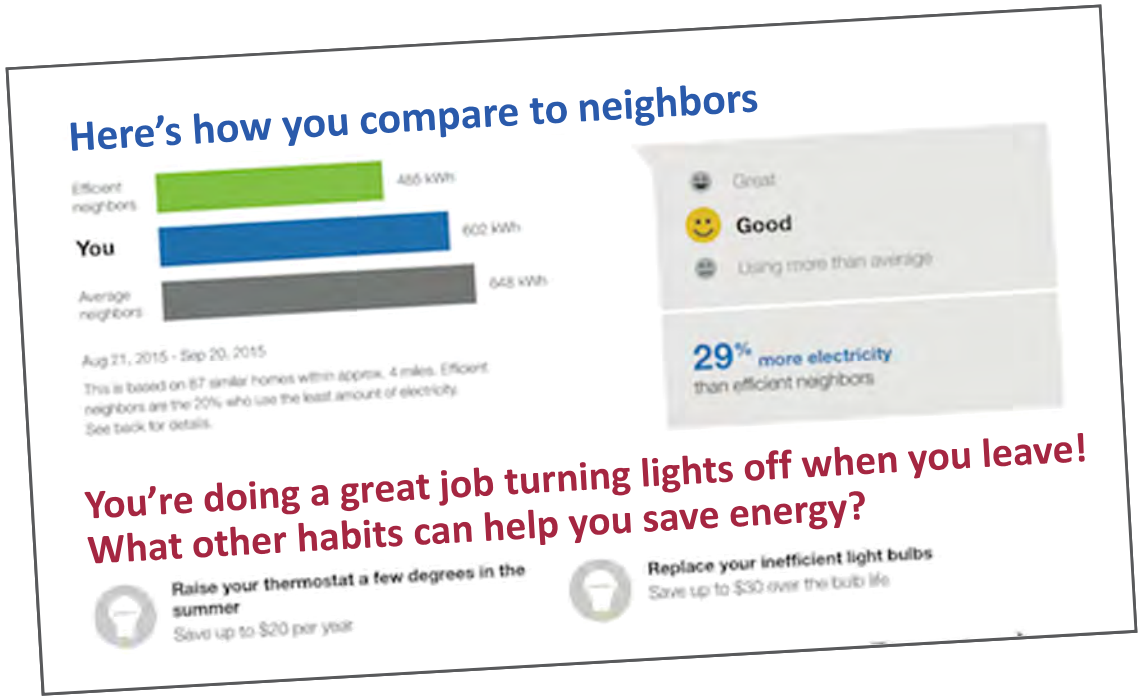

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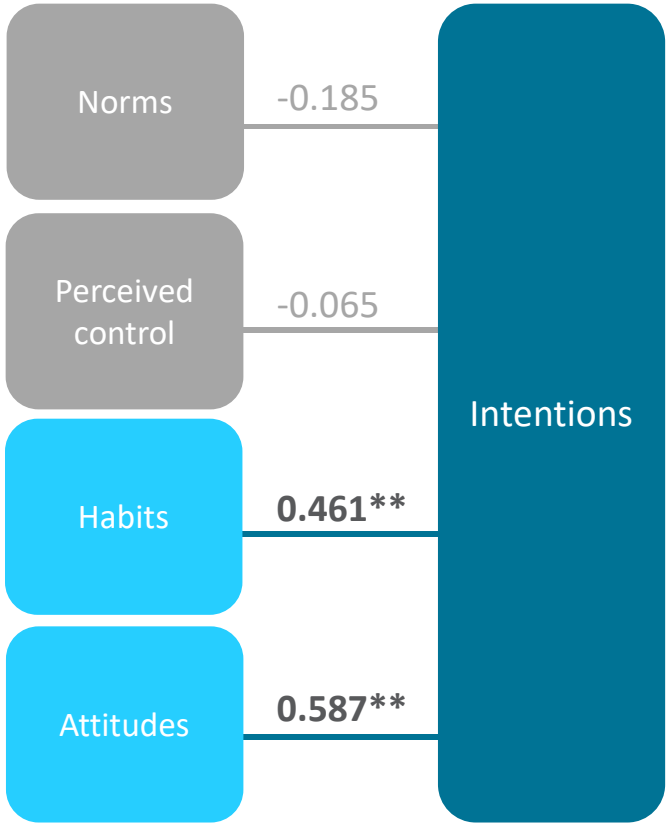

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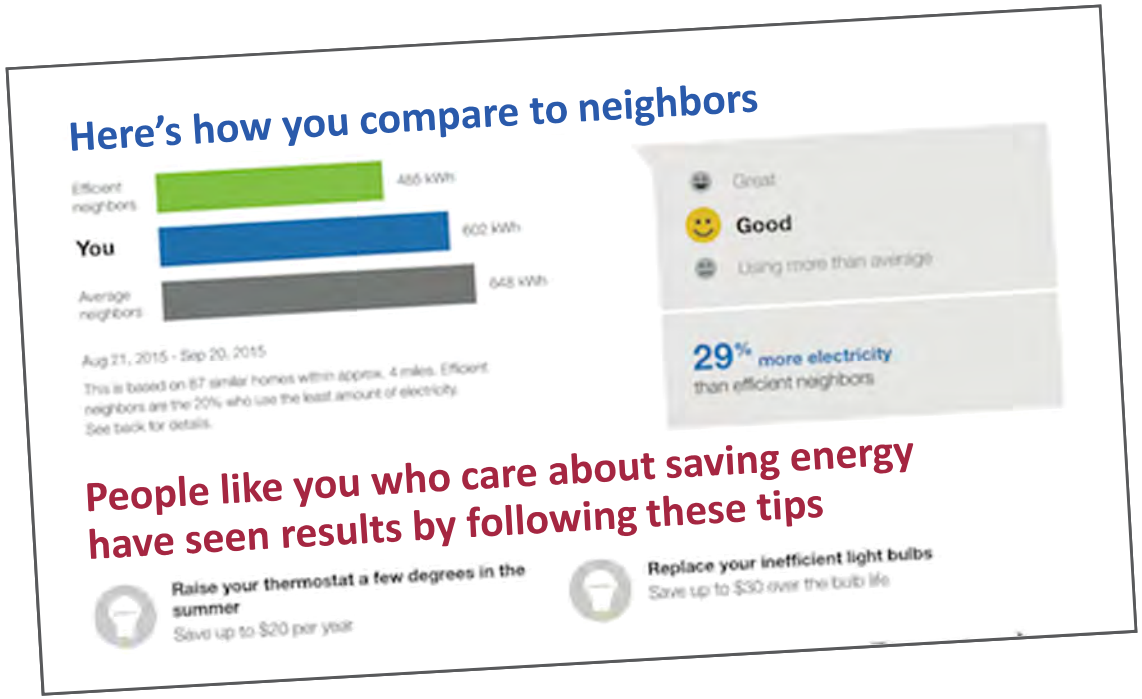
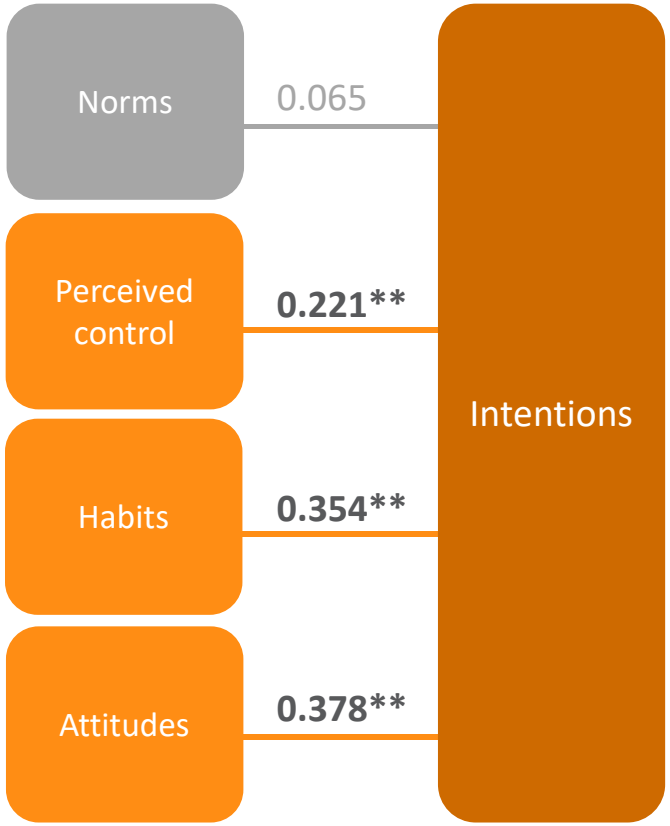
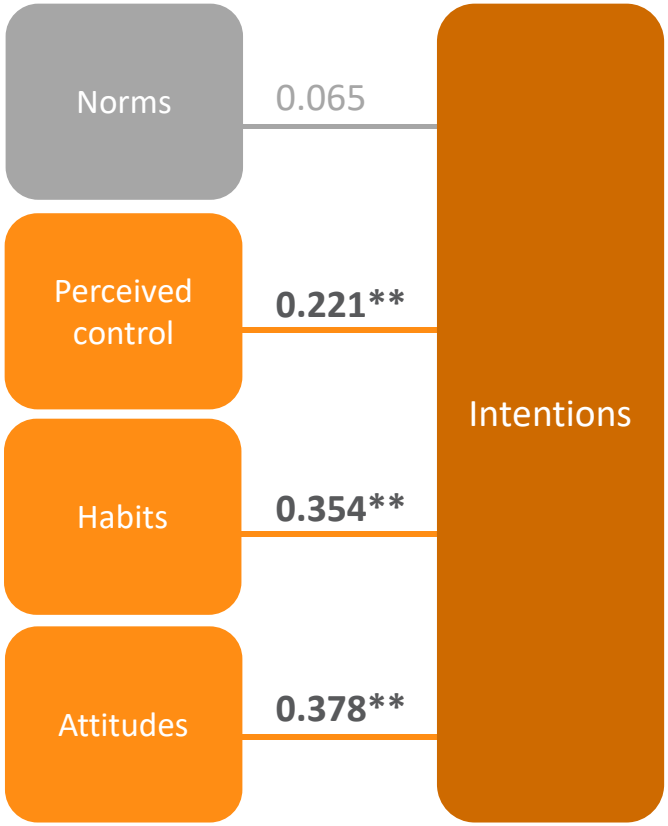


Steady Eddies



- For Steady Eddies, **Perceived Control** is also predictive of intention to save
- Could Steady Eddies' lower 1.4% EE savings rate be boosted further by sending messaging tailored to Control?

Steady Eddies



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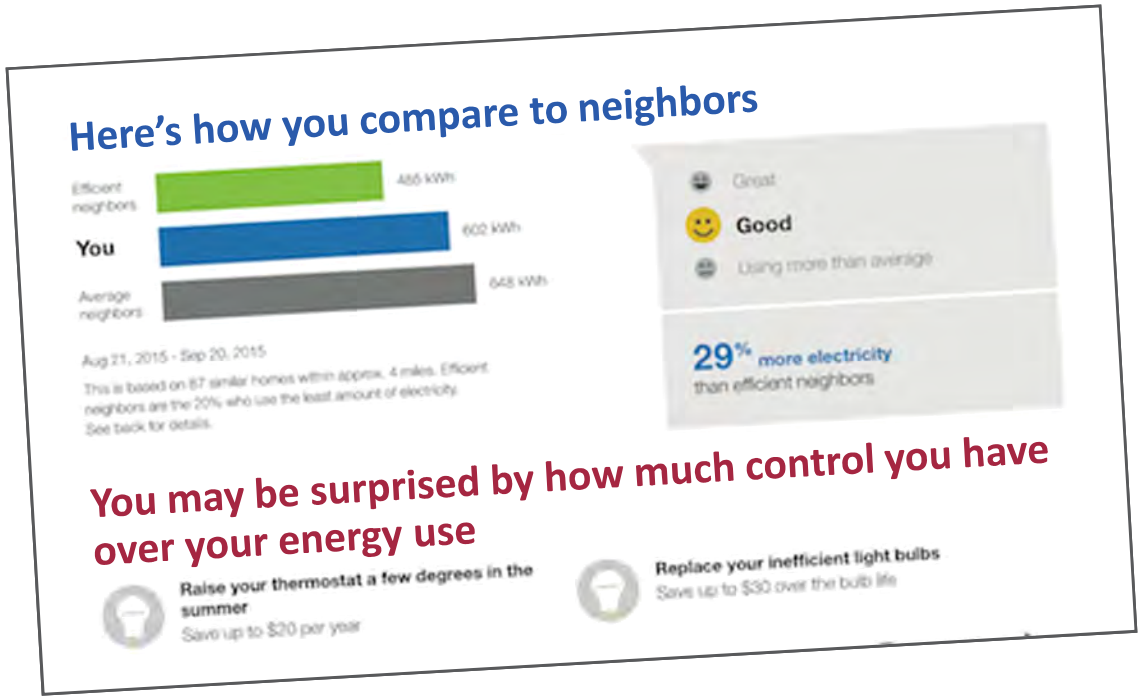

Open question: What does this relationship tell us about energy savings behavior?

- What is the *causal* relationship between customers' beliefs about EE, what time of day they use energy, and EE savings?

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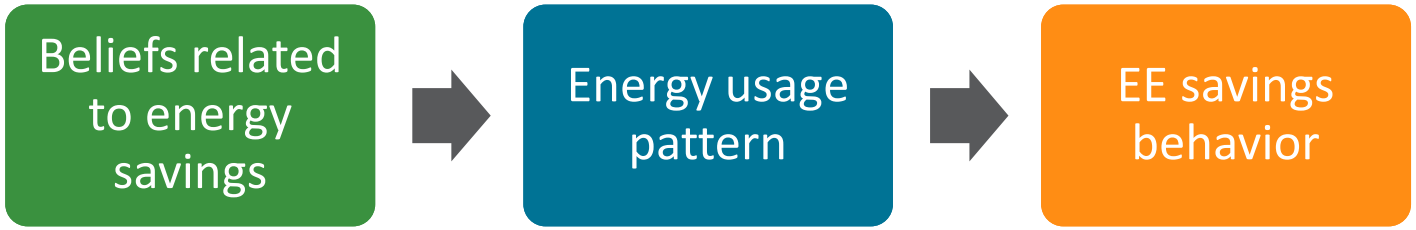

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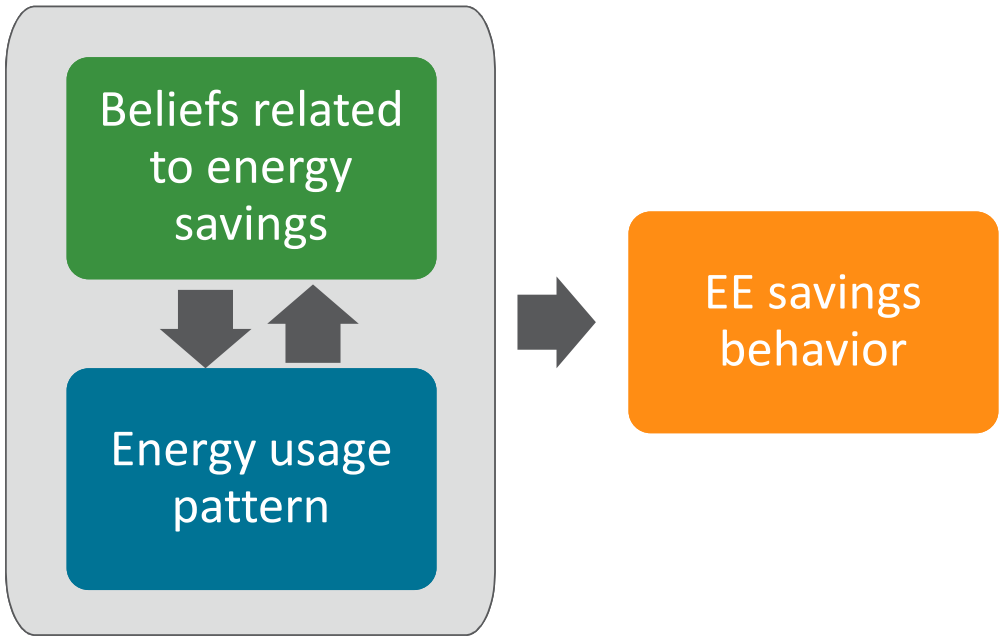

Thank you

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