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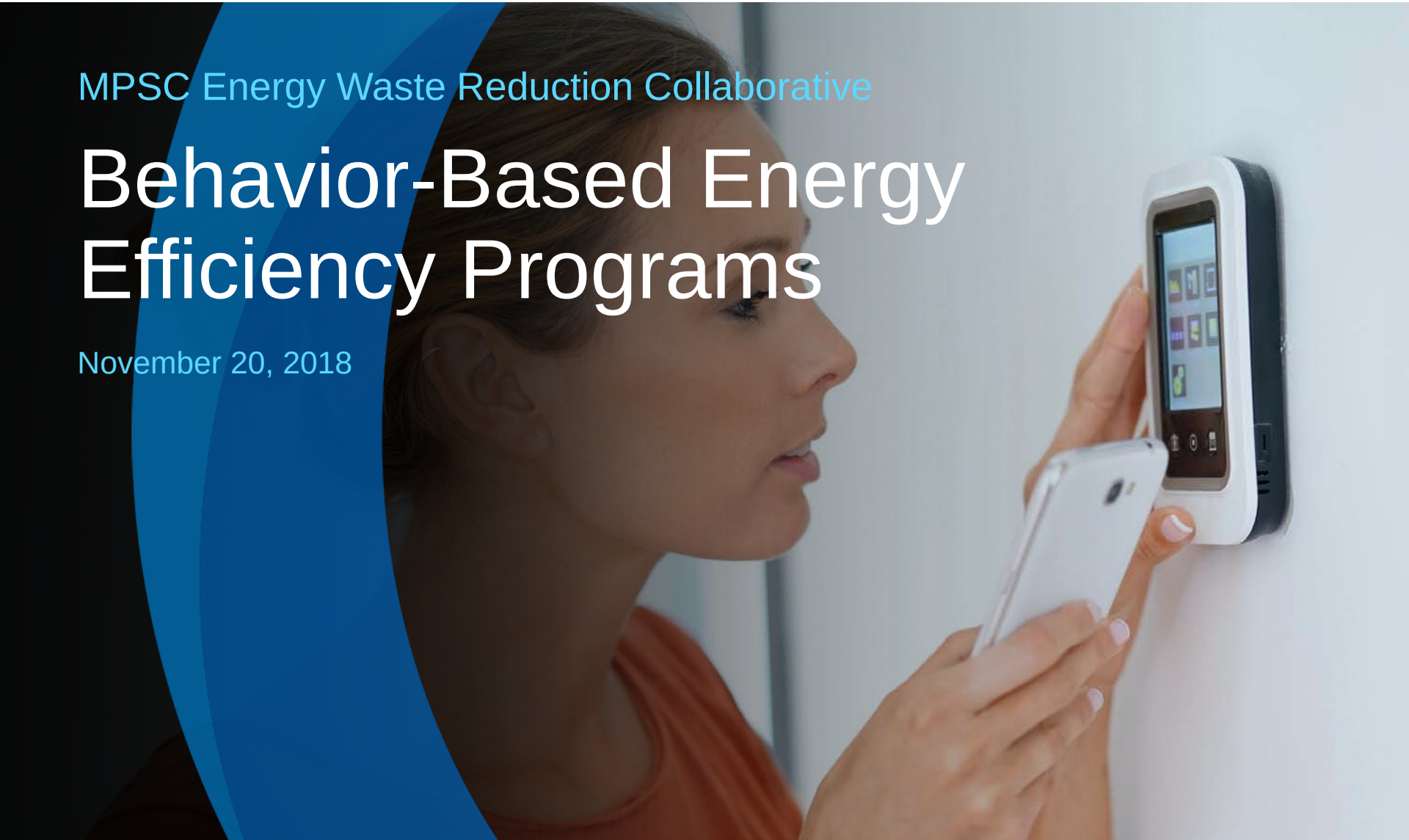
MPSC Energy Waste Reduction Collaborative

Behavior-Based Energy Efficiency Programs

November 20, 2018



Agenda

Introduction

Foundations of Behavior-Based EE Programs

Sources of BB Program Savings

Topics for Future Discussion

Questions and Wrap Up

Introduction

My Background

- Ph.D. Economist
- Cadmus Principal
- Reed College Assistant Professor

At Cadmus

- Lead behavior and DR program evaluations

Other

- DOE Uniform Methods Project (UMP) Behavior Program Evaluation Protocols (2017)
- UMP SEM Evaluation Protocols (2017)
- Cadmus whitepaper on HER savings persistence and measure life (2014)
- Conferences and workshops including BECC, IEPEC, and AESP

Foundations of Behavior-Based EE Programs

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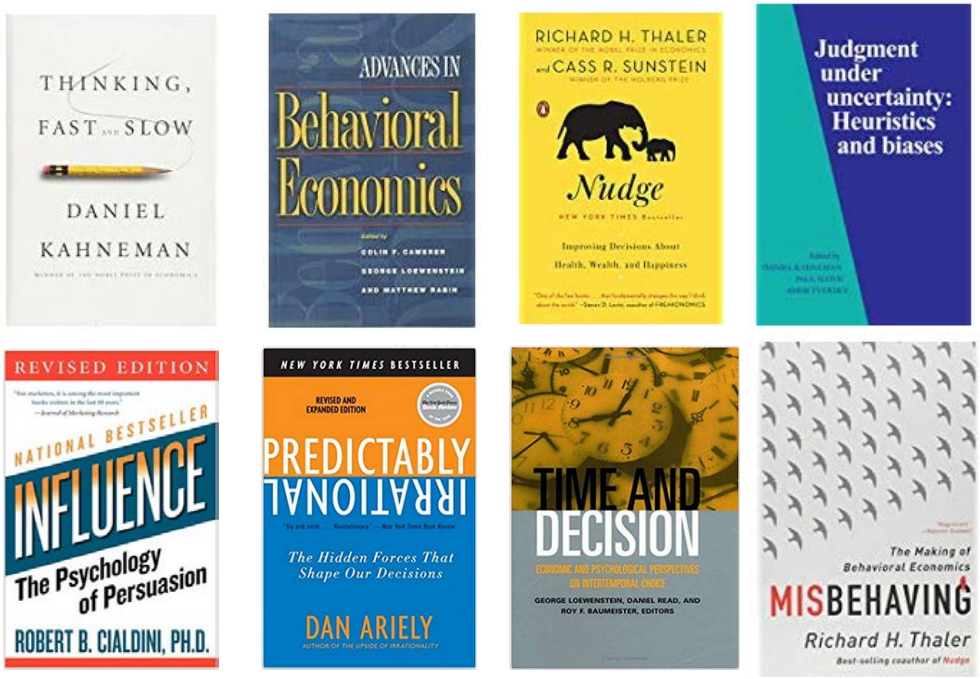
“Nudges”

- Humans not rational decision makers of economics textbooks
- Opportunity to improve welfare
- Changes in “customer choice architecture” – Thaler and Sunstein (2009)
  - Do not change economic incentives
  - No harm and easy to avoid

Rigorous foundation in behavioral economics and psychology



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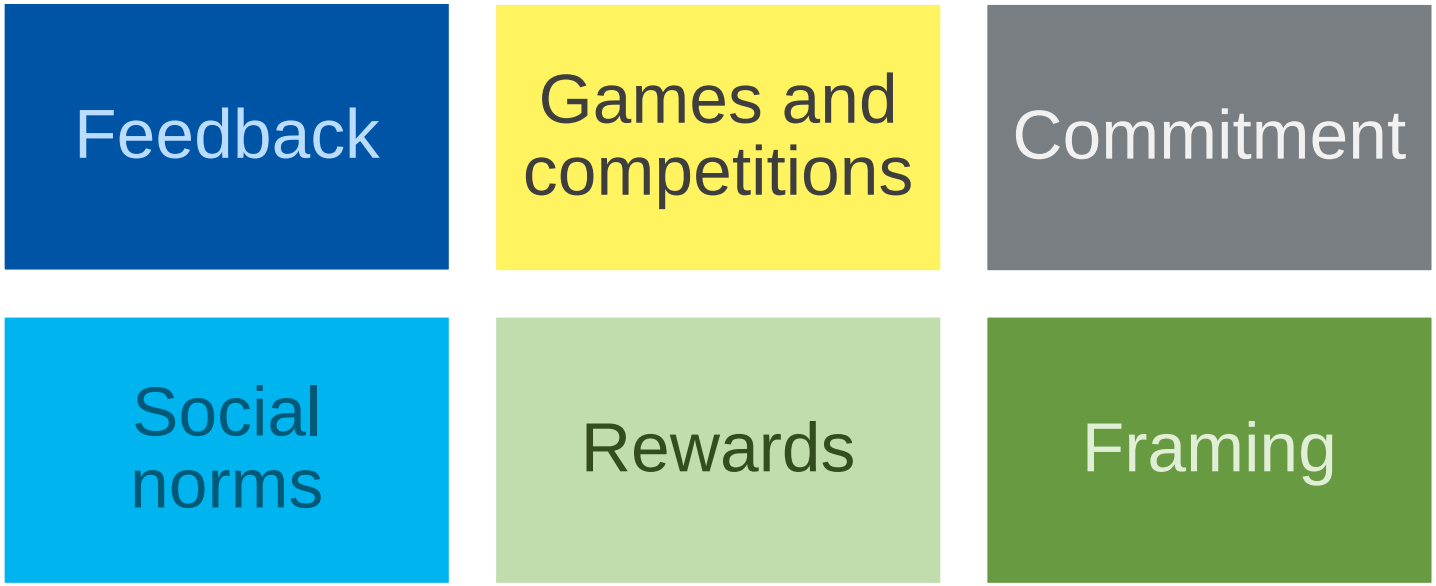
Examples of Nudges



Energy Efficiency Behavior Programs

In Michigan:

To qualify as a behavior measure, the program intervention must meet the following criteria:

Use one or more behavior-based approaches rooted in applied social science (e.g., feedback, social norms, goal setting, rewards) …

-BRM (October 04, 2018- Draft)

Mechanisms for delivering EE nudges to residential and SMB customers

- Energy reports
- Web portals
- Mobile apps
- Text messages
- On-site training
- Door hangers

Home Energy Reports

- Mature, scalable, widely implemented utility programs
- Implemented as RCTs
- Savings of 1-3% of electricity and 0.5-2% of gas
  - Highest users contribute most savings (Allcott 2011)
  - Savings ramp up, reaching a steady-state after 2-3 years
  - Seasonality of savings

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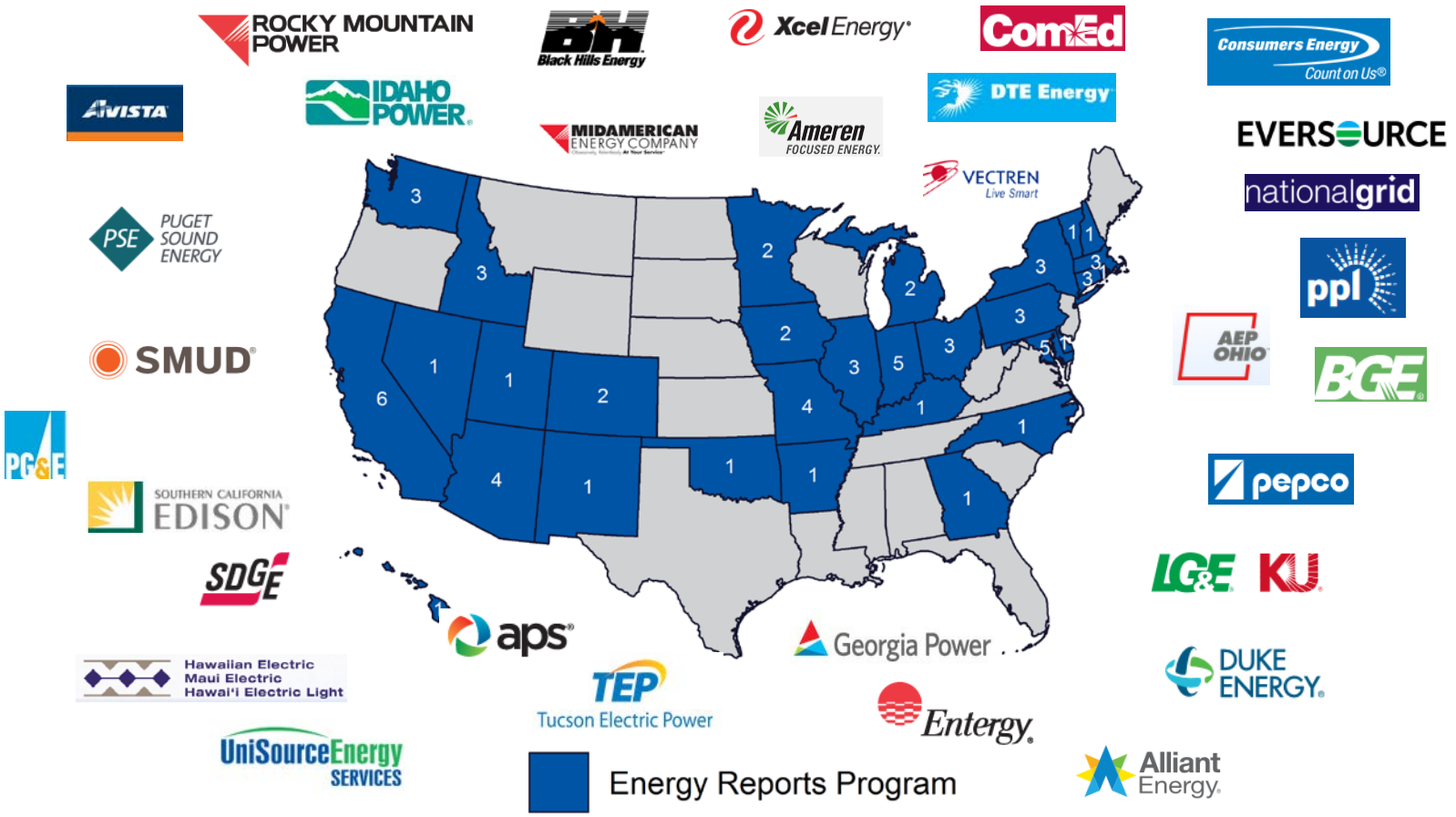
HER Programs are Widely Deployed

Electric utilities with residential energy reports programs



Source: Esource (2018) and Consortium for Energy Efficiency (2018)

Other Scalable Residential Behavior Programs

Customer Web Portal

- Customer feedback, goal setting, on-line audits, social comparisons, moral suasion
- Xcel Energy (Cadmus, 2015) 2% electricity savings, 1% gas savings;
- ComEd (Harding & Hsiaw, 2011) 4% electricity savings

High Bill Alerts

- Addresses customer inattention and high costs of tracking monthly usage
- Midwestern utility (Cadmus, 2018) 0.5% gas savings and 0.3% electricity savings

Mobile Web App

- Social comparisons, moral suasion, customer feedback, gamification
- DTE electricity savings of 1% (Navigant, 2015)

Takeaways

BB programs

1. Have a rigorous foundation in behavioral economics and psychology
2. Are widely deployed by utilities across the U.S.
3. HERs are best known, but program administrators are testing other mechanisms for delivering nudges to utility customers

Sources of Behavior-Based Program Savings

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How Do BB Program Customers Save Energy?

Potential sources of HER savings

- Behavior change
- Home EE improvements

Important because

- Greater acceptance of HERs
- New or more cost-effective treatments
- Measure life
- Avoids potential double-counting of savings
  - Rebated measures

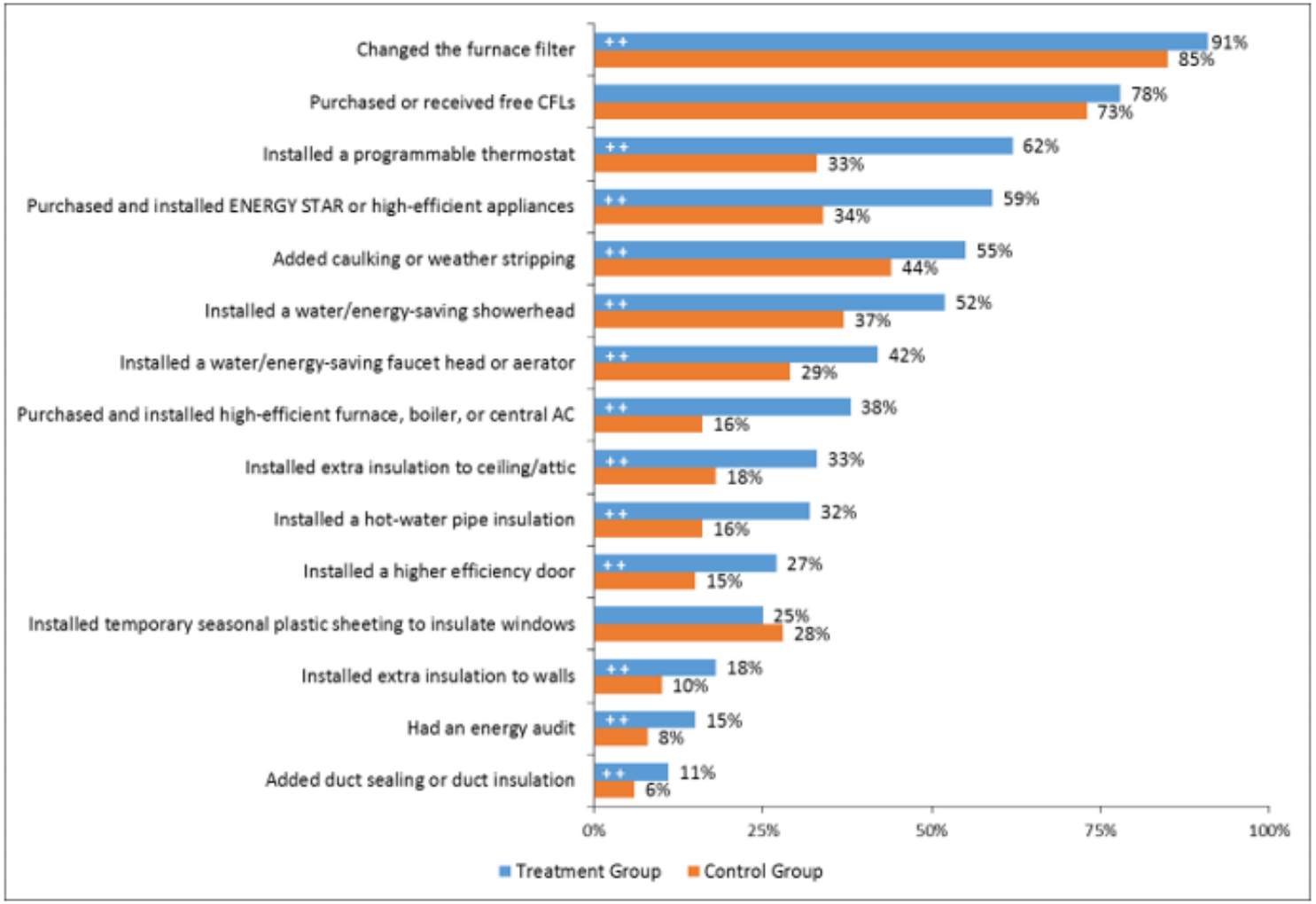
Research methods

- Customer surveys
- AMI meter data analysis
- EE program data analysis
- Customer/home observation

HERs Impacts on EE Home Improvements in Michigan

Consumers Energy customers who received HERs were more likely to make improvements.

Figure 8. Energy-Saving Improvements Made



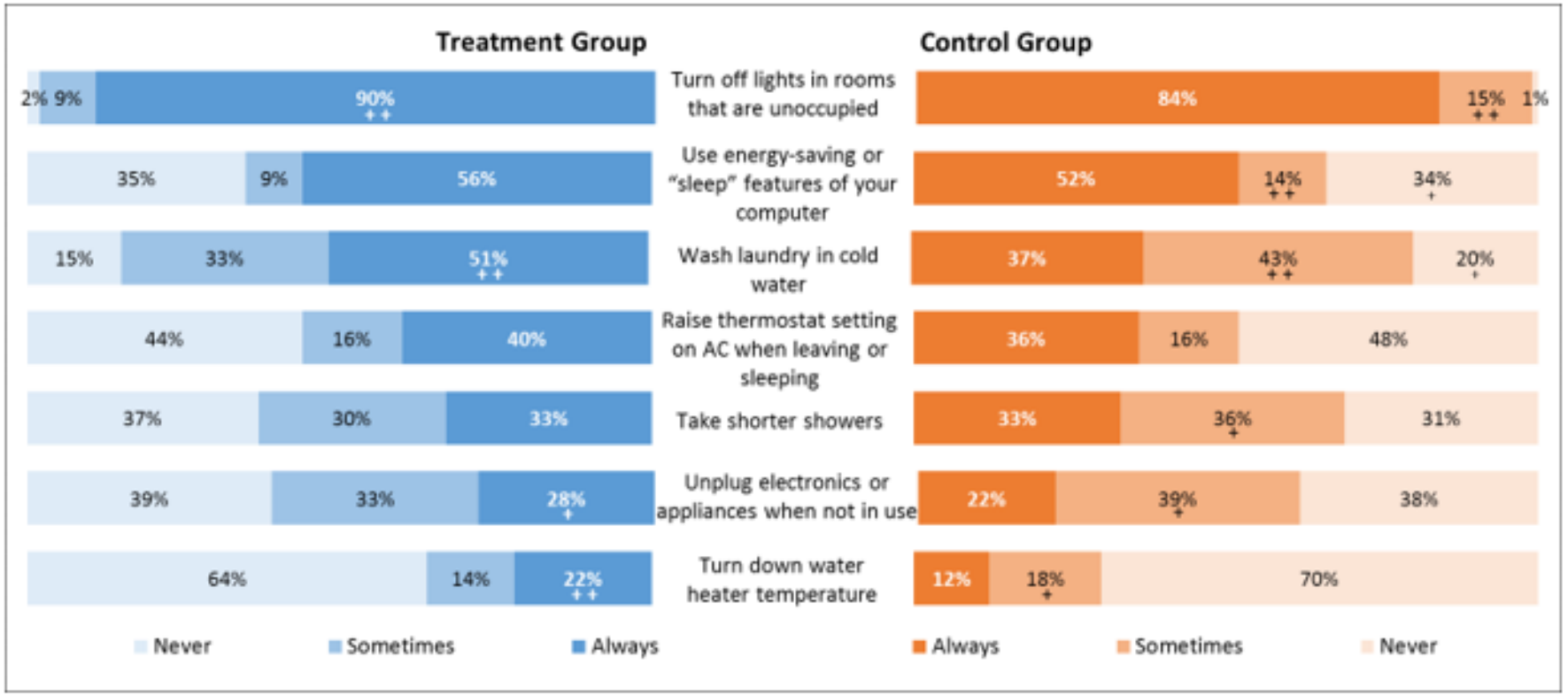
++Indicates a significant difference at the 5% significance level.

Source: Cadmus (2015). 2014 HERs Program Final Report

HERs Impacts on EE Behaviors in Michigan

Consumers Energy customers who received HERs were more likely to make behavior changes.

Figure 11. Frequency of Energy-Saving Actions



++Indicates a significant difference at the 5% significance level.

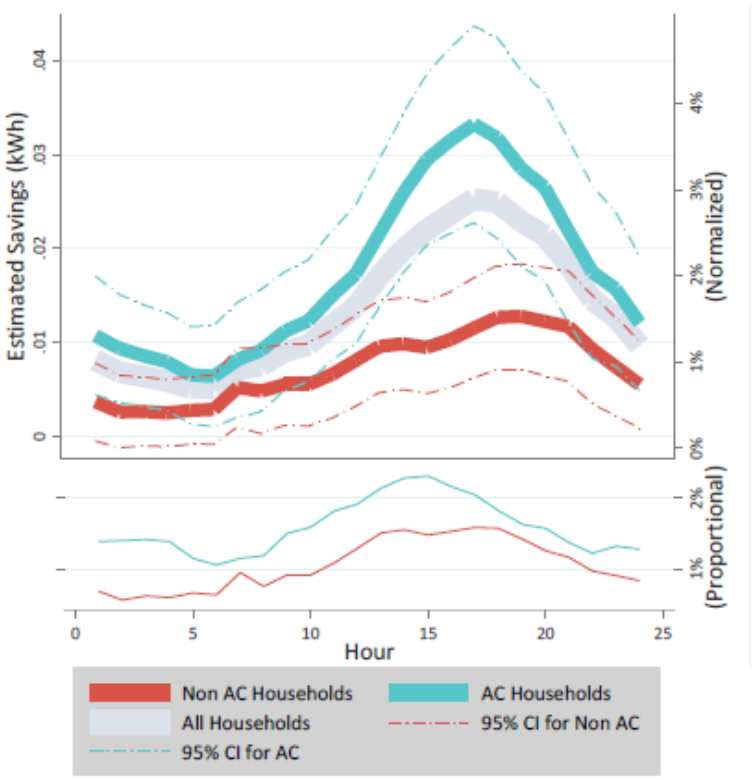
+Indicates a significant difference at the 10% significance level.

Source: Cadmus (2015). 2014 HERs Program Final Report

Air Conditioning Behavior Changes (Todd, Perry, et al., 2014)

- "Insights from Smart Meters: Identifying Specific Actions, Behaviors, and Characteristics that Drive Savings in Behavior-Based Programs." LBNL Report
- Air conditioning-related behavior changes for PG&E customers
  - Hourly AMI meter data
  - Segment customers by likelihood of AC use
  - Estimate hourly HER energy savings
- AC-user savings are strongly correlated with hours of air conditioning →behavior change

HER Saving from AC and non-AC HHs



Source: Todd, Perry et al. (2014).

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Formation of Household Energy Efficiency Habits (Allcott and Rogers, 2014)

- "The Short-Run and Long-Run Effects of Behavioral Interventions: Experimental Evidence from Energy Conservation." American Economic Review
- Analysis of daily interval consumption data for Opower HER program
  - Estimate daily savings as a function of time since previous report
- "Action and backsliding"
  - Decay of savings between initial HER treatments consistent with habit formation, leading to lasting behavior change

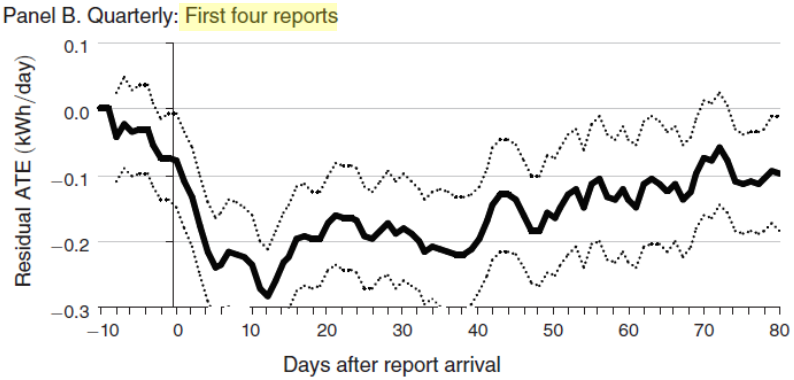

FIGURE 3A. HIGH-FREQUENCY EFFECTS IN EVENT TIME

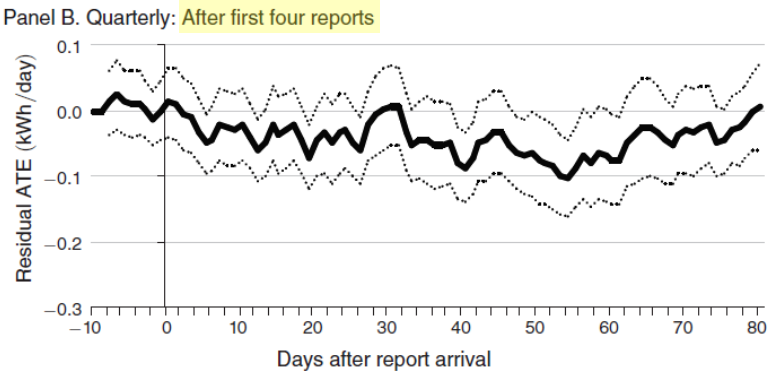

FIGURE 3B. HIGH-FREQUENCY EFFECTS IN EVENT TIME

Source: Allcott and Rogers (2014).

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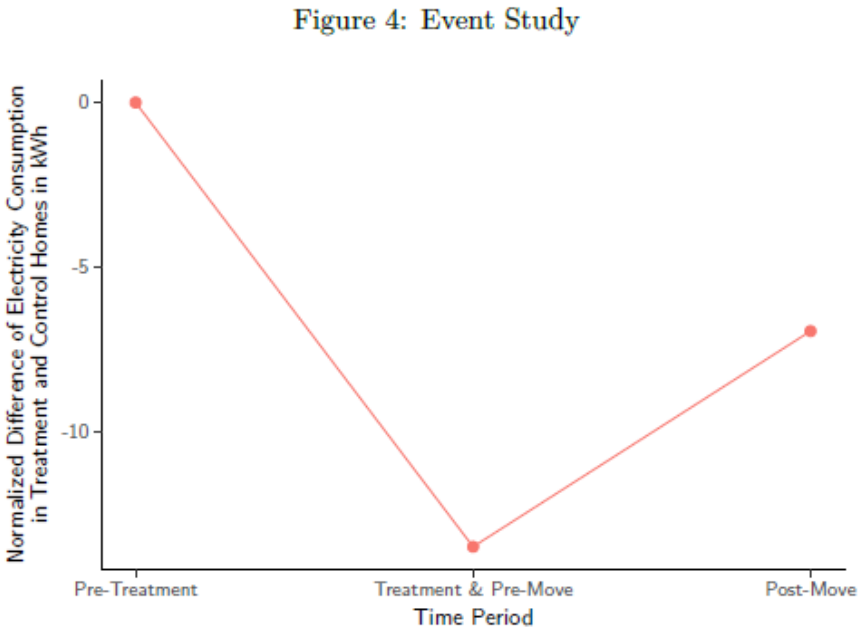
Persistence of HER Savings from Home EE Improvements (Brandon et al, 2017)

- "Do the Effects of Social Nudges Persist? Theory and Evidence from 38 Natural Field Experiments" Working paper.
- Estimate savings in homes after HER customers move out
  - Analysis of individual customer consumption data for 38 HER programs
- 33-55% of HER savings persist in homes after treated customer moves
  - Suggests significant savings from physical home improvements

HER Savings Pre- and Post-Move



Source: Brandon et al. (2017).

Takeaways

1. Growing area of research with considerable recent progress
2. Research suggests HERs cause customers to change EE behaviors and to make home EE investments

Topics for Future Discussion

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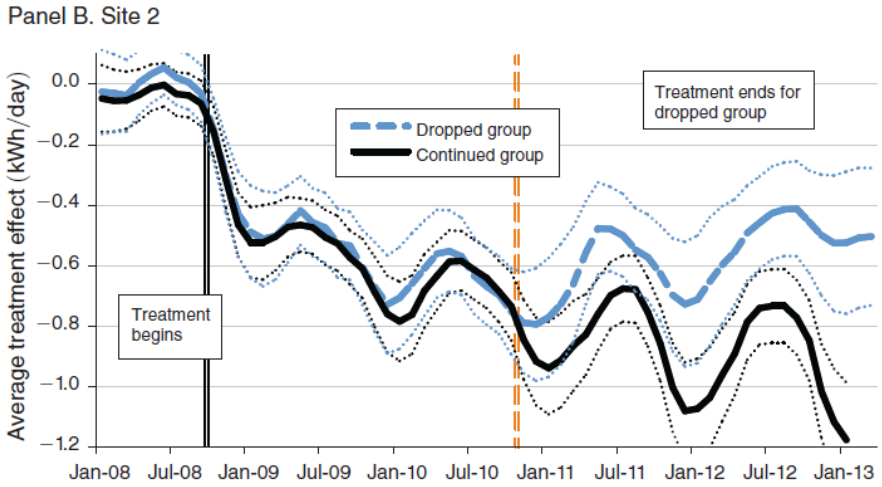
HER Savings Persistence and Measure Life

Convention was to assume HER measure life of one year

- Insufficient evidence about measure life



Source: Allcott & Rogers, 2014. American Economic Review, p. 3018

New RCT studies show that savings persists after treatment ends

- Savings do not decay immediately
- Suggests HER multi-year measure life

Potential benefits of assuming multi-year measure life?

Requirements to implement a multi-year measure life?

Behavior Program Evaluation

BEHAVIORAL RESEARCH MANUAL

Provides strong foundation for reliable evaluation

Behavior programs must… “Adhere to a systematic design that allows for the reliable quantification of attributable energy savings (e.g., randomized control trials, normalized metered energy consumption analysis) by following industry best practice research designs and removing any energy savings that may be claimed by parallel EWR programs.”

Consumers Energy and DTE often employ RCTs to evaluate HER and other behavior programs

TOPICS FOR DISCUSSION

Randomized experiments and quasi-experiments

Advantages of randomized experiments

Sample sizes

Quantifying lift in utility EE program participation

Conclusions

Conclusions

1. Behavior programs employ nudges and have a strong foundation in behavioral social sciences.
2. HER programs are a widely deployed energy efficiency resource
3. Understanding of HERs' impacts on utility customers is growing. Evidence points to behavior changes and home EE improvements.
4. Further discussions with MPSC staff about behavior program savings persistence, measure life, evaluation, and other subjects would be welcome.

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Thank You / Q&A

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