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Opower

Using behavioral science to improve energy efficiency

February 27, 2014

Prepared For

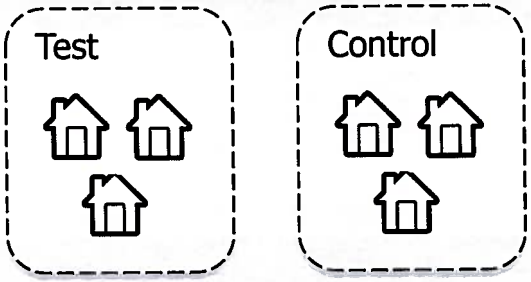
Experiment setup: Randomized Controlled Trial

Opower's savings measurement method generates unassailable results

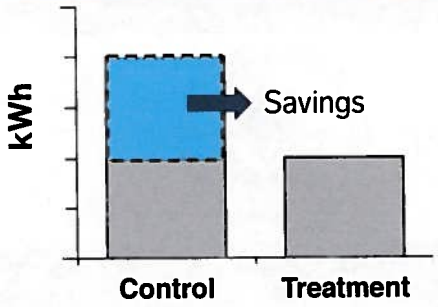
1. Identify target households

2. Match program size to desired impact

3. Establish statistically equivalent groups using randomization



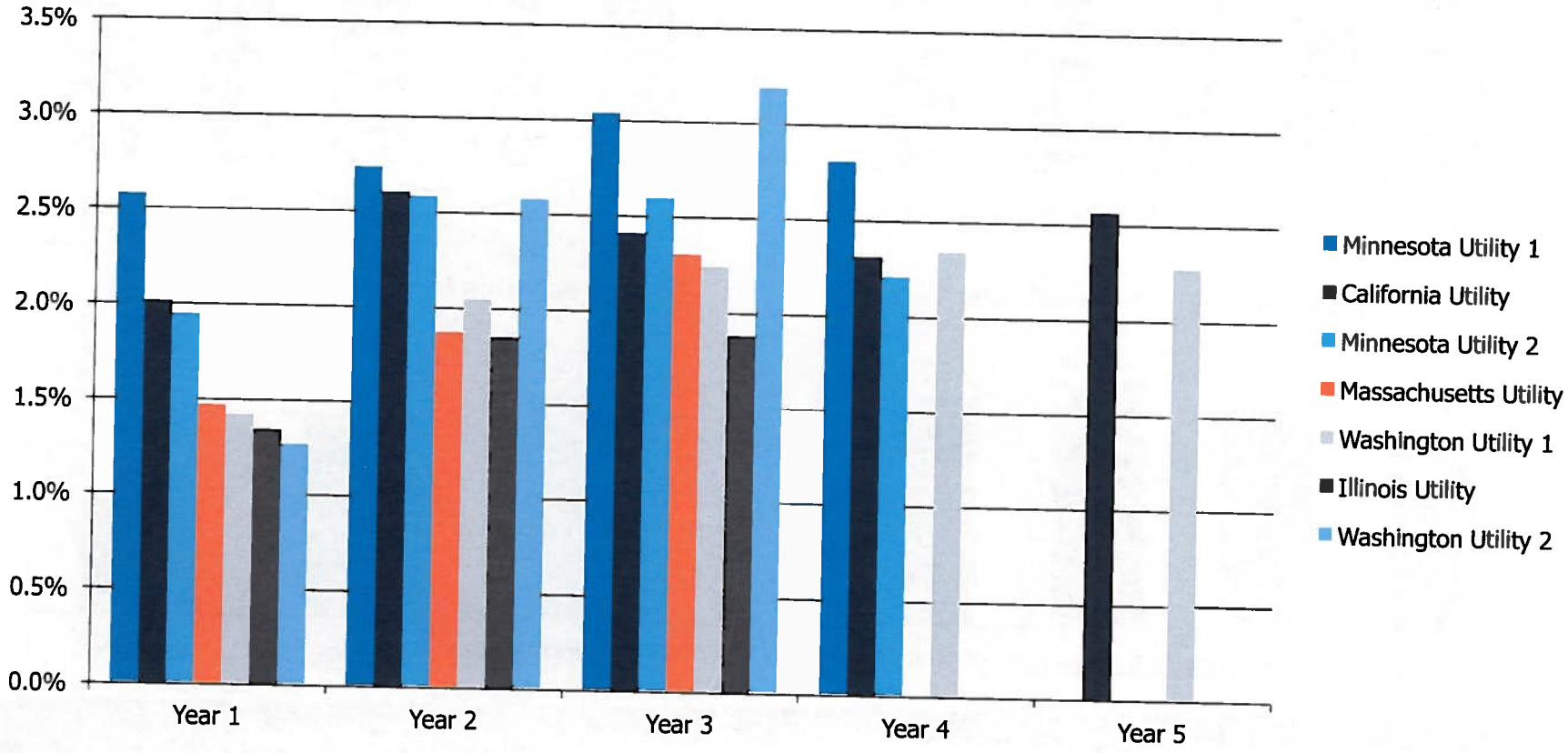
4. Measure program savings



Consistent and reliable results over time

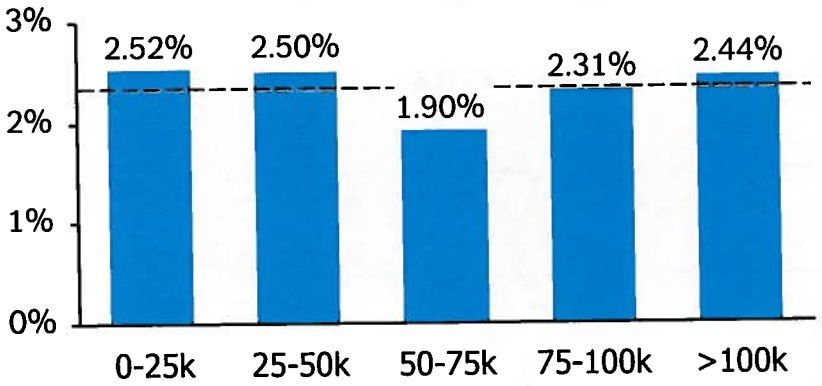
Results from 7 of Opower's longest running electric deployments show consistent improvement from Year 1 to Year 2, and persistent results in Year 3 and beyond

Savings Rates Over Time, Longest Running Electric Fuel Deployments

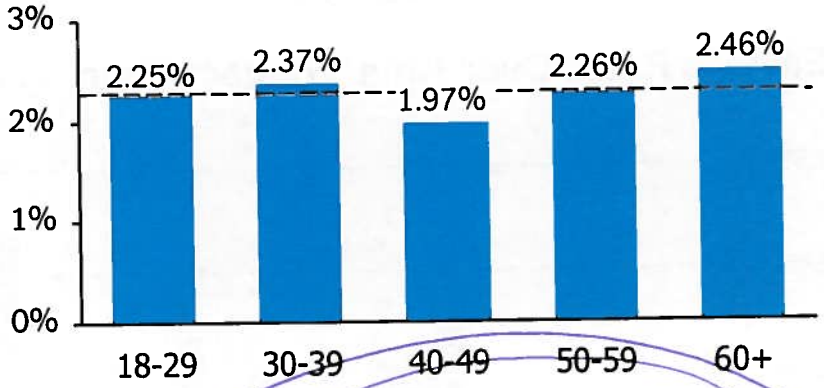


Impact Across All Segments

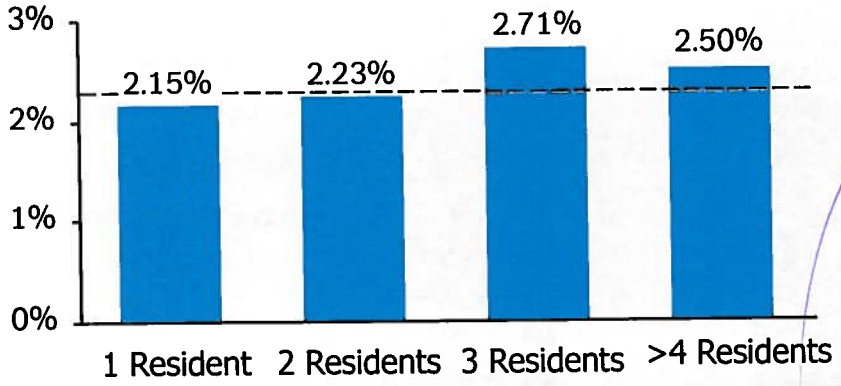
Energy Savings by Income



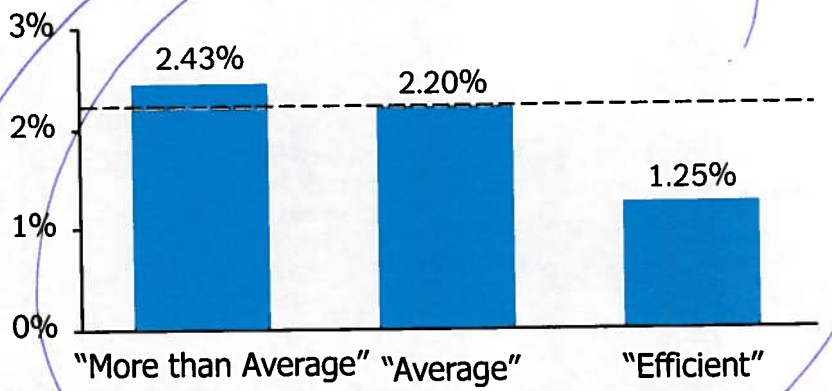
Energy Savings by Age



Energy Savings by # of Residents



Energy Savings by Household Efficiency

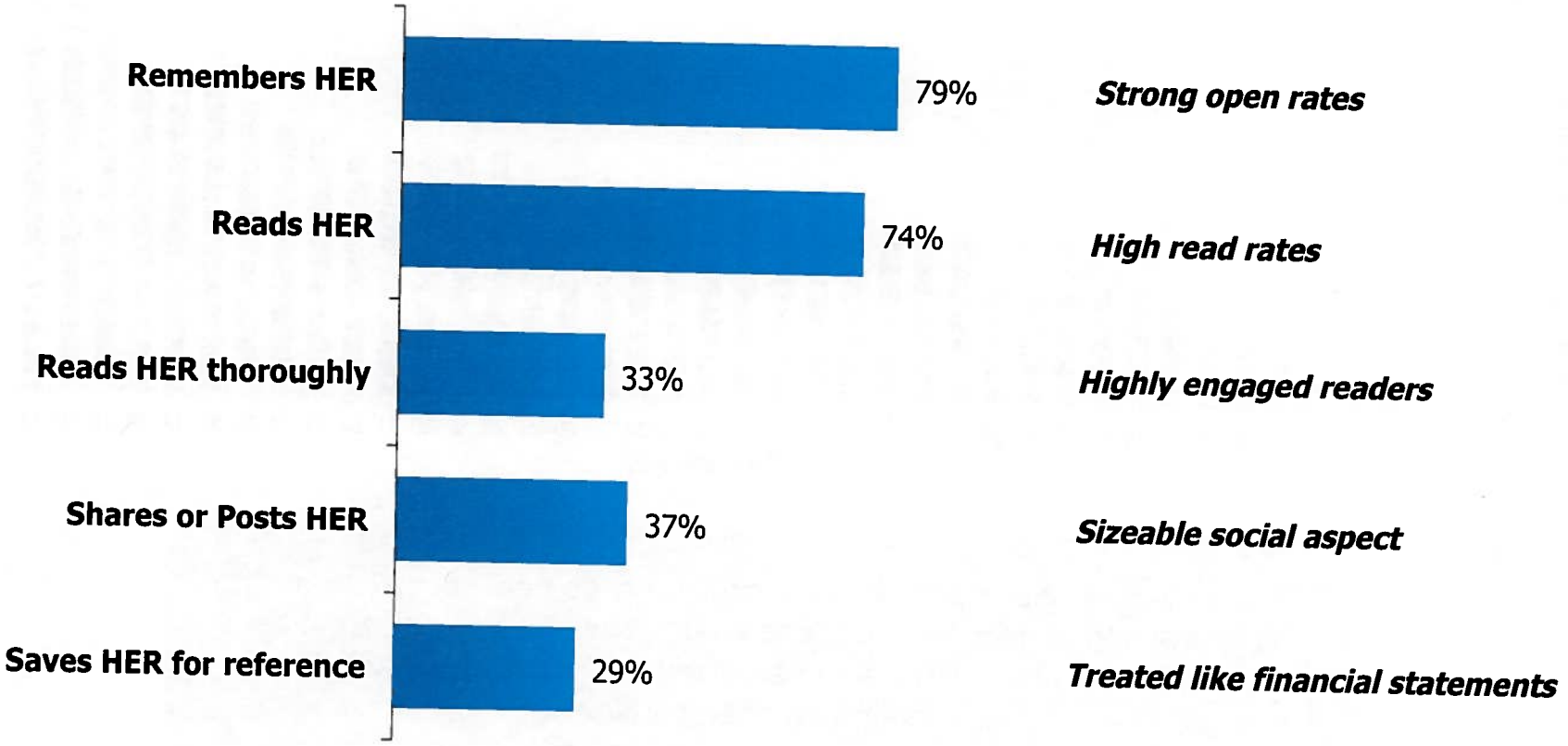


Impact Variance Very Low Across Demographic Groups and Energy Profiles

Reports demonstrate wide reach and strong influence

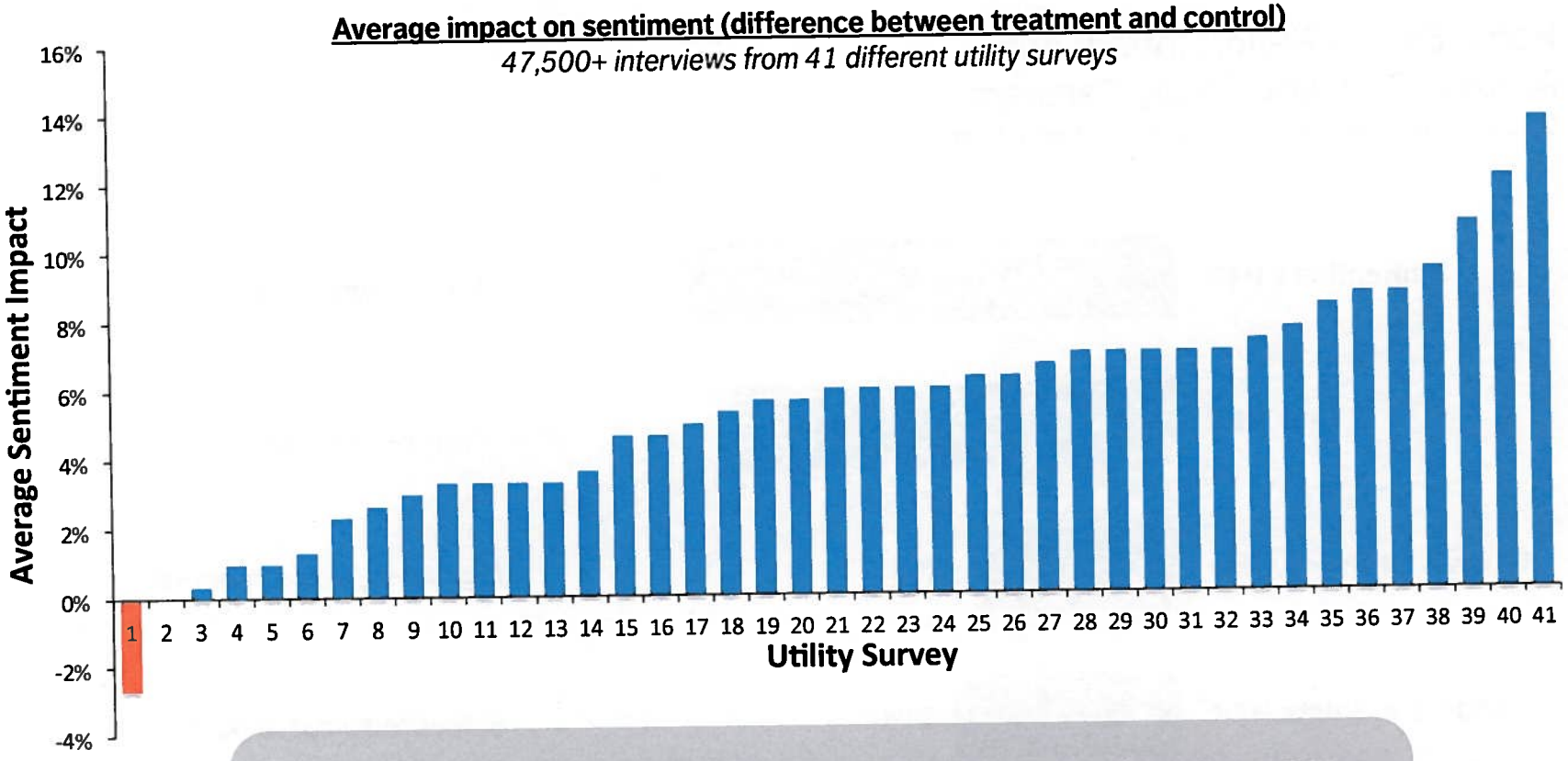
Home Energy Report Interaction Across 27 Distinct Utility Partners

27,577 interviews with customers sent Home Energy Report



Thinking about the Home Energy Reports that you have received, what do you typically do with them?

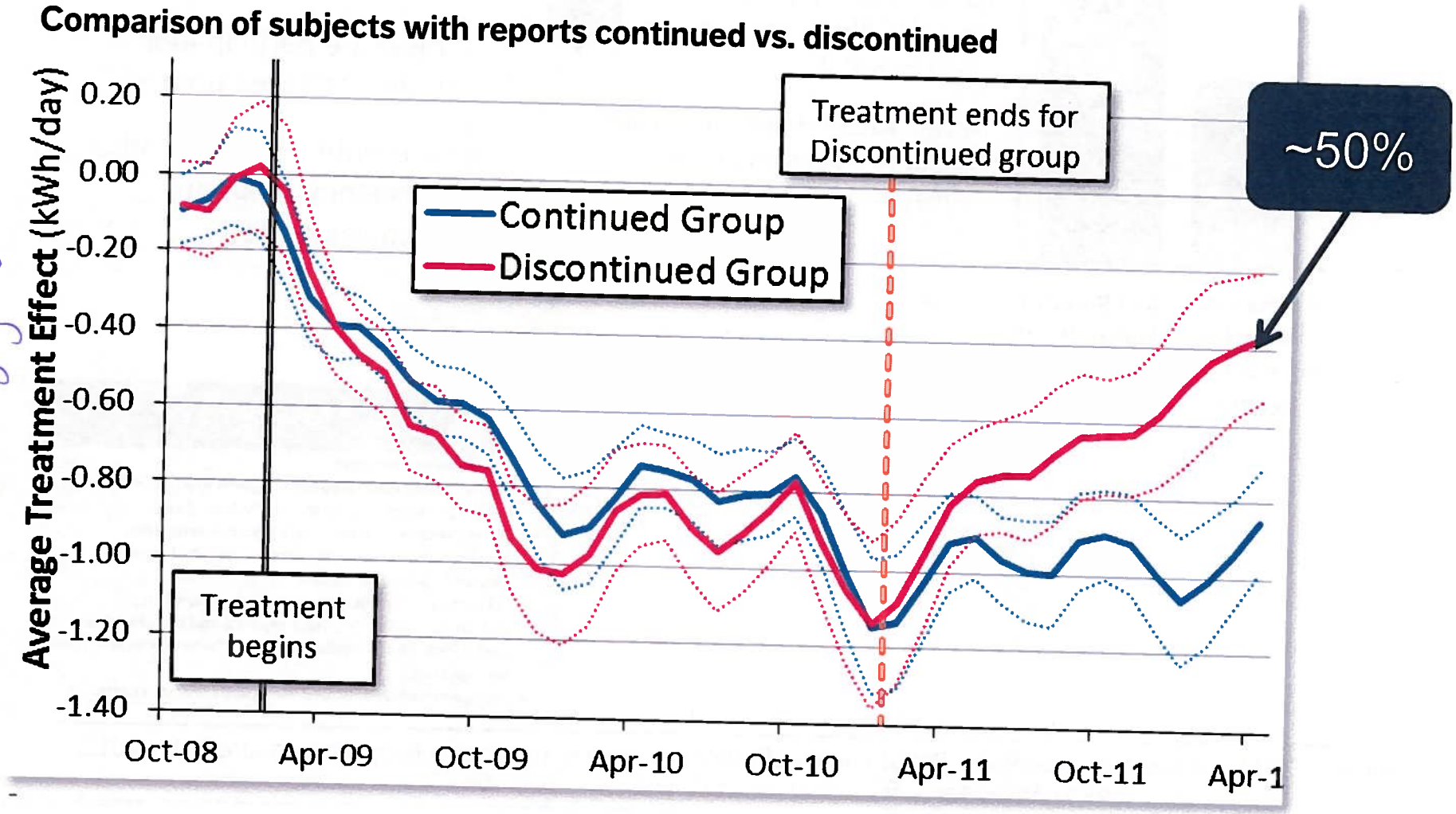
On average, sentiment improves by almost 6%



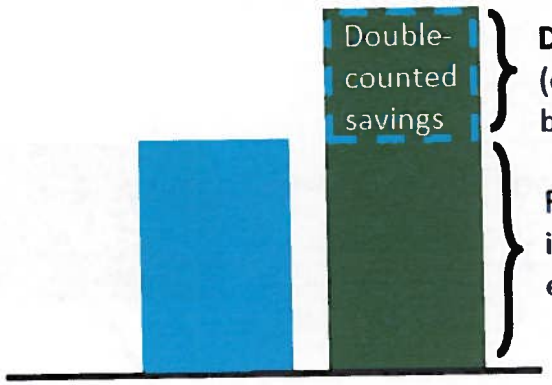
This is the average improvement in sentiment scores, consisting of "the utility wanting to help reduce home energy use', 'utility wanting to help save money' and 'utility being perceived as a trustworthy source of information on energy efficiency'

Savings decay post-treatment

Study by Hunt Allcott (NYU) of metering data at Midwestern Utility



Addressing Double Counting



Double-counted savings (causally linked to behavior-based program)

Rebates automatically not included in behavioral program's impact estimates

Methodology

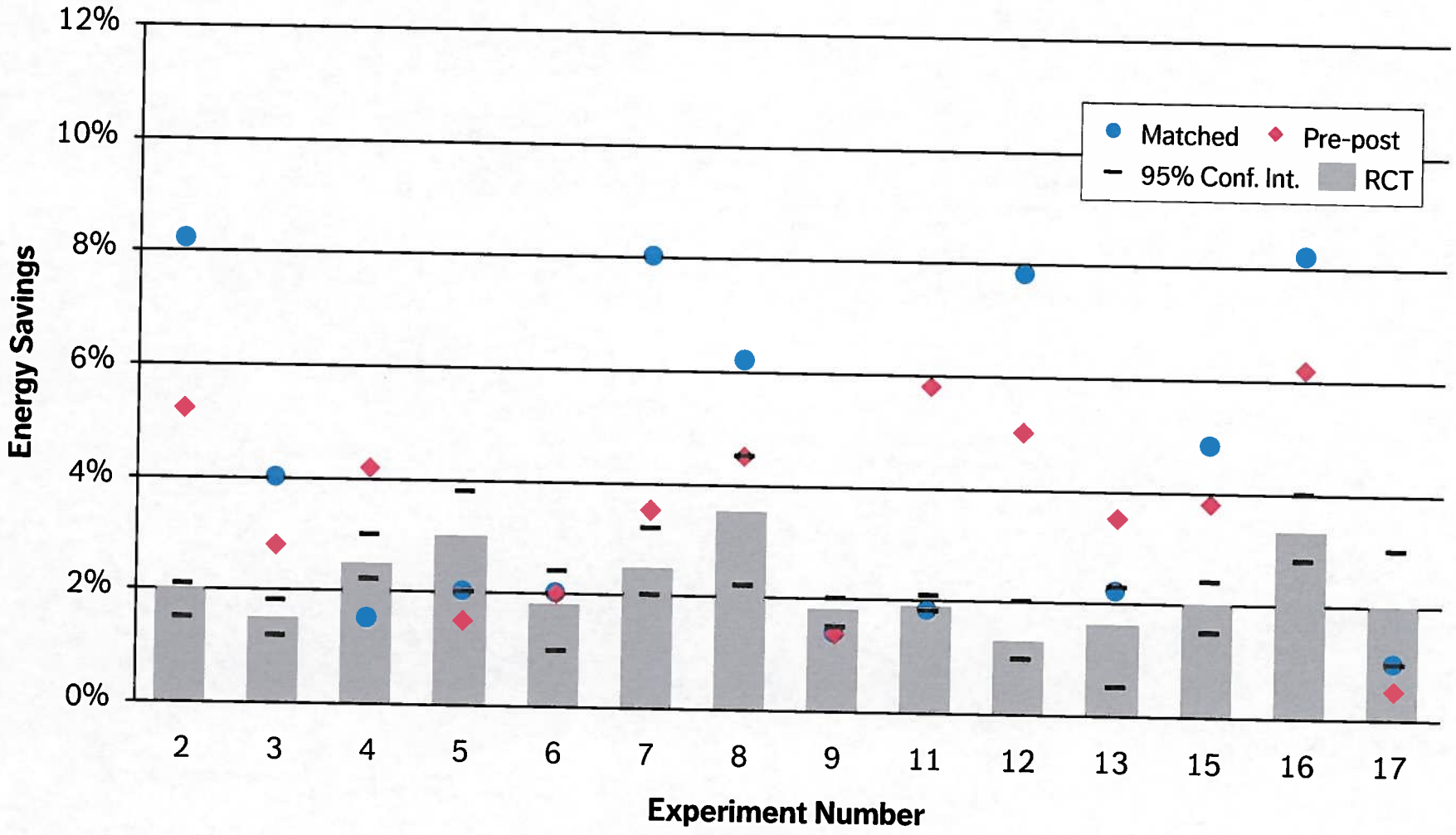
- Measure participation difference (see box)
- Attribute savings to other efficiency program, Opower, or both

This approach is best practice

Star Rating		Condition
If RCT:	If Quasi-Experimental:	
★★★★★	★★★★☆	**Double-counted savings:** • **Are rigorously estimated** for programs in which efficiency measures can be tracked to specific households • **Do not exist or a compellingly rigorous estimation approach was used** for programs in which efficiency measures cannot be tracked • Take into account **the measurement period** (e.g., accounting for seasonal load impacts) **and the effective useful lifetime of installed measures** (when lifetime savings are reported) • Are appropriately allocated **along with program costs.**

Source: "EM&V of Residential Behavior-Based Energy Efficiency Programs: Issues and Recommendations," May 2012, *State & Local Energy Efficiency (SEE) Action Network*, p. 14

The Importance of RCTs



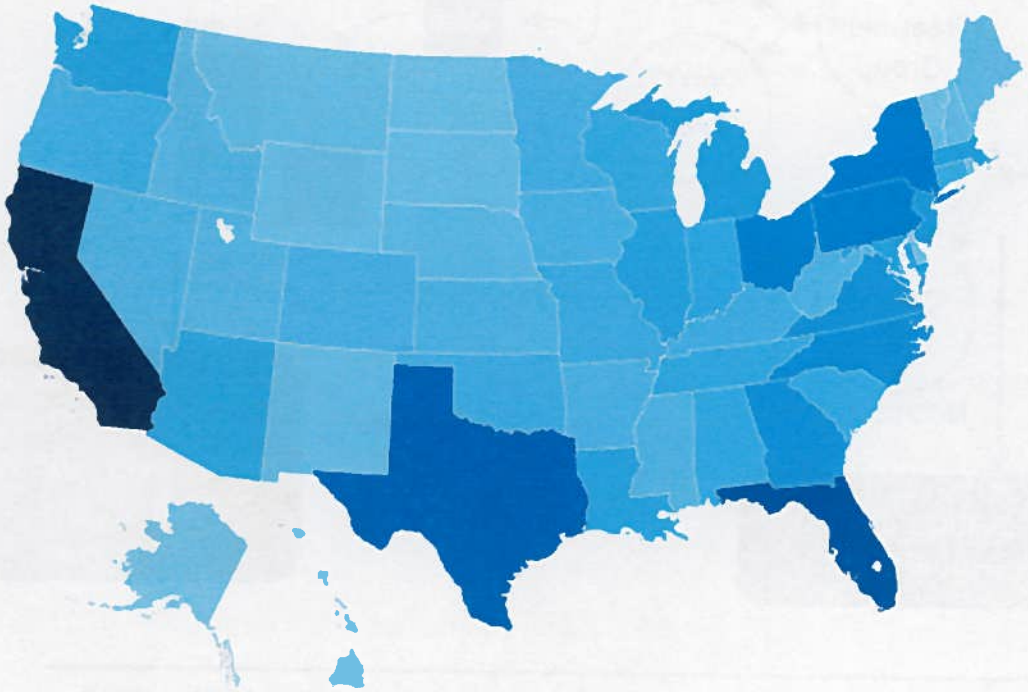
Source: Alcott, Hunt. "Social Norms and Energy Conservation," Journal of Public Economics (2011)

Appendix

Behavioral Energy Efficiency Potential

Energy Savings is the total savings opportunity of all cost-effective households. This metric shows annual energy savings in GWhs, savings per household (kWh) and equivalent light bulbs powered.

Please click on the map to see a specific state's behavior energy potential



NATIONAL

ANNUAL ENERGY SAVINGS (GWhs)

18,677

Savings per household

kWh

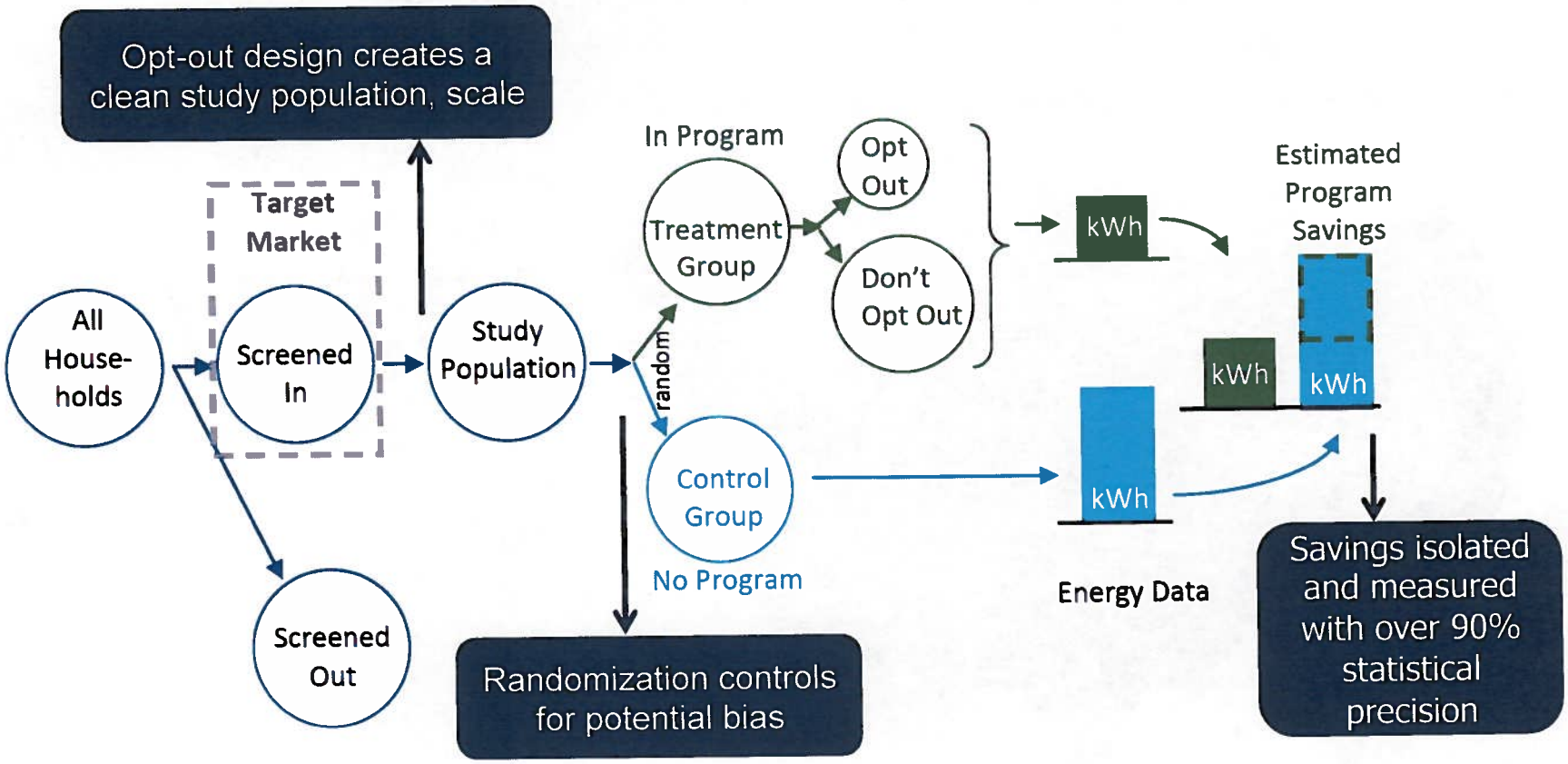
169

Lightbulbs we'd power 24/7 for a year

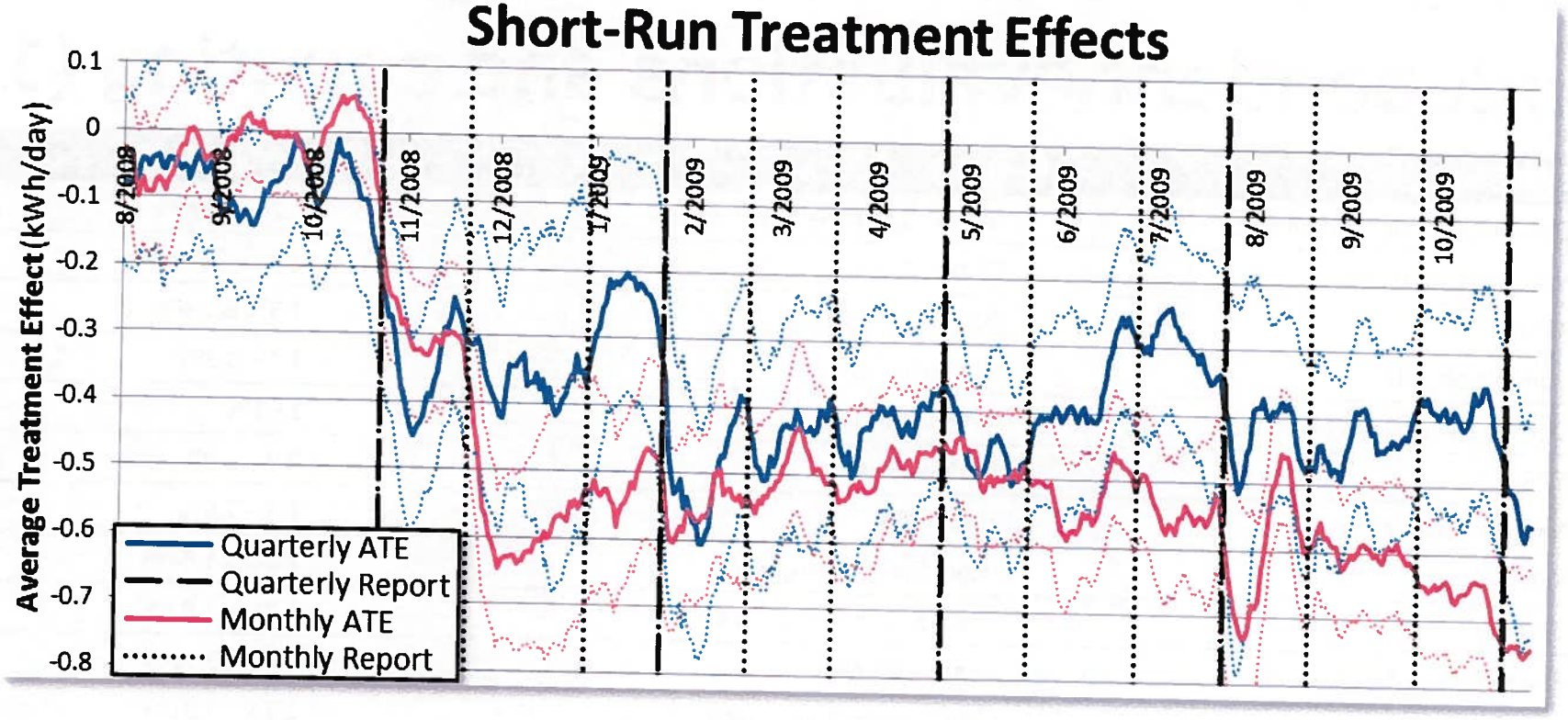
35,534,626

EM&V: Opt-out Randomized Controlled Trials

This best practice approach leads to precise, unbiased savings estimates



Source: "EM&V of Residential Behavior-Based Energy Efficiency Programs: Issues and Recommendations," May 2012, *State & Local Energy Efficiency (SEE) Action Network*, p. 14



Allcott and Rogers (2012)

Notes: This figure plots the smoothed ATEs for each day of the first year of treatment for the monthly and quarterly treatment groups, as estimated by Equation (1). The dotted lines reflect 90 percent confidence intervals, with robust standard errors clustered by household.

Savings have been verified by nearly 30 independent evaluations and counting (1)

Evaluator	Utility	Results
Opinion Dynamics & Navigant	NSTAR & National Grid (MA)	1.25 – 2.06%
Navigant Consulting	ComEd (IL)	1.55 – 2.02%
KEMA	Puget Sound Energy (WA)	1.3% & 2.6%
Hunt Allcott, MIT	17 deployments	1.4 – 3.3%
Opinion Dynamics & Navigant	National Grid (MA)	1.61%
EDF	11 deployments	0.9 – 2.9%
Navigant Consulting	SMUD (CA)	1.3 – 2.9%
KEMA	Puget Sound Energy (WA)	1.26 & 1.84%
LBNL (meta-analysis)	Puget Sound Energy (WA)	1.26 & 1.84%
Power System Engineering	Connexus (MN)	2.05 – 2.10%
Power System Engineering	Lake Country Power (MN)	2.73 – 2.81%
Hunt Allcott, MIT	N/A	2.70%
Hunt Allcott, MIT	Connexus (MN)	2.3 – 2.4%
Ian Ayres, Yale	SMUD (CA) & Puget Sound Energy (WA)	2.1% & 1.2%
Summit Blue (d/b/a Navigant)	SMUD (CA)	2.13 – 2.24%

KEMA NYU Massachusetts Institute of Technology HARVARD NAVIGANT CONSULTING BERKELEY LAB

Savings have been verified by nearly 30 independent evaluations and counting (2)

Evaluator	Utility	Results
Opinion Dynamics & Cadmus Group	Ameren (IL)	1.14% & 0.70%
Integral Analysis	SMUD (CA)	2.2%
Navigant	ComEd (IL)	2.20%
Navigant	Progress Energy Carolinas (NC)	1.23%
KEMA	Puget Sound Energy (WA)	2.8% and 1.3%
NMR	Connecticut Light & Power (CT)	2.2% (monthly); 1.2% (quarterly)
Freeman, Sullivan & Company	Pacific Gas & Electric (CA)	0.9% - 1.5% and 0.4% - 0.9%
Navigant	AEP Ohio (OH)	2.00%
Opinion Dynamics	NSTAR, National Grid (MA)	0.89 - 2.47% and 0.50 - 1.80%
ADM Associates	Indiana Michigan Power (IN)	1.70%
TecMarket Works	Indianapolis Power & Light (IN)	1.00%