Behavioral Demand Response
Residential customers: An untapped demand response resource

FERC Assessment of Residential DR Potential

- Scenario 1: Business As Usual
- DR Opportunity
- Scenario 2: Achievable Participation

Utilities are on track to reach only 10% of residential DR potential

Source: FERC 2009 Potential Study
Legacy technologies are difficult to scale

Traditional Direct Load Control

Challenges

» Historically low participation leaves 70%-95% of customers unengaged

» Hardware focused programs are **costly** and take years to reach scale

» Neglected customer experience leads to **low satisfaction** and churn

» Hardware-centric platforms lead to **technology lock-in**
Behavioral Demand Response: 150k Homes, 3 Utilities

**Peak day notification**
- Targeted communication
- Channel of choice
- Opt-out program design

**Personalized adjustments**
- Large-scale engagement
- Access to more kW
- Highly accurate EM&V

**Post-event feedback**
- Immediate feedback
- Highly personalized results
- Ongoing encouragement
Randomized Controlled Trial (RCT) ensures accurate measurement of load impact

Targeted households in utility footprint → Random Allocation → Control Group (Statistically equivalent groups) + Test Group + No Treatment → Peak Demand

Large-Scale Data Analysis
- Follows experimental design blueprint
- Clearly isolates impact of BDR
- Follows NAPEE guidelines
- Endorsed by ACEEE, DOE
- Used in PUC filings in dozens of states
M&V:  RCT Design + Regression Estimation

Measures difference in treatment and control usage during event hours conditional on:

- **Recent hourly customer usage**
  Usage during event hours in the same day of the week in four weeks prior to BDR season

- **Hourly usage in the same month last year (when available)**
  Usage during event hours in the same day of the week of the same month last year

- **Average seasonal usage**
  Average summer, winter, and annual usage in the year prior to the BDR season

**Sensitivity Analysis:** Ensure results robust to alternate specifications
Result:

Significant load reduction during peak hours

Performance across 10 events:

» 3% avg. peak reduction
» 5.04% max. peak reduction
Result:
Consistent savings across events

Incentive-based (rebates) program at BGE yielded ~5% savings
Result:
Measurable savings, engaged customers

Can Demand Response be engaging?

“I am satisfied with the peak energy days program”

Strongly Agree 40%
Somewhat Agree 34%
Neutral 8%
Disagree 14%

Leah borillo
@Honeybabe0210

GWP ENERGY RESULT #7thmost efficient household #didourpart #doyourpart @ Glendale, California
instagram.com/p/sTyW_zCwUV/
12:33 AM - 30 Aug 2014

Andrea Arvanigian
@andiarvanigian

According to Glendale water & power, I'm the 6th best at saving energy out of 100 of my peers. 'A' student for life! #overachiever
3:49 PM - 2 Sep 2014
1 FAVORITE
Result:
Measurable savings, engaged customers

Impact on Customer Relationship Metrics
(689 Treatment and 288 Control – 5 Point Scale, Top 2 Box)

- I have access to a trustworthy source of information on energy efficiency.
  - Control Group: 64%
  - Recipient Group: 71%
  - +7%**

- My energy provider wants to help me save money.
  - Control Group: 49%
  - Recipient Group: 59%
  - +9%**

- I receive help with managing my monthly energy usage.
  - Control Group: 20%
  - Recipient Group: 27%
  - +7%**

- I receive useful suggestions on ways I can reduce my energy usage and lower my monthly bills.
  - Control Group: 58%
  - Recipient Group: 66%
  - 7%**

- I have access to a variety of energy efficiency programs.
  - Control Group: 52%
  - Recipient Group: 55%
  - +3%

**95% significant difference
*90% significant difference
Opportunity: What would 3% deliver across 500k homes?

Behavioral Demand Response

Key Outcomes (500k HH utility)

- 100% Participation
- 45 MW
- 1,575 MWh
- 2.1 TRC   1.9 RIM

Assumptions: 3.0% Peak Savings, 3.0 kW/Home Demand, 5 Events * 7 Hours, $70 Avoided Cost per kW