



What Do We Know About Comparative Energy Usage Feedback Reports for Residential Customers?

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Results

- Yes
- Yes
- Yes, but only a small portion
- Yes
- Yes, but at reduced levels
- No consistent patterns, more study needed
- Inconclusive, more study needed

Sample Comparative Energy Usage Feedback Report

October Neighbor Comparison | You used **4% MORE** energy than your neighbors.



* This energy index combines electricity (kWh) and natural gas (therms) into a single measurement.

HOW YOU'RE DOING:

GREAT 🌟🌟

GOOD 😊

▶ **BELOW AVERAGE**

Compares your household's energy use in prior month to "your neighbours"

WHO ARE YOUR "NEIGHBORS"?

ALL NEIGHBORS

Approximately 100 occupied nearby homes that are similar in size to yours (avg 2,519 sq ft) and have both electricity and natural gas service.

EFFICIENT NEIGHBORS

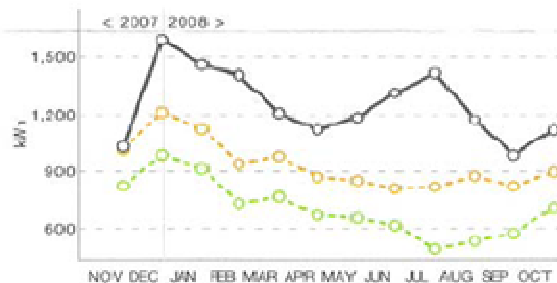
The most efficient 20 percent from the "All Neighbors" group.

Explains "who are your neighbors"

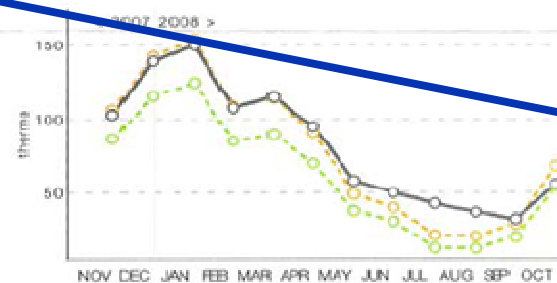
Last 12 Months Neighbor Comparison

You used **19% MORE** energy than your neighbors.
This costs you about **\$409 EXTRA** per year.

⚡ **Electricity** | 34% more electricity than your neighbors



🔥 **Natural Gas** | 4% more natural gas than your neighbors



Compares your monthly and annual energy use in prior year to "your neighbours"

Personalized Action Steps

Lower the temperature of your hot water heater

Switch to compact fluorescent bulbs

Look for the ENERGY STAR® label

Provides "personalized" recommendations

Key Program Feature: Experimental Design

- The expected levels of average energy savings from the program are small in comparison to baseline consumption levels.
- Therefore, the use of **experimental designs** is critical for assessing program effects.
- Most programs include random assignment of customers to a treatment group (those who receive the reports) and a control group (those who do not).
- Comparative analysis of billed energy consumption over time for treatment v. control group “built in” to the program design

Theoretical Basis

- Social psychology research and experiments on the relationships between social norms, messaging, and environmentally-responsible behaviour
- Early studies concluded that focusing on social norms in messaging is an effective strategy to promote sustainable behaviour (Cialdini 2003)
- **Social validation of recommended actions** by a reference group of acknowledged peers is one of the six major mechanisms by which influence can be exerted over large groups
 - Other major mechanisms include appeals to authority, reciprocity, previous publicly-made commitments, scarcity, and fellow feeling (Cialdini 2009)
- Schultz et al. experiments (2007) utilized random groups, social norm information, feedback messaging (i.e., 😊 and ☹️)
- Strategies examined in these types of early studies have been incorporated into today's growing range of comparative energy usage feedback reports

Proliferation of Comparative Feedback Programs

OPPOWER

EFFICIENCY2.0

ACLARA®

TENDRIL™

- Adding new features and approaches in response to competition and customer needs
 - Provisions for voluntary participation outside of initial trials, detailed on-line audits customizable to the customer's home, and feedback points redeemable for discounts on merchandise
- Rich set of results targeting various customer segments with a wide range of offerings
- Evaluations help validate results and inform future program designs

Findings from Completed Evaluations

- Sacramento Municipal Utilities Department (SMUD), Puget Sound Energy (PSE), and a consortium of Massachusetts electric and gas utilities (MA)
- Research questions:
 - To what extent do reductions in energy use observed in the first year of participation **persist** in later years?
 - What effect do **changes in details of program deployment**, such as the frequency and format of reports, have on savings achieved?
 - Which **customer attributes** are associated with high levels of savings through participation in feedback programs? Can these differences be reflected in strategies to increase program savings and cost-effectiveness?
 - Through what **specific actions** do program participants achieve energy savings?
 - To what extent does information and feedback received through the program stimulate recipients to **participate in other energy efficiency programs**? Are these savings incremental to what the other programs would otherwise have achieved?
 - To what extent are customer responses to the program **consistent with the theories of influence**?

Evaluation Methods

- **Analysis of monthly energy bill data** to estimate treatment effects
 - All three studies used analysis of billing data to estimate savings associated with assignment to the treatment group
 - Different methods used, ranging from simple comparisons between treatment and control groups of changes in average consumption over time (“difference of differences”), ordinary least squares regression to estimate consumption changes associated with inclusion in the treatment group, and pooled time-series cross-sectional approaches
- **Customer surveys**
 - The PSE and MA studies included surveys of customers in the Treatment and Control groups, and focused on identifying the energy efficiency actions both groups took in the post-treatment period
- **Cross-participation analysis**
 - The PSE and MA studies included analyses of participation in other energy efficiency programs by customers in the Treatment and Control groups, using cross-referencing of account numbers from the billing analysis to databases of participants in other programs

Estimates of Annual Savings

Sponsor	Average kWh/ Year Savings	Average % kWh Savings (Percent of Pre-Treatment Use)	Average Therm/ Year Savings	Average % Gas Savings (Percent of Pre-Treatment Use)
MA Utilities	184 kWh	1.61%	9.93 Therms	0.77%
90% CI	26 kWh	0.23%	2.23 Therms	0.17%
SMUD	241 kWh	2.13%	n/a	n/a
95% CI	+/- 18 kWh	+/- 0.16%		
PSE	204 kWh	1.84%	12.8 Therms	1.33%
95% CI	+/- 12 kWh	+/- 0.11%	1.3 Therms	0.13%

Electricity savings equivalent to replacing 3-4 incandescent lamps with CFLs. Natural gas savings equivalent to installing one faucet

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Customer Actions and Energy Savings

- To assess the potential persistence of observed savings, we need to understand **what measures customers installed** and which behaviours they initiated **as a result of exposure to the program**
- Moreover, we need to consider whether savings were achieved due to the influence of the feedback program, or whether some portion was due to **participation in other incentive-based programs** in the sponsors' portfolios
- Experimental design framework allows for estimation of savings through three mechanisms:
 - Incremental participation in other efficiency programs
 - Incremental installation of efficiency measures outside of other programs
 - Incremental adoption of efficiency and conservation behaviours

Savings from Incremental Participation in Other Programs

- **Data merges** were used to identify participation in other programs
- Other programs included promotions of energy-efficient appliances, CFLs, energy-efficient heating and cooling equipment, and thermal measures such as added insulation
- Energy savings were estimated from measures installed during the appropriate time period

Savings from Incremental Participation in Other Programs

	Massachusetts		PSE	
	Electric	Gas	Electric	Gas
Participation Rate in Other Programs:				
Treatment	4.22%	3.85%	4.15%	
Control	3.86%	3.21%	4.11%	
Change in Participation Rate	0.35%	0.64%	0.04%	
Average Savings Per Program Year	184 kWh/yr	9.93 therms/yr	278 kWh/yr	12.9 therms/yr
Average Incremental Savings from Measures Taken in Other Program	0 kWh/yr (0%)	0.61 therms/yr (6%)	2.0 kWh/yr (1%)	1.3 therms/yr (10%)

Overall, small effect on levels of participation in other energy efficiency programs



Savings from Incremental Installation of Measures

- Surveys used to identify and characterize energy efficiency measures taken **outside of other programs** during the appropriate time periods
- Measures included purchase of energy efficient appliances, physical improvements to the thermal shell, and changes in energy-related behaviours (e.g., thermostat settings)

Savings from Incremental Installation of Measures

Measure Category	Massachusetts		PSE		
	Treatment	Control	Treatment	Suspended	Control
Heating/Cooling	10.2%	8.4%	11%	11%	9%
Efficient Appliances	★ 24.8%†	19.8%	n/a	n/a	n/a
Efficient Consumer Electronics	★ 20.4%††	13.6%	n/a	n/a	n/a
Efficient Lighting (not incl. CFLs)	10.0%	7.8%	37%	40%	36%
Air Sealing	n/a	n/a	20%	20%	19%
Water Heating	n/a	n/a	34%	31%	30%
Discard Old Refrigerator	n/a	n/a	3%	5%	3%
Building Envelope	★ 16.0%††	9.0%	n/a	n/a	n/a
Low-Cost Measures	45.3%	39.1%	n/a	n/a	n/a

††Difference is significant at the 95% probability level; † Difference is significant at the 90% probability level.

Among PSE customers, there were no significant differences between the Treatment, Suspended, and Control groups for any of the measure categories. Among the MA customers, there were small but statistically significant differences in rates of adoption for three measure categories but the difference in measure adoption rates was less than 7 percent.

Savings from Incremental Adoption of Behaviours

- Surveys also used to identify and characterize energy efficiency and energy conservation **behaviours and practices**
 - Adjusted thermostat settings for heating, cooling, and water heating equipment
 - HVAC and refrigerator maintenance
 - Unplugging idle electronics
 - Cold water washing
- Results indicate **no significant differences** between Treatment and Control group adoption rates
 - May reflect limitations of survey techniques since billing analysis, supported by tens of thousands of observations, demonstrates measured differences
 - Measured differences in monthly gas use during winter period suggests heating-related measures likely (e.g., lowering thermostat setting)
 - Measured differences in monthly electricity use were flat suggesting non-weather related measures

Persistence After Program Suspension

- When feedback programs were first introduced, program sponsors and regulators expressed concern that savings achieved in early periods would not persist into the second and third years of participation.
- Both the PSE and SMUD evaluations contain findings on persistence of savings after the first year, and these findings suggest that **savings realized in the first year persist and even increase in later periods.**
- The PSE program has three complete years of operating experience. In the third year, PSE stopped treatment to a subset of the Treatment group – that is, the company stopped sending reports to the Suspended group.

Persistence After Program Suspension

Program Year and Group	Electricity Savings		Gas Savings	
	kWh/Yr	95% CI	Therms/Yr	95% CI
Program Year One	169.7	+/- 23.9	10.7	+/- 1.7
Program Year Two	234.5	+/- 32.5	13.5	+/- 2.2
Program Year Three (Continued Treatment Group)	274.2	+/- 43.1	11.9	+/- 2.8
Program Year Three (Suspended Treatment Group)	216.4	+/- 55.6	11.9	+/- 3.6

Overall, results indicate average savings persist and in some cases continue to grow over time. Results also show savings remain positive even after reports are suspended – however, wide confidence interval suggests reduced consistency in behaviour.

Effect of Differences in Program Delivery

- The random assignment capability inherent in the feedback report program model supports evaluation and comparison of the **effectiveness of different implementation approaches** as well as evaluation of overall program effects on consumption.
- The SMUD and PSE evaluations randomly assigned subsets of the Treatment group to receive reports quarterly versus monthly.
- In all cases for which data are available, customers receiving monthly feedback reports achieved higher savings than those receiving quarterly reports, although the differences were small.
 - For PSE gas customers, no difference in savings for monthly v. quarterly reports.
- The SMUD study tested differences in results associated with variations in graphic presentation, but these did not lead to statistically significant differences in savings levels.

Relationship of Customer Attributes to Savings Levels

- All three of the studies assessed the **relationship between customer attributes and levels of savings**
- Range of attributes include electric end-uses, size of home, age of home, value of home and level of energy consumption (pre-treatment)
- Only level of energy consumption during the pre-treatment period appears to be predictive of the level of energy savings post-treatment
- Suggests that program cost effectiveness would be enhanced if targeted to high consumption segments

Participant Response to Home Energy Reports

- Reports are actually **read** by the majority of participants
- About half characterize them as “**useful**”
 - Most commonly cited useful element is the comparison of monthly energy usage to prior year, as well as recommendations for ways to save energy
 - Less useful was the comparison to neighbours energy use
 - Suggests difference in the value customers accord to information that motivates action versus information that guides action
- Reports may not **directly** cause action
 - Few respondents identified a causal link between receipt of the reports and energy use reduction actions they had taken (e.g., new habits, equipment purchases, etc.)

Results

- Are there measurable savings? **Yes**
- Do these savings persist? **Yes**
- Are these savings the result of participating in other programs? **Yes, but only a small portion**
- Do savings increase with the frequency of reports? **Yes**
- Do savings persist once reports are suspended? **Yes, but at reduced levels**
- Do we know what actions are taken to save energy? **No consistent patterns, more study needed**
- Do we know how the program specifically influences behaviours? **Inconclusive, more study needed**