# Using Nudges and Energy Benchmarking to Drive Behavior Change in Commercial, Institutional, and Multifamily Residential Buildings

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## Abstract

In 2013, the City of Chicago passed the Chicago Energy Benchmarking Ordinance to raise awareness of building energy performance through information and transparency, with the goal of unlocking energy and cost savings opportunities. The ordinance requires commercial, institutional, and residential properties over 50,000 square feet to benchmark energy use and report information annually to the City of Chicago, and verify data once every three years. The ordinance also authorizes the City to publicly release the information after the second year that a property reports.

Following two successful years of ordinance implementation, the City of Chicago partnered with several organizations to improve energy benchmarking compliance communications and to prompt energy performance improvement using the benchmarking results. Despite extensive research on "nudging" interventions to encourage energy efficiency among residential households or small businesses, there is more limited research on efforts to target representatives of larger, more complex properties.

To address this gap and utilize building energy benchmarking results to drive energy efficiency action, the City of Chicago and partners launched an ongoing effort to apply behavioral economics principles to large commercial, institutional, and multifamily properties by conducting market research and testing different approaches in randomized controlled trials. This paper provides insights from the team's unique research, initial findings, potential implications for other benchmarking and/or energy efficiency programs, and suggestions for future research.

## Introduction to Chicago Energy Benchmarking

Chicago's residents and businesses collectively spend three billion dollars per year on energy in buildings, and building energy use makes up seventy-one percent of citywide GHG emissions (ICF International 2012), representing an enormous economic and environmental opportunity. The Chicago Energy Benchmarking ordinance aims to improve awareness of energy use and costs, increase transparency of energy use information, and accelerate cost-effective energy efficiency improvements by requiring energy tracking, reporting, and data verification. The law covers commercial, institutional, and residential properties 50,000 square feet or greater, which comprise less than one percent of Chicago's buildings, and account for approximately twenty percent of total energy use by all buildings in Chicago (City of Chicago 2016).

Compliance with the Chicago Energy Benchmarking Ordinance is phasing-in from 2014-2016, according to building size and sector. In 2014, building owners, managers, engineers, and

consultants (representatives) from 254 commercial and institutional properties larger than 250,000 square feet complied with the ordinance, representing a ninety-two percent reporting rate (ninety-eight percent by square footage) (City of Chicago 2014). In 2015, representatives from over 1,840 properties spanning 614 million square feet complied with the ordinance, representing an eighty-four percent reporting rate (ninety-two percent by square footage) (City of Chicago 2015).[1]

## Encouraging compliance and improvements

The City and its partners faced two issues in achieving its goals through implementation of the Chicago Energy Benchmarking ordinance: 1) continuing to ensure compliance; and 2) using the data to effectively encourage energy efficient investments and improvements. The research described in this paper addresses ways that the City and its partners sought to improve benchmarking-related communications to further progress towards these two goals.

### The promise of applying behavioral science to encourage pro-environmental behavior.

Applied behavioral science draws insights from psychology, sociology and economics to help explain decisions people make that may be inconsistent with the rational actor model of economic theory. Where these inconsistencies exist, the decision making process and context can sometimes be changed such that people are "nudged" toward decisions that may align more with their values or interests (Thaler and Sunstein 2008). Some of the specific theories informing Chicago's energy benchmarking communications are described below.

**Encouraging ordinance compliance.** One reason that building representatives may not comply with the energy benchmarking ordinance is that they are likely focused on other, competing priorities, and may suffer from time scarcity. Research by Shah, Mullainathan, and Shafir (2012) and Mullainathan and Shafir (2013) suggests that people who face time scarcity often focus on a single task at hand, or "tunnel," at the expense of other tasks. Some representatives may delay completing the requirements not because they intentionally decide to not comply, but because the task is postponed while they handle other concerns.

Second, benchmarking and reporting is a multiple step process. Similar small steps have been found to inhibit pro-social behavior in a number of situations, from administrative burdens that inhibit health care (American Society of Internal Medicine 1990) to the paperwork required to file for federal student financial aid (Ross et al. 2013). The perceived hassle factors of the steps needed to comply with energy benchmarking may have an outsized impact on building response, and simplifying the instructions may improve compliance.

Third, the consequences of non-compliance may not be significant or salient enough to take precedent over other tasks. Research by Kahneman, Knetch, and Thaler (1991), Kahneman (2003) and Kahneman (2013) indicates that loss aversion—the perception that *losses are more painful than equivalent gains*—may lead people to act in way to avoid or minimize losses. In fact, Kahneman's research shows that people weigh losses about twice as much as equivalent valued gains. Making representatives aware of potential negative consequences of non-compliance could improve responses.

[1] Note: Chicago Energy Benchmarking compliance rates were established at the time of analysis; additional buildings complied with the ordinance after these analysis cutoffs.

**Encouraging energy efficient improvements**. Kollmuss and Agyeman (2002) found that people with pro-environmental values may not take pro-environmental actions, known as the value-action gap. Representatives may intend to analyze long-term profitability while reducing costs, yet they may not make energy efficient improvements despite relatively short return-on-investment periods. This suggests that building owners and managers may benefit from a pro-energy efficiency improvement nudge.

In addition, research has demonstrated that providing peer comparisons of energy use can lead to pro-environmental behavior in individual households (Alcott 2009; Ayres, Raseman, and Shih 2009; Dolan and Metcalf 2013). Also, providing information that shows a person is behaving outside of a social norm is a powerful tool to encourage more pro-social behavior (Sunstein 1995; Cialdini 2001). OPower, a US based company, has partnered with utilities to redesign utility bills and consumer-facing statements with social norms to drive an average energy reduction of about two percent, or over $700 million in savings (OPower 2015).

OPower, similar firms such as EnerNOC, and other researchers have begun to investigate how social norms can reduce energy use in commercial buildings. Some of the initial research is focused on small and medium businesses (Cornish 2015; Stewart 2015). However, while a single homeowner or small business owner may easily make adjustments to achieve large energy reductions, the decisions needed for large multi-family residential, commercial and institutional buildings may be more nuanced. Little research has been focused on using social norms and other approaches to encourage representatives of large buildings to make energy efficient *investments and improvements.*[2]

## Research Approach and Results

The project team is conducting research to better understand how stakeholders in large buildings approach energy benchmarking compliance, as well as how stakeholders use benchmarking results to drive decisions related to energy management.

An early stage of this research applied insights from behavioral economics in a pre-pilot test to inform the design of compliance notification letters. In a second stage, researchers conducted interviews with the representatives of fourteen properties to gain insights into a preliminary Energy Profile to inform future benchmarking communication strategies. A third research effort used the results from the interviews to design an updated Energy Profile. This research team also developed two versions of an Energy Profiles and will compare the results of two messaging strategies in an A/B test.

### Pre-Pilot Testing of Energy Benchmarking Compliance Notification Letters

**Background.** In 2015, the City mailed two notices to building representatives informing them of the new ordinance and encouraging their compliance by the required deadline. Two days after the deadline, the City mailed a Notice to Correct letter to representatives of buildings that were not in compliance. The team conducted a pre-pilot test of the Notice to Correct letters to determine which of two messaging approaches could improve compliance rates.

[2] The authors are aware of Pacific Gas & Electric's (PG&E) plan to launch a full-scale field experiment using social norms and other nudges to 15,000 mid-sized commercial customers in 2013, but have not found publicly available research based on that experiment. See page 27 of the following report: https://www.pge.com/includes/docs/pdfs/myhome/edusafety/systemworks/electric/smartgridbenefits/AnnualReport2013.pdf

**Hypothesis.** The team hypothesized that a redesigned letter would drive more compliance than existing materials. The redesigned version helps building representatives prioritize taking action now, rather than later; simplifies the perceived barriers to compliance with clear action steps; and makes the potential consequences more salient. Due to a small sample size of 696 buildings, the results were not expected to be statistically significant.

**Method.** In the pre-pilot test, the project team randomly assigned non-compliant building representatives into two different groups. The control condition consisted of 358 buildings, which were sent the baseline version (the same letter that was used in the past.) The baseline version emphasized complex legal language regarding the possibility of enforcement actions.

The treatment condition included 338 buildings. These buildings were sent a letter that emphasized action, urgency, and potential losses. The treatment condition letter deemphasized complex legal jargon, made action steps more salient, and reframed the cost of non-compliance to provoke a sense of loss aversion by emphasizing the avoidance of potential fines.

**Results and discussion**. Building representatives who received the behaviorally-informed treatment letter complied with the ordinance in 41.6% of cases, compared to 38.2% who received the control version. Controlling for building size, use type, and location in a probit regression, building stakeholders were 6.2% more likely to comply relative to the control group ($p<0.125$). As expected, the results were not statistically significant at $p<0.05$. However, the positive results suggest an opportunity for further study.

**Chicago Energy Profiles Overview**

The Chicago Energy Profiles are one-to-two page communications sent by the City to buildings that complied with the Chicago Energy Benchmarking Ordinance that are intended to use buildings' energy performance to drive actions to increase energy efficiency. Chicago's Profiles were informed by previous work in the residential sector, as well as Profiles sent by other cities with energy benchmarking ordinances, including Seattle and Philadelphia. Each Profile compares the building's energy performance to a group of peer buildings and includes specific suggestions to increase energy efficiency and reduce costs.

The Energy Profiles employed three behaviorally-informed nudges to motivate energy reduction in the Energy Profiles.

**Peer comparison**. The first tactic was to provide a comparison of the respective building's energy consumption against similar buildings. The composition of the peer comparison group was critical; simply stating that a given building is less efficient than others would not be relevant unless the recipient felt a sense of affinity with members of comparison group. For example, affinity might be based on similar building size, space uses, or geographic location. The team compared each building's 1-100 ENERGY STAR score to a carefully-defined group of peer facilities.[3]

[3] The ENERGY STAR score was used because it was a familiar metric for many recipients, with the added benefit that ENERGY STAR scores control for variations in weather, space uses, and building operating characteristics. If the ENERGY STAR score was not available, then the energy use per square foot was used as the comparison metric.

**Making benefits more salient.** To make benefits more salient, the Chicago team translated the ENERGY STAR score into estimated energy and cost savings that could be achieved if the building conducted energy efficiency upgrades.

**Suggestions with low barriers-to-action.** The Chicago team provided specific low-barrier action steps that could lead to energy efficient improvements.

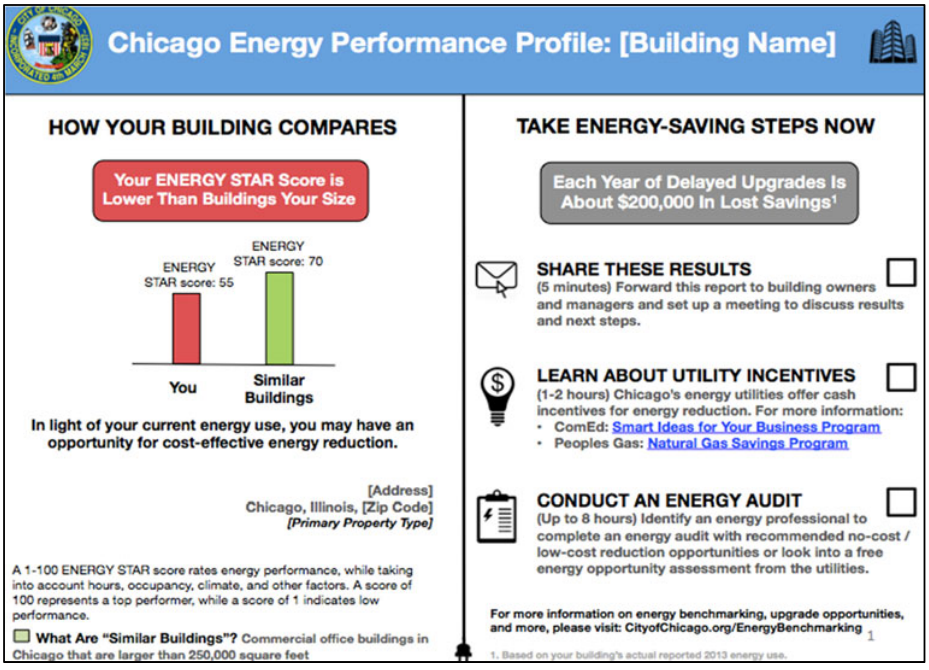
### 2014 Energy Profiles and Associated Market Research

The City of Chicago began by developing 2014 Energy Profiles. The project team sought to improve these initial Profiles, as well as gain a better understanding of attitudes related to energy-related decision-making by interviewing representatives of fourteen commercial and institutional properties. Seventhwave researchers conducted exploratory in-person interviews with staff of the fourteen properties, and sought their feedback on two versions of the 2014 Profiles.

The population targeted for the interviews included a random sample of representatives from office properties of 250,000 square feet ($ft^2$) or greater required to comply with the benchmarking ordinance in 2014. To recruit participants, the project team sent an email invitation, and followed up with phone calls. The recruiting effort achieved a seventy-five percent response rate for scheduling on-site interviews, for which between one and four individuals associated with the facility were present. The properties involved were mostly built after 1970 and ranged in size from approximately 300,000 $ft^2$ to more than 1.5 million $ft^2$, with most buildings' size between 400,000 and 700,000 $ft^2$.

During the interviews, Seventhwave researchers asked building representatives to compare two different versions of the 2014 Energy Profile, both shown in Figure 1. The Primary Version displayed a bar chart comparing the building's energy use to other buildings. The Alternative Version provided a sliding scale of how each building compared to the average of all scores for that building's peer group.

2014 Energy Profile, Primary Version



2014 Energy Profile, Alternative Version

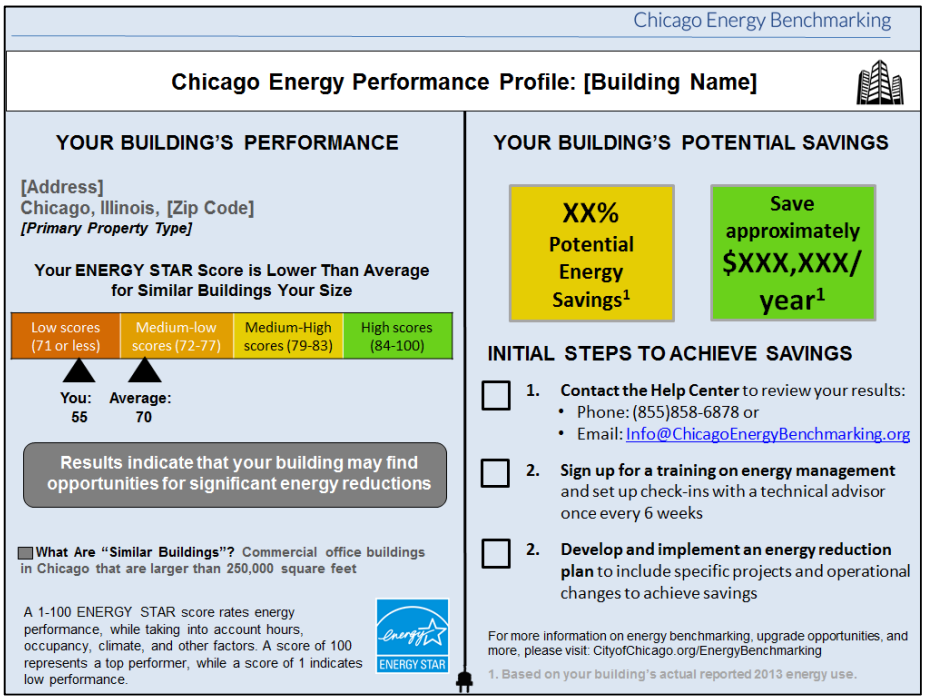



Figure 1: 2014 Energy Profiles: Primary and Alternative Versions. *Source: City of Chicago*

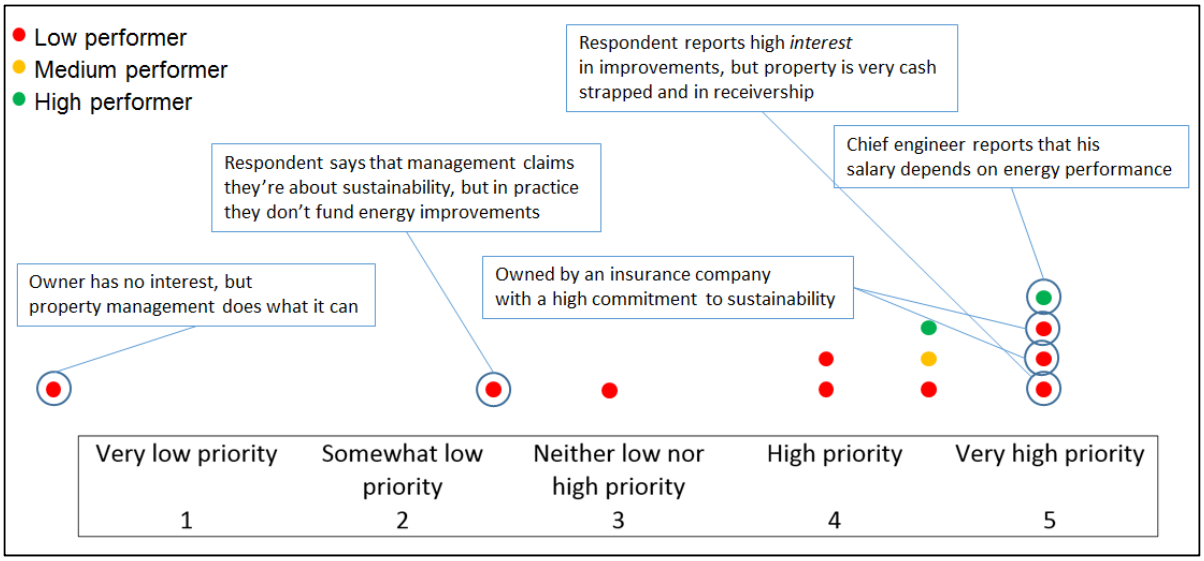
Seventhwave's interviews uncovered a clear preference among the interviewees for the Alternative Version, because it provided the information in a more detailed context, which interview participants viewed as more useful. The Alternative Version also included an estimate of potential energy reductions and cost savings, which interviewees preferred to the Primary Version's description of potential savings as losses.

The interviewees offered a number of helpful suggestions for improving the Profiles going forward, most of which were incorporated into the 2015 Energy Profiles:

- Clarify the basis of the comparisons, and create more specific peer groups for the comparisons
- Include the timeframe covered by the Energy Profile
- Provide information on how much energy reduction would be needed to achieve improved results
- Provide additional metrics beyond the ENERGY STAR score
- Identify opportunities to integrate Profiles with appropriate utility programs

The interviews revealed that the sample population had a generally high level of knowledge about their buildings' energy consumption (see Figure 2), as well as widespread familiarity with certifications such as ENERGY STAR and LEED. There were, however, clear differences in perspectives by interviewees with different roles and job functions. Property managers tended to be more accepting of metrics like the ENERGY STAR score, and they were mainly concerned

with the level of performance necessary to achieve a specific score or certification. Building engineers were more interested in more direct measures of energy consumption like energy use intensity (EUI), and they were more often skeptical of what they perceived as opaque metrics (including the ENERGY STAR score). Engineers also expressed skepticism about square footage and other data provided by peer facilities, and they articulated concerns about false,




"apples-to-oranges" comparisons between properties—even though the purpose of metrics like the ENERGY STAR score is to control for these differences

Figure 2: Summary of property stakeholder attitudes on energy management. *Source: Seventhwave research and analysis*

These findings underscore the need for a variety of clearly-defined metrics (perhaps targeted to specific audiences) and transparent criteria for property peer groupings. The interviews also suggest an opportunity to customize Energy Profile content and suggestions to the specific role of each recipient (for example, to develop separate Profiles for property managers and building operating engineers).

The interviews also indicate that larger facilities tend to have existing relationships with energy service providers or consultants, and most buildings had engaged third party consultants to conduct energy benchmarking. Building staff and consultants were generally quite aware of their ENERGY STAR score, and thus the Energy Profile results were no surprise to them. However, a number of the interviewees stated that the Profiles would be more useful to representatives of smaller properties that may not be as engaged on energy performance. The interviews also suggested that—even among this population of highly-engaged, large properties—the Profiles could provide a useful mechanism for communicating with decision-makers, especially in terms of keeping them informed about current utility programs and other efforts to promote energy efficiency.

## Applying Market Research to the Design of 2015 Energy Profiles

**Background.** Informed by Seventhwave's interviews, the team developed 2015 Energy Profiles for use with buildings that complied with the Chicago Energy Benchmarking ordinance in 2015.

Starting with the 2014 Alternative Version Energy Profile, the team updated the building performance comparison chart, compared each building's energy use to a more specific set of peer buildings, and emphasized potential annual savings associated with incremental energy investments.

In February 2016, individual building Energy Profiles were emailed to representatives of over 1,115 privately-owned buildings in Chicago that had reported under the Chicago Energy Benchmarking Ordinance in 2015.[4] The representatives received one of two versions of the Energy Profile. The development of the peer comparison and potential savings content remained the same between the two versions while the calls-to-action suggesting possible energy improvement activities differed. The first, action-oriented version (Version A) was more focused on encouraging financial and time investments into the building while a second, education-oriented version (Version B) encouraged learning about the building's energy use.

Figure 3 shows the opening portion of the 2015 Energy Profile, which remained the same between the two versions (with some variations according to the property's energy performance). Figure 4 illustrates the calls-to-action in each version of the 2015 Profiles.

[4] Publicly-owned facilities were excluded from this experiment due to other communication and decision-making paths for these buildings.

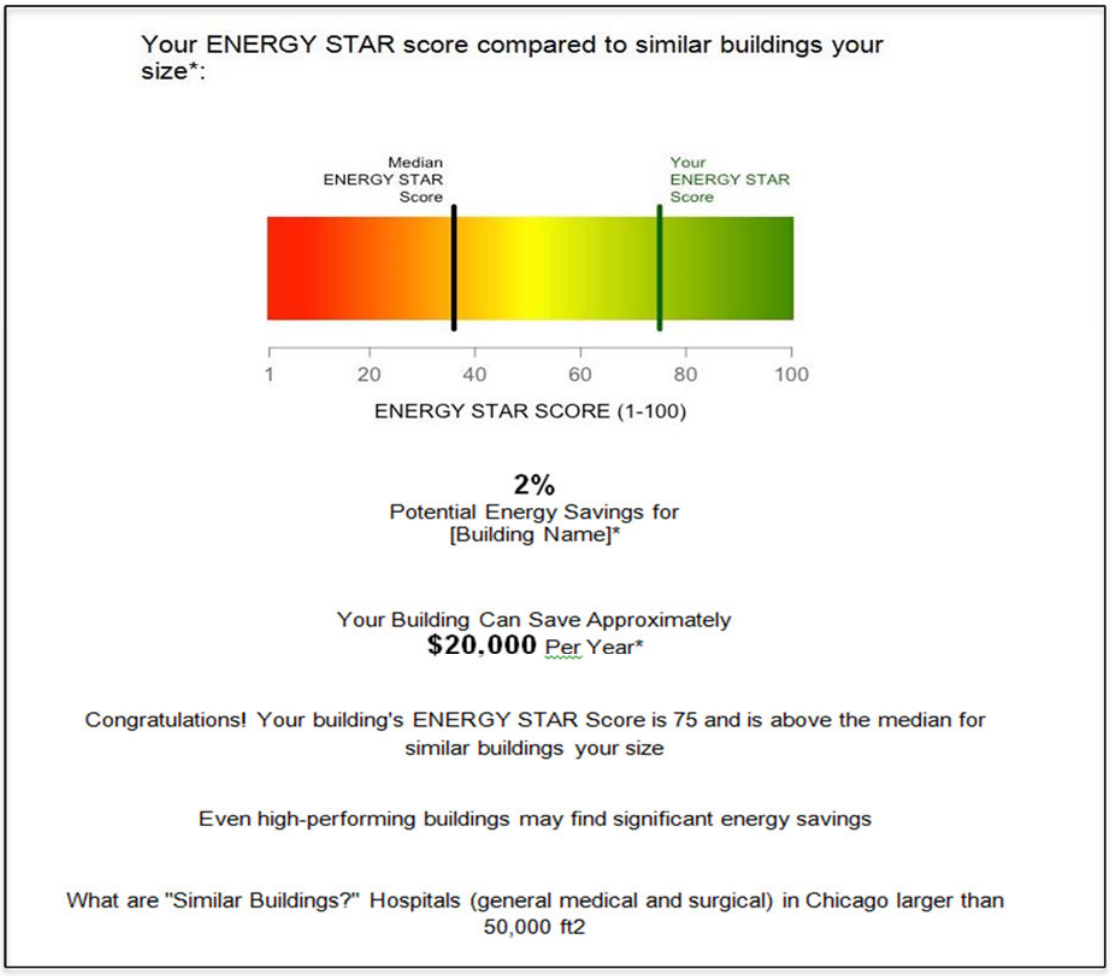



Figure 3: 2015 Energy Profile: Sample Peer Comparison and Savings Estimate, used in both Version A and Version B. *Source: City of Chicago*

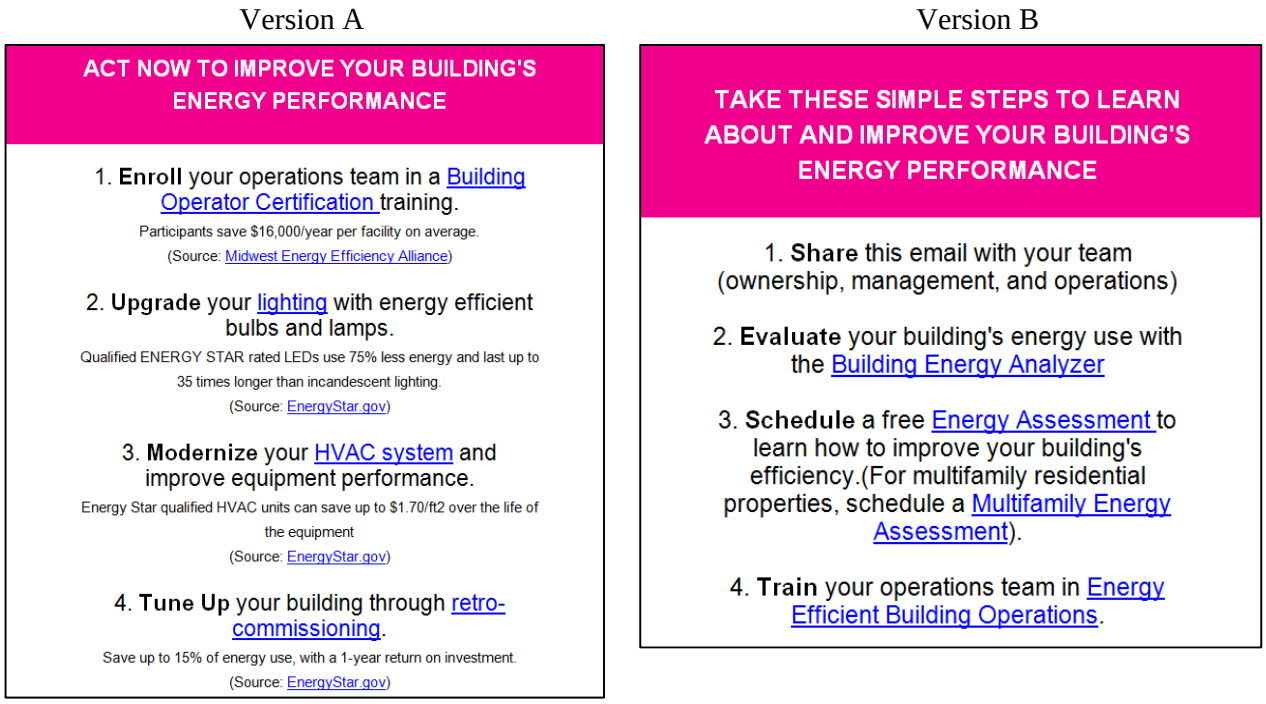



Figure 4: 2015 Energy Profile: Calls-to-action in Version A (left) and Version B (right). *Source: City of Chicago*

**Hypothesis.** We conjecture that action-oriented calls-to-action framed with specific financial benefits (Version A) will encourage more representatives to make pro-environmental changes to their buildings than calls-to-action that encourage learning more about their building's energy use (Version B). We further conjecture that Version A will yield greater reduction in energy use compared to Version B.

**Methods.** The team is conducting an A/B test and used random assignment to determine which version the representatives would receive. Version A, the action-oriented version, was emailed to representatives of 564 buildings. The calls-to-action suggested large financial and time investments. (See Figure 4). Such investments may require applying for utility incentive programs or other hassle factors that may deter people from taking action. To help overcome such hassles, each investment expense is framed with the expected financial benefits. This gain-frame may induce people to take action and better align their intentions with their actions. The subject line for Version A was a simple, direct description of the email content: Chicago Energy Performance Profile for [Building Name].

Version B, the information-oriented version, was emailed to representatives of 551 buildings. The calls-to-action may be much easier to accomplish because do not require large financial investments. Suggested action steps include *learning* about their facilities' energy consumption, *seeking expert advice* on energy savings opportunities, and *training* building staff in energy-efficient operations. The ease with which representatives can learn about their building's energy use and get building-specific efficiency advice may encourage more action. The subject line of the email emphasized the process of learning about energy use: Learn more about [Building Name]'s energy usage.

**Initial Results: Testing of 2015 Energy Profiles**

Emailing the 2015 Energy Profiles provided an opportunity to measure the open rates. The Chicago team hypothesized that Version A's direct subject line would elicit greater recipient interest. Initial results show an open rate of 44.2% for Version A and 31.9% for Version B after fourteen days. Version A had a much higher open rate, with statistical significant results ($p<0.001$).[5]

Full research results are pending. The test was designed to track short-, medium-, and long-term actions and gains in energy efficiency. Table 1 shows the specific measurements that will be used to test the effectiveness of the two 2015 Energy Profile versions.

Table 1: Metrics for A/B Testing of 2015 Energy Profiles

| **Metric** |
|---|
| 1. Email open rate, based primarily on subject line<br>• Version A: Chicago Energy Performance Profile for [Building Name]<br>• Version A: Learn more about [Building Name's] energy use |
| 2. Click-through rates for hyperlinks in each version |
| 3. Participation rates for each suggested activity or program between version A and B |
| 4. Changes in actual building energy efficiency, including ENERGY STAR scores or EUI |

## Conclusions and Recommendations

Energy benchmarking and efficiency programs that focus on large buildings can utilize the results from the market research and the randomized controlled trials discussed in this paper to improve communications while contributing to a growing body of research on behavioral interventions to promote energy efficiency. Specifically, Energy Profiles that use peer comparisons should show performance in the context of a range of performance, and should include details on how comparisons were created. Preliminary results suggest that direct, action-oriented content and subject lines may be more effective in nudging behavior than educational and less direct messaging, though further testing is necessary to isolate specific variables that correspond with stakeholder action and desired energy outcomes.

Future research on this topic could focus on the use of customized messages or suggestions for improvements based on building type. Such studies could expand understanding of the effectiveness of customization based on target recipients' titles or job descriptions.

## Acknowledgements

The City of Chicago partnered with several organizations to develop and implement the benchmarking ordinance; at the time of its passage, more than eighty-five organizations publicly supported the ordinance. A subset of these organizations created the Chicago Energy Benchmarking Working Group to provide extensive outreach and support to complying buildings. Members of this Working Group comprise the team that conducted the research described in this paper, including the City of Chicago, the C40 Cities Climate Leadership Group,

[5] The 95% confidence interval for version A ranges from 40.8% to 47.5% and for version B the range is 28.5% to 38.5%.

ideas42, the Institute for Market Transformation/the City Energy Project, and Seventhwave. Additional support was provided by SocialRaise, which designed the 2015 Energy Profiles. Elevate Energy, which operates the Chicago Energy Benchmarking Help Center, provided technical support for delivery of 2015 Energy Profiles via email and for initial response tracking.

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