

Stay Ahead of the Curve! Responding to Shifting Baselines

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Abstract

Energy efficiency program efforts are paying off – standard practices across sectors are becoming more efficient and improved codes and standards are raising the bar for efficiency. But what does this mean for programs that need to stay ahead of the curve to continue to push the market? One of the primary challenges facing successful energy efficiency programs is changing baselines, which require adjustment of energy efficient measures promoted by programs.

This paper presents a case study of how one utility successfully monitored the baseline conditions for its program and responded to a shift in standard practice. The case study is based on evaluation research conducted from 2006 to 2008 for National Grid's Heating Ventilation and Air Conditioning (HVAC) commercial program, Cool Choice. The evaluation research included customer surveys with Cool Choice participants across three years (2006 to 2008), interviews with HVAC contractors and vendors, and interviews with industry experts.

National Grid adopted the Consortium for Energy Efficiency's Tier 2 efficiency levels for HVAC equipment starting with their 2007 Cool Choice program. This paper provides an overview of the evaluation research conducted for National Grid's Cool Choice program that informed the 2007 program changes and then assessed the effects of those changes. The analysis presented in this paper is based on multiple years of research, including free-ridership research. The free-ridership analysis provided a powerful tool for assessing program design and impacts of changes to that design on participation and future impacts.

The study found that National Grid's 2007 program changes were not premature. The changes in program requirements ensured that Cool Choice will continue to be a major contributing factor moving the HVAC commercial market forward.

Introduction and Background

In 2007, the CEE established higher tier efficiency levels for HVAC equipment, specifically unitary and non-unitary equipment. According to CEE staff, the new 2007 Tier 2 increased efficiency 10–15 percent over the old Tier 2 level. CEE staff reported the change in their Tier levels was in response to changes that will be phased in for federal minimum standards. What used to be CEE's Tier 2 efficiency levels became federal minimum standard for small equipment (less than 65,000 Btuh) in 2008 and will become minimum standard for large equipment (equal to or greater than 65,000 Btuh) in 2010.

In addition to changes in the CEE HVAC Tier standards in 2007, how National Grid delivers HVAC incentives also changed. Prior to 2007, HVAC incentives were delivered through a regional Cool Choice program run by the Northeast Energy Efficiency Partnerships (NEEP). The Cool Choice program promotes high-efficiency unitary commercial air conditioners that meet the efficiency specifications established by the Consortium for Energy Efficiency (CEE). The program targets large commercial and industrial customers that are building new facilities, replacing failed or failing

equipment, or completing major renovations. The benefits are provided in the form of a rebate to customers.

Starting in 2007, Cool Choice was de-regionalized and there are now state-specific HVAC programs. For National Grid, these consist of different state programs in New Hampshire, Massachusetts, and Rhode Island.

The Massachusetts and Rhode Island programs phased in higher efficiency levels for incentive eligibility based on the 2007 CEE Tier 2 standards. The New Hampshire utilities were not in agreement to move forward with higher efficiency levels. An overview of incentives provided for equipment for the 2007 Massachusetts and Rhode Islands programs are shown in Table 1.

Table 1. Changes to Equipment Tier Levels

Size	Old Tier 2	2007 Tier 2
<5.4 ton	13.0 SEER	14.0 SEER
5.4 ton to <11.25 ton	11.0 EER	11.5 EER
11.25 ton to <20 ton	10.8 EER	11.5 EER
20 ton to 30 ton	10.0 EER	10.0 EER

Table 2 illustrates the increased incentive offerings. The equipment program incentive levels increased from 2006 to 2007 to compensate for the higher incremental cost of the more efficient equipment.

Table 2. Equipment Program Incentive Levels

HVAC Equipment	2006 Incentive	2007 Incentive
<5.4 ton	\$92/ton	\$125/ton
5.4 ton to <11.25 ton	\$73/ton	\$80/ton
11.25 ton to 30 ton	\$79/ton	\$80/ton

The Picture from Prior Years' Research

PA Consulting Group (PA) has been conducting National Grid's commercial and industrial free-ridership and spillover studies since 1996. In 2003, PA developed a standardized methodology to estimate the free-ridership and spillover rates for all of the Massachusetts utilities' commercial and industrial programs. The methodology consists of a sequential question technique to identify free riders. PA developed this methodology for a collaborative of investor-owned utilities in Massachusetts and implements free ridership and spillover studies for utilities in several New England states that report results to the regulators. The full report describing PA's methodology is featured on the Consortium for Energy Efficiency's web site (http://www.cee1.org/eval/db_pdf/297.pdf).

This sequential approach asks program participants about the actions they would have taken if the program had not been offered. This approach is considered an accurate method of estimating the actual level of free-ridership among program participants because it addresses the program's impact upon project timing, measure quantity, and efficiency levels while explicitly recognizing that the cost of energy-efficient equipment can be a barrier to installation in the absence of utility-sponsored energy efficiency programs. This method is also recommended because it walks survey respondents through their decision process with the objective of helping them recall the program's impact upon all aspects of

project decision-making.

It is also important to measure the *extent* of free-ridership for each customer. Pure free riders (100%) would have installed exactly the same quantity and type of equipment within one year in the absence of the program. Partial free riders (1–99%) are those customers, who would have installed some equipment within one year on their own, but a smaller quantity and/or a lesser efficiency. Thus, the Program had some impact on their decision. Non-free riders (0%) are those who would not have installed any high efficiency qualifying equipment within one year in the absence of the program services. The total free-ridership estimates that we will measure using the survey approach include pure, partial, and non-free riders.

Survey free-ridership questions are followed by questions designed to measure "like" spillover. *Spillover* refers to additional energy-efficient equipment installed by a customer due to program influences but without any financial or technical assistance from the Program. *Participant "like" spillover* refers to the situation where a customer installed equipment through the program in the past year and then installed additional equipment of the same type due to program influences. In contrast to free-ridership, spillover adds benefits to the program at no additional cost, increasing the program benefits and benefit-cost ratio.

One of the issues with attempting to quantify spillover savings is how to value the savings of measures installed outside the Program or **non-participant spillover**. In the methodology presented in the report, there are consistency questions that are asked of all design professionals and vendors that address non-participant spillover or market effects from the program.

Where possible, study samples are surveyed at the measure level to provide net point estimates at the measure levels. Using the standardized approach, it is possible to review the free-ridership and spillover trends across years for programs. Additionally, calculating estimates at a measure category level allows program managers to review those trends at the measure category level.

A trend analysis revealed that free-ridership rates in the HVAC measures were steadily increasing over the years. Based on this observation, National Grid asked PA to look closer into the increasing trends, specifically focusing on national accounts (chains and franchises). National accounts were both a growing percent of National Grid's commercial population and program participants.

In 2006 and 2007, National Grid hired PA Consulting Group (PA) to conduct a national accounts study for their Cool Choice programs (PA Consulting 2006 and 2007b) (referred to as the 2006 and 2007 national accounts studies, respectively). The 2006 national accounts study investigated standard practice for HVAC purchasing, the influence utility or other public programs have on standard practice, and decision-making process for purchasing energy efficient equipment. The 2006 national accounts study found that national accounts had a higher HVAC free-ridership rate than other participants, and tended to purchase higher efficiency equipment as standard practice (SEER 13 and EER of 11.0).

The 2007 national accounts study built on the findings from the 2006 study and conducted further investigation to identify the efficiency levels of HVAC equipment that national accounts were purchasing in the absence of utility rebates. This study took place just after the CEE established their higher Tier efficiency levels and National Grid revised the efficiency level program requirements and incentives. The study addressed a variety of researchable questions, including the impact the new requirements would have on program enrollment and if it was feasible for National Grid programs to require minimum efficiency levels that exceed the proposed 2007 CEE Tier 2 standards for national accounts.

The 2007 national accounts study could not conclude with certainty the effects of the 2007 Cool Choice program changes since the changes were just beginning. It was hypothesized that the Cool Choice program changes would decrease free-ridership, but at the same time it could also decrease the number of HVAC efficiency projects implemented in 2007. However, the study was not able to capture

any data that could, with certainty, prove or disprove these hypotheses.

2008 Study Objectives and Methods

The 2008 research continued to investigate the impact of the 2007 program changes on program participation and impacts. Specifically, this research addressed the following key questions:

- 1) How did the 2007 program changes affect the number of HVAC projects implemented?
- 2) What is the composition (type of businesses, management structure, etc.) of national account participation? How does this composition affect the free-ridership rate?
- 3) What was the effect of the program changes on free-ridership and spillover rates?

A variety of data sources informed the analysis, including: a) the 2006 free-ridership and spillover study, which represented 171 HVAC measures provided through Cool Choice; b) the 2006 national account study, which included in-depth interviews of 11 national account representatives; and c) the 2007 national account study, which provided in-depth data and free-ridership results from interviews with an additional six out of 12 national accounts represented in the program database. These six national accounts were not included in the 2007 study.

The 2008 national accounts study built upon the former studies to assess the 2007 program changes by conducting surveys in 2008 with 2007 program participants. PA spoke with national and non-national accounts that represented 91 HVAC measures provided through the Cool Choice program.

To address the key researchable questions, PA compared free-ridership and spillover data analysis for the Cool Choice programs participants in 2005, 2006, and 2007 for National Grid HVAC projects.

Key Findings

This section details the key findings from the 2008 national account study. Where appropriate, results from the 2006 and 2007 studies are also incorporated.

The new 2007 Cool Choice incentive structure successfully adjusted to the shifting baseline of energy efficient HVAC equipment and is now pushing the market. In the 2007 national accounts study, HVAC industry experts and HVAC suppliers were unanimous that the new 2007 Cool Choice incentive levels will already be pushing the market, including national accounts for the near term. While at least half of national accounts may have had standard practices that met the 2006 program standards, their standard practice was less than the 2007 program standards based on the study's findings.

The 2008 national accounts study supported the above conclusion of the 2007 national accounts study. A comparison of the 2007 free-ridership and spillover survey results compared to the 2005 and 2006 program free-ridership and spillover survey results indicated that the 2007 Cool Choice program changes have successfully addressed the shifting baseline for commercial HVAC equipment. In 2006, the baseline or standard practice for many national accounts had become the energy efficient equipment the program was providing incentives for. In 2007, the study results indicated that the new Tier 2 standards were ensuring that the program was providing incentives for HVAC equipment beyond the baseline for all commercial customers including national accounts. Supporting evidence surrounding the free-ridership rate analysis is provided in the discussion of the following key findings.

The HVAC free-ridership rates decreased significantly in 2007. National accounts' 2007

HVAC free-ridership rates are now more in line with other customers' and significantly lower for unitary HVAC. First and foremost, a comparison of free-ridership rates from the 2005 and 2007 program year free-ridership results tell a consistent and clear story. Free-ridership decreased significantly as a result of the 2007 Cool Choice program changes.

Figure 1 illustrates this reduction in HVAC unitary and non-unitary free-ridership rates using the results of National Grid's 2002, 2005, and 2007 commercial and industrial free-ridership and spillover results, focusing on the HVAC measures installed through the Design2000*plus* program (the program umbrella under which Cool Choice is offered). The 2002 free-ridership data are captured in the figure to illustrate the steady increase in rates from prior years, although it was not a year reviewed in the national account studies.

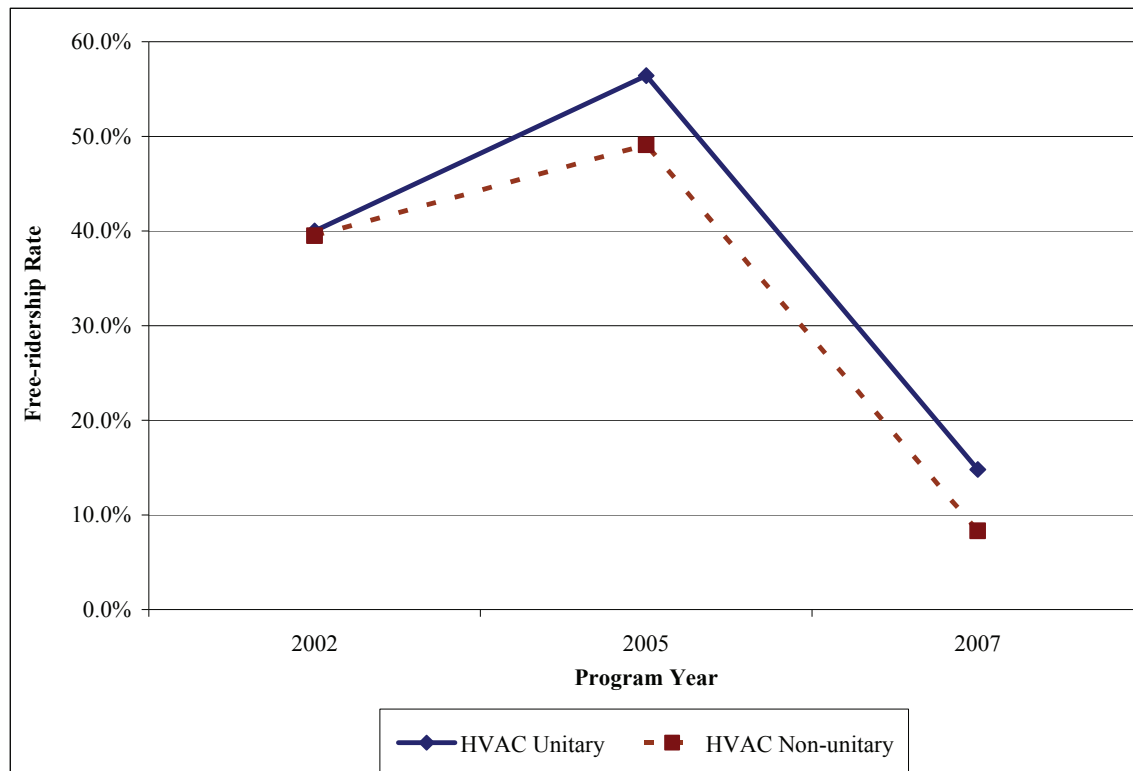


Figure 1. Comparison of 2007 and 2005 Combined Free-ridership and Spillover Rates¹

National accounts were a large driver of the previously high HVAC free-ridership rates as found in the 2006 and 2007 national accounts studies. The 2006 and 2007 national accounts studies found that Cool Choice free-ridership rates were higher for national accounts than other commercial customers. While the national accounts' free-ridership rate decreased from 2005 to 2006 (79 percent in 2005 to 47 percent in 2006), it was found that the main driver in the difference is what types of national accounts participated in 2006 and 2005 as well as their overall kWh energy savings. Therefore, national accounts'

¹ Source PA Consulting Group, *National Accounts Study: Customer Energy Efficiency Equipment Decision Making Process and Standard Practice*, September 2006

PA Consulting Group, *National Grid 2006 Commercial and Industrial Programs Free-ridership and Spillover Study*, June 23, 2007

PA Consulting Group, *National Grid 2007 Commercial and Industrial Programs Free-ridership and Spillover*, October 28, 2008

free-ridership rates were expected to continue to be higher than other commercial customers under the 2006 program requirements. But for the 2007 program year, national accounts' free-ridership rates were consistent with other commercial customers' rates (Table 3).

For unitary HVAC, national accounts' 2007 weighted free-ridership rate was significantly lower than other commercial customers (22 percent for other commercial customers compared to 5 percent for national accounts). Furthermore, national accounts saw the largest decrease in free-ridership (from 80 percent to 5 percent from 2005 to 2007 for unitary HVAC and from 76 percent to 13 percent from 2005 to 2007 for non-unitary HVAC).

Table 3. 2005 and 2007 Free-ridership and Spillover Estimates for All Other Commercial Customers and National Accounts

Measure	kWh Weighted Free-ridership	kWh Weighted Spillover
Non-national accounts 2005 Participants HVAC Unitary (N=68)	39%	6%
Non-National Accounts 2007 Participants HVAC Unitary (N=45)	22%	10%
2005 National Accounts HVAC Unitary (N=33)	80%*	7%
2007 National Accounts HVAC Unitary (N=10)	5%	0%
All Other 2005 Participants HVAC Non-Unitary (N=49)	37%	0%
All Other 2007 Participants HVAC Non-Unitary (N=32)	8%	16%
2005 National Accounts HVAC Non-Unitary (N=21)	76%*	0%
2007 National Accounts HVAC Non-Unitary (N=4)	13%	0%

Source: 2005 and 2007 Free-ridership and Spillover Survey (PA Consulting 2006 and 2008).

The number of projects decreased, but the net savings remained unchanged or increased.

The 2007 national accounts study results also concluded that there would be a decrease in participating HVAC projects in 2007 as a result of the 2007 Cool Choice changes. A comparison of the 2005 free-ridership survey sample information and 2007 free-ridership survey sample information shows that the number of HVAC projects did decrease significantly from 2005 to 2007—a 36 percent decrease for unitary participants and a 38 percent decrease for non-unitary participants. This decrease in projects was expected, as reported in the 2007 national accounts study (Table 4).

Table 4. 2005 to 2007 Cool Choice Project Comparison²

	Population of Accounts	Population kWh – Gross
<i>Unitary HVAC</i>		
Program Year 2005 HVAC Unitary	194	2,037,081
Program Year 2007 HVAC Unitary	124	1,084,154
Percent change from 2005 to 2007	36% decrease	46% decrease
<i>Non-unitary HVAC</i>		
Program Year 2005 Non-Unitary	111	1,047,818
Program Year 2007 HVAC Non-Unitary	69	1,446,774
Percent change from 2005 to 2007	38% decrease	38% increase
<i>Total HVAC</i>		
Program Year 2005 all HVAC		3,084,889
Program Year 2007 all HVAC		2,530,928
Percent change from 2005 to 2007		18% decrease

The decrease is likely a result of both the increased HVAC requirements for equipment receiving incentives and the de-regionalization of the Cool Choice program.³ The slowing economy could also have been a contributing external factor.

While this decrease in projects did occur, the large decrease in free-ridership rates, the relatively stable spillover, and increased savings per project for the 2007 Cool Choice program resulted in virtually unchanged net savings for unitary HVAC and an increase in net savings for non-unitary HVAC (Table 5). PA used National Grid’s 2005 and 2007 free-ridership and “like” spillover rates (PA Consulting 2007b) to estimate net-to-gross adjustment factors. The net-to-gross adjustment factors ((1- the free-ridership rate) + the spillover rate) provide the best estimate of net kWh savings that are attributable to the Cool Choice program efforts.

The comparison of 2005 and 2007 Cool Choice projects provides further evidence of the success of the 2007 program changes. Net kWh savings for unitary HVAC barely decreased (3.5 percent decrease from 2005 to 2007) even though the gross savings decreased significantly (46 percent decrease). Furthermore, while non-unitary gross savings increased by 38 percent, the net savings nearly doubled from 2005 to 2007 (188 percent increase). Overall (combining unitary and non-unitary HVAC), there was an increase in net HVAC savings for the 2007 program year with its increased efficiency requirements.

² Source: 2005 and 2007 free-ridership population data, provided by National Grid. Accounts are not summed for total HVAC as one account may have received both measures; therefore a sum of accounts would over-represent the population.

³ It was reported in the 2006 national accounts study that the de-regionalization of the Cool Choice program resulted in a ‘break’ in marketing efforts as the program moved from regional to different state programs. In addition, customer confusion may have resulted from the change in the program application process.

Table 5. 2005 and 2007 Net Savings Comparison⁴

	Population Measure kWh – Gross	Free-ridership rate	Spillover rate	Estimated Net-to-Gross Adjustment Factor	Population Measure kWh – Net
Program Year 2005 HVAC Unitary	2,037,081	56.4%	6.6%	.50	1,022,615
Program Year 2007 HVAC Unitary	1,084,154	14.8%	5.9%	.91	986,580
Percent change from 2005 to 2007	46% decrease				3.5% decrease
Program Year 2005 Non-unitary	1,047,818	49.1%	0.2%	.51	534,387
Program Year 2007 HVAC Non-Unitary	1,446,774	8.3%	15.2%	1.07	1,543,708
Percent change from 2005 to 2007	38% increase				188% increase

Conclusions

The most important overarching conclusion from the study is the usefulness of program attribution factors in order to make sure that programs are responding to shifting baselines. There is significant debate about the effectiveness of various net-to-gross approaches and how those approaches are applied to estimate program-induced savings. This study shows the importance of self-reported attribution factors such as free-ridership and spillover for tracking program effectiveness on a consistent basis over time. National Grid’s consistent and longitudinal attribution factor data collection directly assisted program planning and design in light of emerging changes in the nature of the HVAC market

Looking forward, the Cool Choice program will likely continue to yield an increase in net savings resulting from the 2007 program changes. The results of three years of evaluation research suggest that the 2007 program changes will increase energy savings attributable to the Cool Choice programs in the near future. The 2007 program already showed an increase in net savings even though the number of projects decreased. Furthermore, it is likely the number of projects will increase as the program overcomes reported administrative difficulties associated with the de-regionalization of the program found in the 2007 national accounts study (e.g., a break in the marketing of the program, customer confusion regarding the application process). However, growth in the near-term may be limited by the economic conditions and commercial customers reporting no capital budgets in 2009.

The national accounts studies also noted a number of market changes that will make the higher efficient HVAC equipment more available and affordable in the future. Market changes include the upcoming changes in federal minimum standards, and demand side changes including the growing use of Energy Management Systems (EMS) and a whole building approach, an overall increase in commitment to energy efficiency by national accounts and other commercial customers. On the supply side, manufacturers reported a changed in business practices resulting from the increased efficiency demand of companies such as Wal-Mart.

⁴ Source: National Grid 2005 and 2007 Free-ridership and Spillover Survey

References

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