

Quantifying Free-Ridership in Four Different Customer Segments

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This paper examines free-ridership rates in four different DSM customer segments. A widely used approach, participants' self-reports of free-ridership, is applied. The paper discusses the limitations of this approach and how the estimates thus obtained can be strengthened. The four programs studied are 1) a direct installation program of energy-efficient lighting measures for small commercial/industrial customers; 2) an incentive program for various energy-saving measures for all commercial/industrial customers; 3) a direct installation program offering air sealing and insulation measures for residential electric space heating customers; and 4) a mail order/rebate program offering fluorescent lights at below-retail prices to all residential customers.

Free-ridership was estimated on a measure-by-measure basis for three of these programs. Depending on the customer segment involved, a matrix was developed reporting the timing, quantity and efficiency level of any purchases the customers intended to make in absence of the program. Free-riders could thus be defined along a continuum from zero (never intended to do anything) to 100% (intended to purchase the same amount and level of efficiency right away).

As a supporting measure of free-ridership, direct installation customers were informed of how much was spent in materials and labor for the various measures they received. It was generally found that homeowners and small businesses who had intended to make some improvements without the programs would have only spent a fraction of the cost of the measures installed.

Introduction

Offering utility incentive programs to influence customer energy efficiency actions continues to be a primary method of implementing demand-side management (DSM). An important consideration in the evaluation of these programs is the estimation of free riders in the program. (Free riders are defined as those customers who participate in a utility program, but would have taken the same energy action in the absence of the program.)

The estimation of free riders, in conjunction with other estimates such as free drivers or spillover, snapback, and persistence, are important to utilities in estimating energy savings and other program benefits attributable to the program. While the value of subsidies to free riders is considered a benefit from the participant perspective, this same value is a cost from the utility and nonparticipant perspective.¹ However, the measurement of free riders remains a complex issue because there is no clear-cut way to determine what an individual will do in the absence of a program.

This paper explores one widely used measurement approach, participants' self-reports of free-ridership. The free riders examined in this paper participated in four

DSM programs targeted at different customer segments. These four programs were offered by the New England Electric System (NEES) Companies (Massachusetts Electric, Narragansett Electric and Granite State Electric). The four programs are 1) a direct installation program of energy-efficient lighting measures for small commercial/industrial customers; 2) an incentive program for various energy-saving measures for all commercial/industrial customers; 3) a direct installation program offering air sealing and insulation measures for residential electric space heating customers; and 4) a mail order/rebate program offering fluorescent lights at below-retail prices to all residential customers.

This paper first discusses the limitations of using self-reports of free riders, and ways to strengthen these estimates. This is followed by a discussion of the different self-report approaches used to estimate free rider levels in each of the four programs.

The most common approach used to assess the extent of free-ridership is to ask program participants whether they would have made the same purchase in the absence of the program. This approach has several limitations.

First, participants may not be able to accurately judge their likely choices in the absence of the program. This is particularly a problem where the program has influenced the range of efficiency levels available to customers. Customers may not realize that without the program a different range of efficiency options may have been available to them.

Second, participant self-reports are subject to response bias. For example, some customers may be reluctant to admit that they would have done something different if the program had not been offered, while other customers may tell evaluators what they think the evaluator wants to hear.

A third limitation of self-reports is customer recall. Customers simply may not accurately recall the dynamics of the purchase decision. This is especially problematic when surveys are conducted some time after the purchase decision.

A fourth limitation of self-reported free-ridership has to do with survey question wording. Many questions are either too simplistic and/or are too vague to measure the several dimensions of free-ridership. Previous research has identified three main types of program participants:

- 1) A pure free rider is defined as someone who would have taken the same energy action at the same time in the absence of the program.
- 2) On the other hand, a non-free rider is a participant who would not have taken the energy action at that time or in the near future in the absence of the program.
- 3) In between these two extremes are incremental free riders who were partially influenced by the program, either in terms of the timing of their purchase, the quantity of equipment purchased and/or the efficiency level of equipment purchased.

There are several other possible limitations of self-reports. Measuring free-ridership in programs that have several components is often difficult because participants may not realize the combined effects of the different components. For example, in programs where the installation of efficiency measures are preceded by an audit or other type of information, a participant who reports being a free rider may not actually have been a free rider if the audit or prior information had not been provided first. In addition, in programs offering different efficiency measures, it is likely that the measures will have different levels of free-ridership, depending upon the technology.

Programs involving minimal effort on the part of participants, such as direct-installation programs, also pose a problem when measuring participant self-reports. These programs often target smaller customers, for whom energy constitutes a relatively small percentage of their expenses. In addition, someone other than the customer often takes the initiative to get customers to participate in these types of programs, leaving the customer less involved in the decision-making process. In both cases, participants in direct-installation programs may not have sufficient knowledge about energy use and conservation, the measures installed, or the expenses incurred by the utility to provide an informed judgment of whether they would have installed the measure in the absence of a program.

Several techniques can be used to strengthen participant self-reports. Using several unambiguously worded questions will help the researcher gain a more complete understanding of participants' behavior and will also measure how participants fall along the "free rider continuum." If different types of measures are installed through the program, the researcher should ask these questions about each type of measure, since it is likely that free-ridership will vary among measures.

For customers with little knowledge of the costs of the efficiency measures installed, the researcher should give customers enough information to make an informed judgement of whether they might have taken the energy action in the absence of the program.

In summary, self-reported free-ridership measurement approaches have serious limitations. However, self-reports can be useful in helping define the magnitude of the problem by asking clearly worded questions in more than one way, and by asking screening questions regarding awareness and other factors that might influence the decision. These estimates can be further strengthened by using other methods of measuring free-ridership, such as a comparison group, analysis of market data, and/or discrete-choice modeling. While these other methods also have limitations, they can be used to converge on the truth.

Small Commercial/Industrial Program

The Small C/I Program began system-wide operation in the summer of 1990. It is open to all nonresidential customers with peak demands of less than 50 Kw. Participants, who usually are recruited through telemarketing or learn of the Program through word-of-mouth, receive an audit of their lighting system followed

by installation of all eligible measures appropriate for the facility. The measures installed include fluorescent lamps with energy-efficient ballasts, fluorescent lamps alone, compact fluorescent fixtures and screw-in lamps, high-intensity discharge fixtures, specular reflectors and occupancy sensors. The Program is offered free of charge to the participants.

The structure of the Small C/I Program presents several challenges in the identification of free riders. This is a direct installation program offering high-grade equipment to participants who often have relatively little knowledge or interest in electricity conservation. Some are 'Mom and Pop' shops who report that electric bills are a small fraction of their operating costs. Although program administrators believe free-ridership is close to zero, they are wary of the ability of customer surveys to accurately estimate this percentage.

As part of the program's process evaluation, a telephone survey was administered to 427 participants, representing a response rate of 60 percent of the sample. The participant sample was chosen at random after stratifying the population of 2643 customers into seven business types and three sizes. A considerable portion of the survey was devoted to free-ridership items.

For each measure category installed, participants were asked whether they planned to install the same measure themselves. If so, they were asked whether they would have (1) installed it immediately or in one to two years, (2) changed out the same amount of lighting or less, and (3) purchased the same efficiency level as the equipment installed. As Table 1 shows, this results in different degrees of free-ridership. As expected, the percentages of 'pure free riders' (those who would have replaced the same amount of lighting with the same high efficiency equipment immediately) and 'incremental free riders' (those who would have done less on at least one count) are quite close and generally low for this program.

One concern about self-reported free-ridership in a program such as the Small C/I is that participants do not know enough about the measures installed or expenses incurred by the utility to provide an informed judgment of whether they would have done the work themselves. (Customers generally only had to sign on the dotted line; a contractor took care of any paperwork and installation.) As a supporting measure of free-ridership, the survey informed respondents of the dollar amount spent on their facilities and then asked if they would spend the same amount to have the measures installed on their own. This is not a measure of 'pure free riders' who would have installed the equipment on their own without the

experience provided to the survey respondents by the program. Indeed, we would expect this after-the-fact free-ridership estimate to be slightly higher than the estimate obtained above.

The self-expenditure question does, in fact, provide a good check of the free-ridership rates. Only 21% of the customers surveyed would be willing to pay the total project cost on their own, even after their experience with the measures installed. Another 21% would be willing to pay some unspecified portion of the cost.

Energy Initiative Program

The Energy Initiative Program began system-wide operation in the summer of 1989. It is the largest of all Conservation & Load Management programs in the System, accounting for over one-half of the 1991 budget. It is also the most heterogenous program, both in terms of the measures covered and the kinds of customers served. Energy Initiative offered incentives for lighting conversions, energy-efficient motors and variable-speed drives, HVAC systems, building shell measures, and custom measures tailored to individual customers' needs. All nonresidential customers were eligible for Energy Initiative, but smaller customers were more likely to participate in the Small C/I Program.

Most Energy Initiative customers applied for the program after contact from a trade ally; hundreds of electricians and other contractors aggressively marketed the program to large customers. Often, the customer had little involvement other than signing off on the contractor's recommendations. In fact, 75% of all incentives were paid directly to trade allies.

As part of the program's process evaluation, a telephone survey was administered to 507 participants, representing a response rate of 70 percent of the sample. The participant sample was chosen at random after stratifying the population of 10,597 customers into thirteen categories based on the measures installed. Again, a good portion of the survey was devoted to free-ridership items.

The program's convenience for the customer and the fact that the incentives paid almost all of the cost of the measures installed argued for a low level of free-ridership. The survey approach was similar to that of the Small C/I, probing on the timing, amount, efficiency level, and expenditure for any measures that customers believed they would have installed without the program. Estimates of 'pure free riders' and 'incremental free riders', as shown in Table 2, were thus developed. Unlike

Table 1. Self-Reported Free-Ridership for the Small C/I Program

<u>Measure</u>	<u>Pure Free Riders (percent)</u>	<u>Incremental Free Riders (percent)</u>	<u>Number of Respondents</u>
Fluorescent lamps with energy-efficient magnetic ballasts	6.9	5.7	271
Fluorescent lamps with highest efficiency electronic ballasts	7.9	6.8	354
Fluorescent lamps with standard ballasts ^(a)	14.7	2.0	16
Fluorescent lamps only (3 & 4 foot)	10.5	1.4	124
Fluorescent lamps only (8 foot)	11.1	4.3	76
Compact fluorescents (hard wired)	14.2	2.5	193
Compact fluorescents (screw-in)	11.9	3.2	104
HID lamps (interior)	8.3	4.6	8
HID lamps (exterior)	11.2	2.6	110
Reduced wattage incandescents	12.3	3.3	231
Specular reflectors	1.9	4.1	158
Occupancy sensors	18.8	0.0	38

(a) Installed only where no other measure is possible.

the Small C/I Program, Energy Initiative had a substantial percentage of 'incremental free riders'.

Customers were then informed of the amount of the incentive for each type of measure installed, which was usually paid to the trade ally, and asked, "If Energy Initiative had not been offered in 1990/91, would your company have spent this amount of money, in addition to any costs you already paid, to install this [measure] at that same time?" As the third column in Table 2 shows, the percentage of respondents answering 'yes' is quite close to the percentage of 'pure free riders'. (Note that the question is worded to ask what the respondent would have done before having any experience with the measure--unlike the other three cases discussed in this paper). This increases confidence in the level of 'pure free riders' estimated for this program.

Residential Electric Space Heating Program

The Residential Electric Space Heating Program began system-wide operation in the fall of 1990. It is open to all residential electric space heating customers in existing one- to four-family buildings who use at least 6000 kWh for heating and cooling annually. These customers first receive a technical assessment (TA) which includes direct installation of appropriate measures such as compact fluorescent light bulbs, hot water conservation measures such as tank wraps and energy-efficient showerheads, and caulking and weatherstripping. If the TA shows they are warranted, additional measures such as attic insulation, basement/sidewall insulation, setback thermostats, storm windows and hardwired lighting fixtures are installed at a later date. Participation is free of charge to the customer.

As part of the program's process evaluation, a telephone survey was administered to 352 participants, representing

Table 2. Self-Reported Free-Ridership for Energy Initiative

<u>Measure</u>	<u>Pure Free Riders (percent)</u>	<u>Incremental Free Riders (percent)</u>	<u>Free Riders After Cost Prompt</u>	<u>Number of Respondents</u>
Fluorescent lamps with energy-efficient magnetic ballasts	12	19	10	80
Fluorescent lamps with highest efficiency electronic ballasts	3	31	3	249
Fluorescent lamps with standard ballasts ^(a)	7	56	37	36
Compact fluorescent systems (hard-wired)	4	28	6	76
Compact fluorescent systems (screw-in)	8	39	22	48
HID lamps (interior)	20	11	12	48
HID lamps (exterior)	10	32	15	55
Lighting controls	3	8	6	57
Other lighting	8	28	7	164
Variable speed drives	13	33	13	30
Motors	15	34	22	57
HVAC	14	35	23	51
Building shell and other custom non-lighting	4	23	16	54

(a) Installed only where no other measure is possible.

a response rate of 56 percent of the population of 625 customers.

This program has several features in common with the Small C/I Program that are relevant to the assessment of free-ridership. Both are direct installation programs serving customers with relatively little knowledge of energy conservation. Again, free-ridership was estimated on a measure-by-measure basis. Customers were also asked, in a separate part of the survey, what would have prevented them from installing, on their own, the measures offered by the program. Finally, customers were informed how much was spent on their home for both the TA measures and the measures installed at a later date and asked to estimate how much they would have spent themselves in the absence of the program.

The first estimate of free-ridership, the percentage of customers who claimed that they would have installed the same measure at the same time themselves, is shown on

the first column of Table 3 for four measure categories. (The remaining categories did not have enough respondents to yield meaningful results).

The responses of the estimated free riders were then cross-tabulated with their responses to the question, "What, if anything, would have prevented you from installing these energy conservation measures on your own?" The second column of Table 3 shows the percentage of free-ridership remaining after eliminating the customers who gave "lack of money" and "did not know measure was needed" as responses to this question.

As a final check on the free-ridership estimates generated, the mean cost of the measures installed was compared to the mean expenditure the participants were willing to make for the work done on their homes. Participants would have spent an average of \$51.73 on the TA measures installed or 22% of the \$236.28 spent on the average home. Fifty-nine percent of the respondents said they

Table 3. Self-Reported Free-Ridership for the Residential Electric Heating Program

<u>Measure</u>	<u>First Estimate (percent)</u>	<u>Revised Estimate (percent)</u>	<u>Number of Respondents</u>
Compact Fluorescents	10	7	310
Hot Water Measures	14	9	276
Attic Insulation	12	5	130
Basement/Sidewall Insulation	12	4	74

would not have spent anything and 11% would have spent the same or more than the actual cost. For the measures installed after the TA, respondents were willing to spend an average of \$160.98 or 17% of the \$964.28 actually spent per home. Sixty-eight percent of the respondents were not willing to spend anything and 5% would have spent the same or more than the actual cost. While these responses do not directly measure free-ridership, they do provide support for the low levels estimated elsewhere by the survey.

Residential Lighting Program

The Residential Lighting Program began system-wide operation in the spring of 1991. Throughout the year, all residential customers received at least one catalog in the mail from which they could purchase compact fluorescent at far below retail prices. Lights which retailed for \$13 to \$25 could be mail-ordered for \$3 to \$7. Customers could also purchase qualifying lights in stores and apply for an equivalent rebate. Participation rates were about two to three percent of all residential customers in the different Companies of the System.

As part of the program's process evaluation, a telephone survey was administered to 292 participants, representing a response rate of 66 percent of the sample. The participant sample was chosen at random after stratifying the population of 21,845 customers by retail company and by whether they had participated through the mail order or retail rebate system.

The Residential Lighting Program posed somewhat different concerns for free-rider estimation than the other three programs discussed. This program required the customer to take the initiative and act upon receiving a mailer. While the lights offered were heavily subsidized and had short payback periods through bill savings, their initial cost was several times higher than the more readily available incandescents. It was thus possible that a sizable

portion of the participants were more conservation/environment-oriented than average and would have located and bought compact fluorescent on their own.

The survey addressed these issues. First, it provided strong evidence that the participants were a self-selected group. Close to 19% of the participants surveyed had purchased a compact fluorescent bulb before receiving the program brochure compared to 4% of a random group of nonparticipants surveyed.

The main free rider question asked participants if they had planned on purchasing any compact fluorescent before they received the program brochure. Respondents who said 'yes' were divided into two groups. Those who had already purchased a compact fluorescent on their own were asked if they would have again paid the full retail price of \$15 to \$20. Twenty-nine percent or 5.5% of the total sample said 'yes'. Respondents who said they had been aware of compact fluorescent before receiving the program materials but had not bought any bulbs before the program were asked if they knew where to buy the bulbs and if they would have paid the full retail price. Thirty-nine percent or 4.4% of the total sample said 'yes' on both counts. The program's free-ridership rate was estimated as the sum of the two group rates at 9.9% (5.5% + 4.4%).

As in the previous evaluations discussed, all participants were asked if they were willing to pay the full retail cost of the compact fluorescent after having had them in their homes through the program. Twenty-five percent were willing to pay \$15 to \$20 for the lights, which is, as we have seen before, a bit higher than the percentage of free riders estimated.²

Conclusions

While this paper deals with four diverse programs addressing different customer segments, several general

conclusions may be drawn from the findings. Direct installation programs tend to have low rates of free-ridership, while programs that require the customer to take significant action have a larger portion of free-riders. However, in most cases, simply asking customers if they would have taken some action in absence of a program will overstate free-ridership. A more accurate, and often lower, estimate will emerge from detailed probing. Investigating awareness and knowledge of conservation measures and willingness to undertake certain expenditures are good places to start.

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Endnotes

1. Dr. R. Weinstein, Dr. R. Scott, and C. Jones, "Free Riders in Energy Conservation Programs: Implications for Cost-Benefit and Impact Evaluation," in Proceedings of the 1987 Conference--Energy Conservation Program Evaluation: Practical Methods, Useful Results, Volume 2, pp. 295-306, August.
2. By contrast, 79.5% were willing to purchase the lights again at the subsidized price offered by the program.

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