

National Grid, NSTAR, Western Massachusetts Electric Company, Unitil, and Cape Light Compact

2010 Commercial and Industrial Electric
Programs Free-ridership and Spillover Study

Final Report

June 23, 2011





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Prepared for: National Grid, NSTAR, Western Massachusetts Electric Company, Unitil, and Cape Light Compact

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1. EXECUTIVE SUMMARY

This report summarizes the findings of the free-ridership and spillover study conducted for the Massachusetts Program Administrators (PAs) for their 2010 Commercial and Industrial (C&I) electric programs. The purpose of this study was to assess program free-ridership and spillover for the programs offered by National Grid, NSTAR, Western Massachusetts Electric Company, Unitil, and Cape Light Compact. These programs include new construction programs, large to medium C&I retrofit programs, and small business retrofit programs.

1.1 STUDY OBJECTIVES

The primary objective of the 2010 program year free-ridership and spillover study was to assist the Massachusetts PAs in quantifying the net impacts of their commercial and industrial energy efficiency programs by estimating the extent of:

- Program free-ridership
- Early participant “like” and “unlike” spillover
- Non-participant “like” spillover.

This executive summary first provides a summary of the study methodology. It also includes the free-ridership, participant spillover and non-participant spillover estimates for 2010 at the program, end-use, and statewide levels. Following this summary, we present the results for each individual PA at the end-use and program levels.

1.2 STUDY METHODOLOGY

The methodology used for this year’s study follows the standardized methodology developed in 2010 and 2011 for the Massachusetts PAs¹ for use in situations where end-users are able to report on program impacts via self-report methods. This methodology updated the previous standardized methodology developed in 2003².

To accomplish the above objective, telephone surveys were conducted with samples of 2010 program participants in each of the PAs’ C&I electric programs and with design professionals and equipment vendors involved in these 2010 installations. The program participant sample consisted of unique electric *accounts*³, not unique customer names. The same customer name, or business identity, can have multiple accounts in multiple locations, but program technical support and incentives are provided on behalf of an individual account. Thus, for the purposes of this study, a customer or participant is defined as a unique account⁴.

¹“Cross-Cutting C&I Free-Ridership and Spillover Methodology Study Final Report”, prepared for the Massachusetts Program Administrators by Tetra Tech, KEMA, and NMR, April 18, 2011.

² Pamela Rathbun, Carol Sabo, and Bryan Zent, *Standardization Methods for Free-ridership and Spillover Evaluation—Task 5 Final Report (Revised)*, prepared for National Grid, NSTAR Electric, Northeast Utilities, Unitil, and Cape Light Compact, June 16, 2003.

³ Each account could include multiple applications for efficiency projects. For example, if one account has five lighting applications and one VSD application, this account would show up twice in the sample frame; once for lighting (aggregating all the lighting applications) and once for VSD.

⁴ Unique accounts with two or more end-uses were asked about the two largest saving end-uses during one interview.



The 2010 free-ridership and spillover studies ran concurrently for National Grid, NSTAR, Western Massachusetts Electric Company (WMECO), Cape Light Compact, and Unitil. The majority of the telephone interviews were completed with program participants between April 4 and May 20, 2011. All sampled participating customers were mailed a letter on PA letterhead in advance of the telephone call. This letter explained the purpose of the call, informed customers that someone from Tetra Tech would be calling them in the next couple of weeks to ask them some questions about their experiences with the programs, and thanked them for their cooperation in advance. This advance letter and repeated call attempts over a 7 week period resulted in an overall cooperation rate of 63 percent, which increases the level of confidence in the survey results. The duration of interviews with program participants averaged twelve minutes.

The number of survey completions for some end-uses is low because the number of installations within these end-use categories for program year 2010 was small. Thus, although a high percentage of the 2010 program participants completed surveys, some caution should be used when interpreting these results for some specific end-uses.

In addition to the customer surveys, additional surveys were conducted with:

- Design professionals and vendors identified by customers as being the most knowledgeable about the decision to install the energy efficient equipment through the PAs' programs. These surveys were used to estimate free-ridership for those installations where customers said the design professional/equipment vendor was more influential in the decision than the customer.
- Design professionals and equipment vendors who had recommended, sold and/or installed equipment through the PAs' new construction and medium to large C&I retrofit programs. These surveys were used for estimating the extent of non-participant "like" spillover at a statewide level for all the PAs' electric programs.

1.2.1 Participant free-ridership methodology

A program's *free-ridership rate* is the percentage of program savings attributed to free-riders. A *free-rider* refers to a program participant who received an incentive or other assistance through an energy efficiency program, and who would have installed the same high efficiency end-use⁵ on their own at that same time if the program had not been offered. For free-riders, the program is assumed to have had no influence or only a slight influence on their decision to install or implement the energy efficient end-use. Consequently, none or only some of the energy (and demand) savings from the energy efficient end-uses taken by this group of customers should be credited to the energy efficiency program.

In addition to simply identifying free-riders, it is important to estimate the *extent* of free-ridership for each customer. Pure free-riders (100%) would have adopted exactly the same energy efficient end-use at that time absent the program. Partial free-riders (1–99%) are those customers who would have adopted some end-use on their own, but of a lesser efficiency or a lesser quantity, or at a later time. Thus, the program had some impact on their decision. Non-free-riders (0%) are those who would not have installed or implemented any energy efficient end-use (within a specified period of time) absent the program services.

For programs that offer monetary incentives for multiple end-use categories (e.g., motors, lighting, HVAC), it is important to estimate free-ridership by specific end-use category. Category-specific estimates produce feedback on the program at the level at which it actually operates and allow for cost-effectiveness testing by end-use category. In addition, for commercial and industrial incentive

⁵ For purposes of this discussion, an "energy efficient end-use" includes high efficiency equipment, an efficiency end-use such as weatherization, or an energy efficient practice such as turning off a computer when not in use.



programs, free-ridership has often been found to be highly variable among end-use categories, making it essential to produce end-use category-specific estimates. The ability to provide reliable estimates by end-use category depends on the number of installations within that end-use category—the fewer installations, the less reliable the estimate.

Once calculated, each individual's free-ridership rate is then applied to the end-use savings associated with that project. The total free-ridership estimates in this report include pure, partial, and non-free-riders.

Changes made in the current methodology from the 2003 methodology include estimating free-ridership acceleration, probing to rule out rival hypotheses, using more consistency checks, modifying the treatment of missing data, and measuring indicators of participant “unlike” spillover. In addition, the methodology now reduces a project's free-ridership rate if the equipment installed absent the program would have been less efficient than what was incentivized *but more efficient* than standard or baseline equipment.

One of the most significant changes in the current methodology is how acceleration is treated in Massachusetts. Unlike evaluation methods used in Wisconsin, California and New York, the 2003 Massachusetts method of treating acceleration differed from many acceleration treatments in that it gave full attribution credit for end-uses accelerated by more than one year, and no attribution credit for end-uses accelerated by less than one year. The current methodology explores acceleration in more detail by calculating life cycle net savings which determines the amount of savings attributable to the program over its lifetime. For example, any project assessed using the 2003 methodology that would not have been completed within a year of participation was scored as a non-free-rider. In contrast, the 2010-11 methodology increases that limit to 24 months for small business programs and 48 months for large commercial and industrial programs.⁶

Our approach to estimating free-riders follows the approach outlined in the 2011 Cross-Cutting C&I Free-Ridership and Spillover Methodology Study Final Report, which consists of a sequential question technique to identify free-riders. This sequential approach asks program participants about the actions they would have taken if the program services had not been offered. This approach addresses the program's impact on project timing, end-use quantity, and efficiency levels while explicitly recognizing that the cost of energy-efficient equipment can be a barrier to installation absent PA-sponsored energy efficiency programs. This method 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.

Note that program total free-ridership (pure and partial) rates illustrated in the tables in the Results Summary section of this Executive Summary are weighted by end-use category kWh savings as well as by the disproportionate probability of being sampled. Weighting by kWh savings ensures that overall end-use savings are considered in the overall results. Likewise, weighting by the disproportionate probability of being sampled accounts for any oversampling of a specific end-use as part of our sampling strategy. When reviewing the end-use category free-ridership rates it is important to consider the number of survey completions that the estimate is based upon.

1.2.2 Spillover methodology

Spillover refers to additional energy efficient end-uses adopted 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 energy efficient end-use equipment through the program, and then installed additional end-use equipment of the same type due to program

⁶ The California methodology uses 4 years for large C&I customers and 2 years for small C&I customers to more accurately reflect the length of time involved in planning different sizes of projects.



influences. *Participant “unlike” spillover* is where the customer installs other types of energy efficient end-use equipment than those offered through the program, but are influenced by the program to do so.

Survey free-ridership questions were followed by questions designed to estimate “like” and “unlike” spillover. These questions asked about recent purchases (since program participation in 2010) of any additional energy-efficient equipment that were made without any additional technical or financial assistance from the PA. This report presents early spillover estimates. Both types of spillover will be estimated again as part of the C&I non-energy impacts (NEI) surveys conducted later in 2011 and 2012.

a. Early “like” spillover

A “like” spillover estimate was computed based on how much more of the same energy-efficient equipment the participant installed outside the program and did so because of their positive experience with the program.

One of the issues with attempting to quantify spillover savings is how to value the savings of end-use equipment installed outside the program since we are relying on customer self-reports of the quantity and efficiency of any end-use equipment installed. Estimating “like” spillover uses a conservative approach; it reports only that end-use equipment installed outside the program that was of exactly the same type and efficiency as one installed through the program. This conservative approach allows customers to be more certain about whether the equipment they installed outside the program was the same type as the program equipment. This, in turn, makes it possible for us to use the estimated program savings for that end-use to calculate the customer’s “like” spillover savings. Program-eligible end-use equipment that were installed by the participant but were not of the same type as what was installed through the program are excluded from “like” spillover estimates. These pieces of end-use equipment Could be included in any “unlike” spillover analysis (see discussion below).

Note that the “like” spillover rates illustrated in the Results Summary section of this Executive Summary are weighted by end-use category kWh savings and the disproportionate probability of being sampled. When reviewing “like” spillover by end-use category, it is important to consider the number of survey completions that the estimate is based upon. The number of survey completions for some end-use categories is low because very few customers in the sample installed equipment for that end-use. Thus, although a high percentage of the 2010 program participants completed surveys, some caution should be used when interpreting the results.

b. Early “unlike” spillover

The evaluation team included questions to address “unlike” spillover – energy efficient equipment installed by a participant due to program influence, but that is not identical to the equipment they received through the program. However, given the difficulties in estimating savings for these installations, we present only indicators of “unlike” spillover and not savings estimates. The joint NEI/spillover study to be conducted later in 2011 and 2012 by expert interviewers will allow for better estimation of “unlike” spillover. Early “unlike” spillover indicators are presented in the full report.

c. Non-participant spillover estimates

Free-drivers, or non-participant spillover, refers to energy efficient end-use equipment adopted by program non-participants due to the program's influence. The program can have an influence on design professionals and vendors as well as an influence on product availability or practices, product or practice acceptance, customer expectations, and other market effects. All of these may induce non-participants to install energy efficient equipment. *Non-participant “like” spillover* refers to additional end-use equipment of the same type as offered through the program that is adopted due to the program’s influence.



The methodology for the 2010 study estimated only a portion of non-participant “like” spillover based on responses from design professionals and vendors participating in the PAs’ programs⁷.

The data for the analysis could have been collected from non-participants directly or from the design professionals and vendors who recommended, sold, and/or installed qualifying high efficiency equipment. We chose to survey the design professionals and vendors primarily because they could typically provide much more accurate information about the efficiency level of installed equipment than could the non-participants. Experience has shown that customers cannot provide enough data to a telephone interviewer about the new equipment they have installed to allow for accurate estimates of the energy savings achieved from the equipment. While they usually can report what type of equipment was installed, they typically cannot provide sufficient information about the quantity, size, efficiency, and/or operation of that equipment to allow us to determine whether the equipment is “program-eligible.” On the other hand, design professionals and equipment vendors who have worked with the program are typically more knowledgeable about equipment as they are familiar with what is and is not “program-eligible.”

Another argument in favor of using design professionals and equipment vendors to estimate non-participant spillover was that we could use data in the program tracking system database to attach kWh savings estimates to non-participant spillover. In the program tracking system database, end-use-specific program kWh savings are associated with each design professional and vendor who participated in the program in 2010.

To determine non-participant spillover, design professionals and equipment vendors were asked (by end-use category they installed through the program in 2010) what percent of their sales were program-eligible and what percent of these sales did not receive an incentive through the PA programs. They were then asked about the programs’ impact on their decision to recommend/install this efficient equipment outside the program. Using the survey responses and end-use savings data from the program tracking system, the participating vendor’s non-participant “like” spillover savings could be estimated for each design professional/vendor, and the results then extrapolated to the total savings for all programs.

This method of estimating non-participant spillover is a *conservative* estimate for two reasons. First, not all design professionals and equipment vendors who are familiar with the programs specified and/or installed equipment through the program in 2010. Thus, we miss any non-participant spillover that was associated with these other design professionals/vendors (although it is less likely these design professionals/vendors had non-participant spillover if they were not involved with the program in 2010).

Second, this method only allows us to extrapolate non-participant spillover for those same end-use categories that a particular design professional/vendor was associated with for the 2010 programs. Thus, if a vendor installed program-eligible equipment in other end-use categories in the year 2010 outside the program, but none through the program, we did not capture non-participant spillover savings with that particular type of equipment. In essence, we end-used only “like” non-participant spillover; that is, spillover for end-uses like those installed through the program in 2010.

It is important to note that non-participant spillover was asked at the statewide level, resulting in statewide estimates by end-use. These estimates were then applied to each PA program that offered that end-use. Of the participant savings with eligible contractor information, we completed interviews that covered 62 percent of the savings. The identified non-participant savings were then applied to the appropriate end-use categories on a program by program basis.

⁷ Non-participant spillover for small business programs was not estimated because of the small number of vendors involved in delivering the program.



1.3 RESULTS SUMMARY

This section presents the results of the 2010 free-ridership and spillover study. First, we present summary tables that include statewide figures both at a program level and an end-use level. Following the summary tables, we present detailed results for each PA. The detailed results include free-ridership and spillover rates by end-use and by program, along with corresponding error margins.

summarizes the free-ridership and spillover estimates by PA and program, in addition to presenting overall rates by program type and statewide. The statewide free-ridership rate is 15.3 percent, the participant spillover rate is 8.8 percent, and the non-participant spillover rate is .6 percent, resulting in a statewide net-to-gross ratio (NTGR) of 94.1 percent.

Table 1-1. 2010 C&I Free-ridership and Spillover Results Summary⁸

PA	Program	Free-ridership	Spillover	Non-participant Spillover	Overall Net-to-Gross ⁹	Number of Surveyed Accounts
Cape Light Compact	Medium and Large C&I Retrofit	12.5%	0.0%	3.4%	90.9%	4
	Medium and Large Government Retrofit	22.2%	0.0%	2.4%	80.2%	7
	New Construction	75.4%	0.0%	0.0%	24.6%	5
	Services & Products	40.1%	64.3%	0.0%	124.1%	6
	Retrofit	8.6%	5.3%	N/A	96.7%	97
National Grid	Energy Initiative	15.0%	5.4%	0.7%	91.1%	277
	Design 2000plus	22.5%	19.6%	0.6%	97.8%	214
	Small Business Services	4.6%	0.9%	N/A	96.3%	232
NSTAR	Business Solutions	16.6%	15.5%	0.8%	99.6%	299
	Construction Solutions	18.4%	10.1%	0.9%	92.6%	254
	Small Business Solutions	8.3%	6.0%	N/A	97.7%	301
Unitil	Large C&I Retrofit	23.9%	0.0%	6.1%	82.2%	5
	New Construction	30.6%	0.0%	3.6%	73.0%	7
	Small C&I Retrofit	7.3%	7.9%	N/A	100.6%	21
WMECO	Retrofit	17.7%	4.3%	0.0%	86.6%	38
	New Construction	19.5%	0.3%	0.0%	80.8%	41
	Small Business	9.8%	1.5%	N/A	91.7%	126
Large Retrofit programs		15.7%	9.1%	0.7%	94.1%	727
New Construction programs		20.0%	11.5%	0.8%	92.3%	521
Services & Products programs		40.1%	64.3%	0.0%	124.1%	6
Small Business programs		7.2%	3.7%	N/A	96.4%	680
Massachusetts Overall		15.3%	8.8%	0.6%	94.1%	1934

⁸ Results are weighted by savings and for disproportionate sampling.

⁹ NTG = (1-FR) + PSO + NPSO



Table 1-2 presents statewide free-ridership and spillover rates for each end-use combined across all PAs and programs. Excluding the limited number of hot water end-uses, Combined Heat & Power (CHP) and refrigeration end-uses have the lowest level of free-ridership: 7.4 percent for both end-uses. Excluding the limited number of comprehensive design and building envelope projects, compressed air end-uses have the highest free-ridership rate. Table 1-3 on the following page presents free-ridership and spillover rates by end-use and major program type across all PAs.

Table 1-3 on the following page presents free-ridership and spillover rates by end-use and major program type across all PAs.

**Table 1-2. 2010 Statewide C&I Free-ridership and Spillover Results by End-use¹⁰
(all PAs and all Programs)**

End-use	Free-ridership	90% Error Margin	Participant "Like" Spillover	90% Error Margin ¹¹	Non-participant Spillover	Net-to-Gross	Surveyed Accounts ¹²	Population of Accounts
Compressed Air	19.3%	± 4.9%	1.8%	± 1.7%	1.1%	83.6%	89	182
HVAC	17.1%	± 2.7%	9.0%	± 2.0%	0.0%	92.0%	320	795
Lighting	14.6%	± 1.7%	6.8%	± 1.2%	0.0%	92.2%	977	5690
Motors & Drives	13.0%	± 2.2%	4.6%	± 1.4%	7.5%	99.2%	296	575
Process	18.6%	± 5.2%	14.7%	± 4.7%	0.0%	96.1%	76	153
Refrigeration	7.4%	± 2.3%	27.9%	± 3.9%	0.0%	120.6%	247	792
Hot Water	0.0%	± 0.0%	97.9%	± 4.8%	0.0%	197.9%	6	8
Building Envelope	73.8%	± 29.5%	0.0%	± 0.0%	0.0%	26.2%	3	6
CHP	7.4%	± 15.7%	15.8%	± 21.9%	0.0%	108.4%	5	15
Comprehensive ¹³	39.8%	± 26.6%	0.0%	± 0.0%	0.0%	60.2%	5	11

¹⁰ End-use is defined by the DOER categories assigned to individual projects in the PAs' program tracking databases.

¹¹ Error margins through-out this report are absolute, not relative, values.

¹² The sum of surveyed accounts at the end-use level is greater than the total number of surveys as some projects were split into two end-use categories.

¹³ Five National Grid projects were listed as "Comprehensive Design" projects and could not be assigned a single end-use.



Table 1-3. 2010 Statewide C&I Free-ridership and Spillover Results by End-use and Program Type

Program Type	End Use	Free-ridership	90% Error Margin	Spillover	90% Error Margin	Non-participant Spillover	Net-to-Gross	Surveyed Accounts	Population of Accounts
Large Retrofit	Compressed Air	7.0%	5.9%	0.0%	0.0%	1.5%	94.5%	22	39
	HVAC	13.4%	4.2%	6.4%	3.0%	0.0%	93.0%	98	212
	Lighting	16.9%	3.0%	8.4%	2.2%	0.0%	91.5%	319	1404
	Motors/Drives	9.6%	3.0%	6.0%	2.4%	7.7%	104.1%	128	256
	Process	25.7%	11.6%	11.1%	8.4%	0.0%	85.4%	22	52
	Refrigeration	8.7%	5.2%	36.0%	8.8%	0.0%	127.3%	51	140
	CHP	7.4%	15.7%	15.8%	21.9%	0.0%	108.4%	5	15
	Comprehensive	40.7%	33.0%	0.0%	0.0%	0.0%	59.3%	2	3
New Construction	Compressed Air	33.6%	7.0%	4.0%	2.9%	1.5%	71.9%	66	142
	HVAC	21.6%	4.2%	11.9%	3.3%	0.0%	90.3%	162	416
	Lighting	19.9%	4.5%	8.8%	3.2%	0.0%	88.9%	125	294
	Motors/Drives	22.5%	4.1%	1.4%	1.2%	7.7%	86.6%	113	191
	Process	9.7%	4.7%	19.3%	6.2%	0.0%	109.6%	44	74
	Refrigeration	12.5%	10.2%	34.5%	14.7%	0.0%	122.0%	11	18
	Building Envelope	75.0%	39.0%	0.0%	0.0%	0.0%	25.0%	2	5
	Comprehensive	10.8%	23.3%	0.0%	0.0%	0.0%	89.2%	3	8
Small Business	Compressed Air	10.0%	0.0%	0.0%	0.0%	N/A	90.0%	1	1
	HVAC	6.8%	4.5%	14.0%	6.2%	N/A	107.2%	54	149
	Lighting	7.8%	1.8%	2.8%	1.1%	N/A	95.0%	533	3,992
	Motors/Drives	6.1%	4.0%	0.7%	1.4%	N/A	94.6%	55	128
	Process	16.7%	15.4%	0.0%	0.0%	N/A	83.3%	10	27
	Refrigeration	2.2%	1.5%	9.2%	2.9%	N/A	107.0%	185	634
	Hot Water	0.0%	0.0%	97.9%	4.8%	N/A	197.9%	6	8
	Building Envelope	1.0%	0.0%	0.0%	0.0%	N/A	99.0%	1	1

Below we present more detailed findings for each PA program.



1.4 DETAILED PA RESULTS

1.4.1 National Grid results

Table 1-4 summarizes the free-ridership and spillover rates for the National Grid programs by end-use. Comprehensive design end-uses and industrial process end-uses have the highest levels of free-ridership: 39.8 percent and 22.1 percent respectively. However, industrial process end-uses also have the highest reported participant spillover rate of 27 percent. CHP projects reported no free-ridership.

Table 1-4. National Grid Free-ridership and Spillover Results by End-use

End-use	Free-ridership	90% Error Margin	Participant "Like" Spillover	90% Error Margin	Non-participant Spillover	Net-to-Gross	Surveyed Accounts	Population of Accounts
Compressed Air	14.7%	± 5.4%	0.0%	± 0.0%	1.1%	86.4%	62	131
HVAC	14.7%	± 3.7%	6.1%	± 2.5%	0.0%	91.5%	147	360
Lighting	14.8%	± 2.8%	4.3%	± 1.6%	0.0%	89.5%	363	2014
Motors/Drives	7.3%	± 2.6%	5.2%	± 2.2%	7.3%	105.2%	150	321
Process	22.1%	± 10.3%	27.0%	± 11.0%	0.0%	104.9%	23	48
Refrigeration	3.5%	± 3.5%	14.4%	± 6.8%	0.0%	110.9%	46	126
CHP	0.0%	± 0.0%	0.0%	± 0.0%	0.0%	100.0%	3	11
Comprehensive ¹⁴	39.8%	± 26.6%	0.0%	± 0.0%	0.0%	60.2%	5	11

¹⁴ Five National Grid projects were listed as "Comprehensive Design" projects and could not be assigned a single end-use.



Table 1-5 presents free-ridership and spillover for each legacy measure category by program. Overall, the Design 2000plus program has the highest free-ridership rate (22.5 percent), while the Small Business Services program has the lowest (4.6 percent). The Design 2000plus program also has the highest participant spillover rate (19.6 percent). Please note that for the National Grid programs, we are not presenting the results by DOER end-use. Instead, at the request of program staff, we present them using measure categories from past evaluation efforts (e.g. custom projects, new motors).

Table 1-5. National Grid Free-ridership and Spillover Results by Program and End-use

Program	Measure Category	Free-ridership	90% Error Margin	Participant "Like" Spillover	90% Error Margin	Non-participant Spillover	Net-to-Gross Rate	Surveyed Accounts	Population of Accounts
Design 2000plus	Custom	16.1%	6.4%	28.6%	7.9%	0.1%	112.6%	38	67
	New Motors	13.6%	7.0%	2.9%	3.4%	7.7%	96.9%	20	29
	Failed or Stock Motors	10.6%	7.4%	0.0%	0.0%	7.7%	97.1%	15	22
	Unitary HVAC	28.9%	10.7%	1.7%	3.1%	0.0%	72.8%	32	95
	Non-unitary HVAC	26.4%	10.9%	1.7%	3.2%	0.0%	75.3%	26	63
	VSD	25.4%	16.0%	0.0%	0.0%	7.7%	82.2%	10	20
	Lighting	32.8%	9.4%	16.0%	7.3%	0.0%	83.2%	38	86
	Compressed Air	31.7%	10.0%	0.0%	0.0%	1.5%	69.8%	35	86
Total	22.5%	3.5%	19.6%	3.3%	0.6%	97.8%	214	468	
Energy Initiative	Custom	14.0%	5.9%	8.2%	4.7%	0.8%	95.0%	69	272
	HVAC	10.9%	6.3%	3.6%	3.8%	0.0%	92.7%	31	58
	VSD	10.2%	4.5%	6.9%	3.8%	7.7%	104.3%	48	79
	Lighting	16.9%	5.2%	2.5%	2.2%	0.0%	85.7%	114	630
	Compressed Air	23.2%	10.6%	0.0%	0.0%	1.5%	78.3%	15	23
	Total	15.0%	3.0%	5.4%	1.9%	0.7%	91.1%	277	1,062
Small Business Services	Lighting	4.8%	2.4%	0.8%	1.0%	N/A	96.0%	186	1,188
	Other	1.9%	2.6%	1.6%	2.4%	N/A	99.7%	46	119
	Total	4.6%	2.1%	0.9%	0.9%	N/A	96.3%	232	1,307



1.4.2 NSTAR results

Table 1-6 summarizes the free-ridership and spillover rates for the NSTAR programs by end-use. Compressed air end-uses have the highest free-ridership rate (37 percent) and hot water and refrigeration end-uses have the lowest free-ridership rate (0 and 10 percent, respectively).

Table 1-6. NSTAR Free-ridership and Spillover Results by End-use

End-use	Free-ridership	90% Error Margin	Participant "Like" Spillover	90% Error Margin	Non-participant Spillover	Net-to-Gross	Surveyed Accounts	Population of Accounts
Compressed Air	37.0%	± 11.1%	9.5%	± 6.8%	1.1%	73.6%	25	49
HVAC	17.4%	± 4.1%	11.0%	± 3.4%	0.0%	93.6%	142	357
Lighting	14.1%	± 2.6%	10.4%	± 2.3%	0.0%	96.3%	414	2,818
Motors/Drives	17.6%	± 3.7%	4.6%	± 2.0%	7.7%	94.7%	125	224
Process	18.5%	± 8.2%	1.5%	± 2.5%	0.0%	83.0%	31	63
Refrigeration	10.0%	± 3.7%	38.8%	± 5.9%	0.0%	128.8%	125	398
Hot Water	0.0%	± 0.0%	100.0%	± 0.0%	0.0%	200.0%	5	6
CHP	25.0%	± 35.6%	53.7%	± 41.0%	0.0%	128.7%	2	4



Table 1-7 presents free-ridership and spillover rates for each end-use by program. The Construction Solutions program has the highest free-ridership rate (18.4 percent) while the Small Business Solutions program has the lowest (8.3 percent). Participant spillover is highest for the Business Solutions program (15.5 percent) and lowest for the Small Business Solutions program (6 percent).

Table 1-7. NSTAR Free-ridership and Spillover Results by Program and End-use

Program	End-use	Free-ridership	90% Error Margin	Participant "Like" Spillover	90% Error Margin	Non-participant Spillover	Net-to-Gross	Surveyed Accounts	Population of Accounts
Business Solutions Program	Compressed Air	50.0%	± 67.2%	0.0%	± 0.0%	1.1%	51.1%	1	3
	HVAC	13.3%	± 5.8%	6.1%	± 4.1%	0.0%	92.8%	50	109
	Lighting	17.7%	± 4.4%	16.5%	± 4.3%	0.0%	98.8%	147	563
	Motors/Drives	13.5%	± 5.0%	6.7%	± 3.6%	7.7%	100.9%	58	106
	Process	28.6%	± 18.6%	2.2%	± 6.1%	0.0%	73.6%	8	16
	Refrigeration	14.1%	± 7.2%	56.4%	± 10.3%	0.0%	142.3%	37	90
	CHP	25.0%	± 35.6%	53.7%	± 41.0%	0.0%	128.7%	2	4
	Total	16.6%	± 2.9%	15.5%	± 2.8%	0.8%	99.6%	303	891
Construction Solutions Program	Compressed Air	36.7%	± 11.2%	9.7%	± 6.9%	1.1%	74.1%	24	46
	HVAC	20.6%	± 6.0%	14.4%	± 5.2%	0.0%	93.8%	74	189
	Lighting	12.1%	± 4.9%	2.4%	± 2.3%	0.0%	90.2%	71	172
	Motors/Drives	23.4%	± 5.6%	1.5%	± 1.6%	7.6%	85.7%	67	118
	Process	9.5%	± 7.9%	0.8%	± 2.4%	0.0%	91.3%	13	20
	Refrigeration	14.4%	± 13.1%	41.5%	± 18.5%	0.0%	127.2%	7	11
	Total	18.4%	± 2.9%	10.1%	± 2.3%	0.9%	92.6%	256	556
Small Business Solutions Program	HVAC	9.6%	± 9.5%	26.6%	± 14.3%	N/A	117.1%	18	59
	Lighting	9.2%	± 3.2%	4.1%	± 2.2%	N/A	94.9%	196	2,083
	Process	16.7%	± 15.4%	0.0%	± 0.0%	N/A	83.3%	10	27
	Refrigeration	1.8%	± 2.1%	13.1%	± 5.3%	N/A	111.3%	81	297
	Hot Water	0.0%	± 0.0%	100.0%	± 0.0%	N/A	200.0%	5	6
	Total	8.3%	± 2.4%	6.0%	± 2.1%	N/A	97.7%	310	2,472



1.4.3 WMECO results

Table 1-8 presents the free-ridership and spillover rates for each end-use across all the WMECO programs. HVAC end-uses have the highest free-ridership rate (30.2 percent) and a low participant spillover rate (less than one percent).

Table 1-8. WMECO Free-ridership and Spillover Results by End-use

End-use	Free-ridership	90% Error Margin	Participant "Like" Spillover	90% Error Margin	Non-participant Spillover	Net-to-Gross	Surveyed Accounts	Population of Accounts
HVAC	30.2%	± 13.2%	0.7%	± 2.4%	0.0%	70.6%	20	52
Lighting	17.6%	± 4.6%	2.9%	± 2.1%	0.0%	85.4%	134	506
Process	6.1%	± 7.4%	0.1%	± 1.1%	0.0%	94.0%	16	36
Refrigeration	3.2%	± 4.5%	1.8%	± 3.4%	0.0%	98.5%	33	167
Hot Water	0.0%	± 0.0%	0.0%	± 0.0%	0.0%	100.0%	1	2

Table 1-9 presents free-ridership and spillover rates by end-use at the program level. The New Construction program has the highest free-ridership rate (19.5 percent) and the lowest participant spillover rate (less than one percent). The Small Business program has the lowest free-ridership rate (9.8 percent).

Table 1-9. WMECO Free-ridership and Spillover Results by Program and End-use

Program	End-use	Free-ridership	90% Error Margin	Participant "Like" Spillover	90% Error Margin	Non-participant Spillover	Net-to-Gross	Surveyed Accounts	Population of Accounts
New Construction Program	HVAC	30.2%	± 13.2%	0.7%	± 2.4%	0.0%	70.6%	20	52
	Lighting	59.1%	± 23.4%	0.0%	± 0.0%	0.0%	40.9%	7	17
	Process	7.1%	± 8.4%	0.1%	± 1.2%	0.0%	93.0%	14	31
	Total	19.5%	± 7.8%	0.3%	± 1.1%	0.0%	80.8%	41	100
Retrofit Program	Lighting	19.6%	± 8.9%	4.7%	± 4.8%	0.0%	85.1%	36	109
	Process	0.0%	± 0.0%	0.0%	± 0.0%	0.0%	100.0%	2	5
	Total	17.7%	± 8.3%	4.3%	± 4.4%	0.0%	86.6%	38	114
Small Business Program	Lighting	10.6%	± 4.6%	1.4%	± 1.8%	N/A	90.9%	91	380
	Refrigeration	3.2%	± 4.5%	1.8%	± 3.4%	N/A	98.5%	33	167
	Hot Water	0.0%	± 0.0%	0.0%	± 0.0%	N/A	100.0%	1	2
	Total	9.8%	± 3.8%	1.5%	± 1.6%	N/A	91.7%	125	549



1.4.4 Unitil results

Table 1-10 presents the free-ridership and spillover rates by end-use across all Unitil programs. Process and compressed air end-uses have the highest free-ridership rates of 84.8 percent and 80.3 percent, respectively. Caution should be used as these free-ridership rates are based on responses from very few participants.

Table 1-10. Unitil Free-ridership and Spillover Results by End-use

End-use	Free-ridership	90% Error Margin	Participant "Like" Spillover	90% Error Margin	Non-participant Spillover	Net-to-Gross	Surveyed Accounts	Population of Accounts
Compressed Air	80.3%	± 0.0%	0.0%	± 0.0%	0.8%	20.6%	2	2
HVAC	10.0%	± 0.0%	0.0%	± 0.0%	0.0%	90.0%	1	1
Lighting	4.8%	± 5.4%	8.7%	± 7.1%	0.0%	103.9%	18	31
Motors/Drives	7.1%	± 0.0%	0.0%	± 0.0%	7.2%	100.1%	6	6
Process	84.8%	± 0.0%	0.0%	± 0.0%	0.0%	15.2%	6	6

Table 1-11 presents the free-ridership and spillover rates by end-use at the program level. The New Construction program has the highest free-ridership rate (30.6 percent) while the Small C&I Retrofit program has the lowest rate (7.3).

Table 1-11. Unitil Free-ridership and Spillover Results by Program and End-use

Program	End-use	Free-ridership	90% Error Margin	Participant "Like" Spillover	90% Error Margin	Non-participant Spillover	Net-to-Gross	Surveyed Accounts	Population of Accounts
Large C&I Retrofit Program	Motors/Drives	4.8%	± 0.0%	0.0%	± 0.0%	7.7%	102.9%	3	3
	Process	100.0%	± 0.0%	0.0%	± 0.0%	0.0%	0.0%	2	2
	Total	23.9%	± 0.0%	0.0%	± 0.0%	6.1%	82.2%	5	5
New Construction Program	Compressed Air	100.0%	± 0.0%	0.0%	± 0.0%	1.1%	1.1%	1	1
	HVAC	10.0%	± 0.0%	0.0%	± 0.0%	0.0%	90.0%	1	1
	Motors/Drives	6.3%	± 0.0%	0.0%	± 0.0%	7.7%	101.5%	1	1
	Process	70.2%	± 0.0%	0.0%	± 0.0%	0.0%	29.8%	4	4
	Total	30.6%	± 0.0%	0.0%	± 0.0%	3.6%	73.0%	7	7
Small C&I Retrofit Program	Compressed Air	10.0%	± 0.0%	0.0%	± 0.0%	N/A	90.0%	1	1
	Lighting	4.8%	± 5.4%	8.7%	± 7.1%	N/A	103.9%	18	31
	Motors/Drives	35.7%	± 0.0%	0.0%	± 0.0%	N/A	64.3%	2	2
	Total	7.3%	± 5.8%	7.9%	± 6.0%	N/A	100.6%	21	34



1.4.5 Cape Light Compact results

Table 1-12 summarizes free-ridership and spillover rates for each end-use in the Cape Light Compact programs. Excluding building envelope end-uses due to the limited number of projects including in the study, HVAC end-uses have the highest free-ridership rate (26 percent) while refrigeration end-uses have the lowest rate (3.9 percent). Participant spillover was identified with both HVAC and lighting end-uses (5.3 percent and 5.8 percent respectively).

Table 1-12. Cape Light Compact Free-ridership and Spillover Results by End-use

End-use	Free-ridership	90% Error Margin	Participant "Like" Spillover	90% Error Margin	Non-participant Spillover	Net-to-Gross	Surveyed Accounts	Population of Accounts
HVAC	26.0%	± 17.7%	5.3%	± 9.1%	0.0%	79.4%	10	25
Lighting	9.9%	± 6.5%	5.8%	± 5.1%	0.0%	95.9%	48	321
Motors/Drives	21.5%	± 10.7%	0.0%	± 0.0%	6.4%	84.9%	15	24
Refrigeration	3.9%	± 3.7%	0.0%	± 0.0%	0.0%	96.1%	43	101
Building Envelope	75.0%	± 29.1%	0.0%	± 0.0%	0.0%	25.0%	3	6



Table 1-13 presents free-ridership and spillover rates by end-use at the program level. The New Construction program has the highest free-ridership rate (75.4 percent) and the Retrofit program has the lowest (8.6 percent). Due to the small number of participants in all but the Retrofit program, caution should be used when interpreting the results.

Table 1-13. Cape Light Compact Free-ridership and Spillover Results by Program and End-use

Program	End-use	Free-ridership	90% Error Margin	Participant "Like" Spillover	90% Error Margin	Non-participant Spillover	Net-to-Gross	Surveyed Accounts	Population of Accounts
Medium And Large C&I Retrofit	Lighting	12.5%	± 0.0%	0.0%	± 0.0%	0.0%	87.5%	3	3
	Motors/Drives	12.5%	± 0.0%	0.0%	± 0.0%	7.7%	95.2%	1	1
	Total	12.5%	± 0.0%	0.0%	± 0.0%	3.4%	90.9%	4	4
Medium And Large Government Retrofit	HVAC	25.0%	± 0.0%	0.0%	± 0.0%	0.0%	75.0%	1	1
	Lighting	0.0%	± 0.0%	0.0%	± 0.0%	0.0%	100.0%	1	1
	Motors/Drives	25.0%	± 39.0%	0.0%	± 0.0%	7.7%	82.7%	2	5
	Refrigeration	7.5%	± 0.0%	0.0%	± 0.0%	0.0%	92.5%	3	3
	Total	22.2%	± 7.2%	0.0%	± 0.0%	2.4%	80.2%	15	18
New Construction Program	HVAC	0.0%	± 0.0%	0.0%	± 0.0%	0.0%	100.0%	1	1
	Lighting	87.9%	± 32.1%	0.0%	± 0.0%	0.0%	12.1%	2	7
	Building Envelope	75.0%	± 39.0%	0.0%	± 0.0%	0.0%	25.0%	2	5
	Total	75.4%	± 24.9%	0.0%	± 0.0%	0.0%	24.6%	5	13
Retrofit Program	HVAC	23.3%	± 38.1%	0.0%	± 0.0%	N/A	76.7%	2	5
	Lighting	8.8%	± 6.7%	6.4%	± 5.8%	N/A	97.6%	42	310
	Motors/Drives	13.7%	± 9.4%	0.0%	± 0.0%	N/A	86.3%	12	18
	Refrigeration	3.7%	± 3.8%	0.0%	± 0.0%	N/A	96.3%	40	98
	Building Envelope	27.3%	± 0.0%	0.0%	± 0.0%	N/A	72.7%	1	1
	Total	8.6%	± 4.1%	5.3%	± 3.3%	N/A	96.7%	97	432
Services & Products Program	HVAC	40.1%	± 26.9%	64.3%	± 26.3%	0.0%	124.1%	6	18
	Total	40.1%	± 26.9%	64.3%	± 26.3%	0.0%	124.1%	6	18



2. INTRODUCTION

This report summarizes the findings of the free-ridership and spillover study conducted for the Massachusetts Program Administrators (PAs) for their 2010 Commercial and Industrial (C&I) electric programs. The purpose of this study was to assess program free-ridership and spillover for the electric programs offered by National Grid, NSTAR, Western Massachusetts Electric Company, Unitil, and Cape Light Compact. These programs include new construction programs, large to medium C&I retrofit programs, and small business retrofit programs.

One important concept affecting the interpretation of the free-ridership and spillover estimates is the ability to generalize the results. The results of this study can only be generalized to the population of 2010 program year participants, and the design professionals and equipment vendors who were active in the 2010 program year. The results cannot be used to predict the actions of any future program participants or program vendors. Essentially, the current study is a performance audit of the year 2010 programs using survey research methods to estimate the free-ridership and spillover rates.

2.1 ORGANIZATION OF THIS REPORT

In this introductory chapter of the report, we review the study's objectives and methodology. Chapter 3 summarizes the survey questions used to identify the key decision-maker and the questions designed to serve as project review for the respondent. Chapter 3 also describes the questions and approach used to estimate the extent of participant free-ridership, participant "like" spillover, and participant "unlike" spillover". Chapter 4 presents the questions and approach used to estimate non-participant "like" spillover approach. In Chapter 5, we present the free-ridership and spillover results at the state level, as well as at the individual PA level.

Appendices A–B detail the sampling plans for the Participant and the Design Professional and Vendor spillover surveys. Appendix C documents the weighting methodology used to produce the participant free-ridership and "like" spillover estimates. Appendix D contains the survey instruments and Appendix E details response rate and program savings coverage. Appendix F contains an example of the Design Professional and Vendor spillover calculation, and Appendix G charts how the free-ridership and spillover scoring was done.

2.2 STUDY OBJECTIVES

The primary objective of the 2010 program year free-ridership and spillover study was to assist the Massachusetts PAs in quantifying the net impacts of their commercial and industrial energy efficiency programs by estimating the extent of:

- Program free-ridership
- Early participant "like" and "unlike" spillover
- Non-participant "like" spillover.

At this point, it is helpful to define free-ridership and spillover. A program's *free-ridership rate* is the percentage of program savings attributed to free-riders. A *free-rider* refers to a program participant who received an incentive or other assistance through an energy efficiency program who would have installed the same high efficiency end-use¹⁵ on their own at that same time if the program had not been

¹⁵ For purposes of this discussion, an "energy efficient end-use" includes high efficiency equipment, an efficiency end-use such as weatherization, or an energy efficient practice such as turning off a computer when not in use.



offered. For free-riders, the program is assumed to have had no influence or only a slight influence on their decision to install or implement the energy efficient end-use. Consequently, none or only some of the energy (and demand) savings from the energy efficient end-uses taken by this group of customers should be credited to the energy efficiency program.

In addition to simply identifying free-riders, it is important to estimate the *extent* of free-ridership for each customer. Pure free-riders (100%) would have adopted exactly the same energy efficient end-use at that time in the absence of the program. Partial free-riders (1–99%) are those customers who would have adopted some end-use on their own, but of a lesser efficiency or a lesser quantity, or at a later time. Thus, the program had some impact on their decision. Non-free-riders (0%) are those who would not have installed or implemented any energy efficient end-use (within a specified period of time) absent the program services.

In contrast, spillover adds benefits to the program, increasing the program benefits and benefit–cost ratio. *Spillover* refers to additional energy efficient end-uses adopted 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 energy efficient end-uses through the program, and then installed additional end-uses of the same type due to program influences. *Participant “unlike” spillover* is where the customer installs energy efficient end-uses different from those offered through the program, but are influenced by the program to do so.

Free-drivers, or non-participant spillover, refers to energy efficient end-uses adopted by program non-participants due to the program's influence. The program can have an influence on design professionals and vendors as well as an influence on product availability or practices, product or practice acceptance, customer expectations, and other market effects. All of these may induce non-participants to take energy efficient end-uses. *Non-participant “like” spillover* refers to additional end-uses of the same type as offered through the program that are adopted due to the program's influence.

2.3 STUDY METHODOLOGY

The methodology used for this year's study follows the standardized methodology developed in 2010 and 2011 for the Massachusetts PAs¹⁶ for use in situations where end-users are able to report on program impacts via self-report methods. This methodology updated the previous standardized methodology developed in 2003¹⁷.

To accomplish the study objectives, telephone surveys were conducted with samples of 2010 program participants in each of the PAs' C&I electric programs and with design professionals and equipment vendors involved in these 2010 installations. The following PA electric C&I programs were included in the 2010 study:

National Grid

- Energy Initiative Program
- Design2000 Program
- Small Business Services Program

¹⁶“Cross-Cutting C&I Free-Ridership and Spillover Methodology Study Final Report”, prepared for the Massachusetts Program Administrators by Tetra Tech, KEMA, and NMR, April 18, 2011.

¹⁷ Pamela Rathbun, Carol Sabo, and Bryan Zent, *Standardization Methods for Free-ridership and Spillover Evaluation—Task 5 Final Report (Revised)*, prepared for National Grid, NSTAR Electric, Northeast Utilities, Unitil, and Cape Light Compact, June 16, 2003.



NSTAR

- Business Solutions Program
- Construction Solutions Program
- Small Business Solutions Program

Western Massachusetts Electric Company (WMECO)

- New Construction Program
- Retrofit Program
- Small Business Program

Unitil

- New Construction Program
- Large C&I Retrofit Program
- Small C&I Retrofit Program

The Cape Light Compact

- New Construction Program
- Medium and Large C&I Retrofit Program
- Medium and Large Government Retrofit Program
- Retrofit Program
- Services and Products Program

2.3.1 Participant free-ridership, “like” and “unlike” spillover surveys

The program participant sample consisted of unique electric *accounts*¹⁸, not unique customer names. The same customer name, or business identity, can have multiple accounts in multiple locations, but program technical support and incentives are provided on behalf of an individual account. Thus, for the purposes of this study, a customer or participant is defined as a unique account¹⁹. Table 2-1 presents the number of participant accounts sampled for the 2010 study, as well as the number of telephone surveys completed for each PA program.

The 2010 Free-ridership and Spillover studies ran concurrently for National Grid, NSTAR, Western Massachusetts Electric Company (WMECO), Cape Light Compact, and Unitil. The majority of the telephone interviews were completed with program participants between April 4 and May 20, 2011. All sampled participating customers were mailed a letter on PA letterhead in advance of the telephone call. This letter explained the purpose of the call, informed customers that someone from Tetra Tech would be calling them in the next couple of weeks to ask them some questions about their experiences

¹⁸ Each account could include multiple applications for efficiency projects. For example, if one account has five lighting applications and one VSD application, this account would show up twice in the sample frame; once for lighting (aggregating all the lighting applications) and once for VSD.

¹⁹ Unique accounts with two or more end-uses were asked about the two largest saving end-uses during one interview.



with the programs, and thanked them for their cooperation in advance. This advance letter and repeated call attempts over a 7 week period resulted in an overall cooperation rate of 63 percent, which increases the level of confidence in the survey results.²⁰ The duration of interviews with program participants averaged twelve minutes.

Table 2-1. 2010 Participant Free-ridership and Spillover Survey Cooperation and Response Rates

Status	Cape Light Compact	National Grid	NSTAR	Unitil	WMECO	Grand Total
Total Sample	187	1,080	1,223	49	375	2,915
Bad Phone #	51	40	53	0	39	183
No Knowledgeable R	9	98	111	1	30	250
Language Barrier	0	3	6	0	1	10
Adjusted sample	127	939	1,053	48	305	2,472
Refusal	7	49	46	5	7	114
Active Sample ²¹	43	313	296	10	130	792
Completed Interviews	77	577	711	33	168	1,566
Cooperation Rate²²	61%	61%	68%	69%	55%	63%
Response Rate²³	41%	53%	58%	67%	45%	54%

2.3.2 Non-participant spillover surveys

In addition to the customer surveys, surveys were conducted with design professionals and equipment vendors who had installed equipment through the PAs' electric C&I programs in 2010. This survey was used for estimating the extent of non-participant spillover for the programs.

The program tracking system databases contained the names of design professionals and vendors. After removing names that did not appear to be actual vendors (for example, some "vendors" were actually customers such as schools) and duplicate names, 514 design professionals and vendors remained. We attempted to complete a survey with as many of these as possible.

Table 2-2 presents the number of designers/vendors in the population, the number sampled, and the number surveyed. Multiple attempts (on different days of the week, and different weeks) were made to complete interviews with these designers and vendors in May 2011.

²⁰ More detailed cooperation rate tables by PA program, as well as savings coverage, can be found in Appendix E.

²¹ Unable to reach respondent despite multiple attempts over a several week time period.

²² Completed Interviews/Adjusted Sample

²³ Completed Interviews/Total Sample



Table 2-2. 2010 Cooperation and Response Rates to the Non-participant Spillover Survey

Status	Number of Records
Total Sample	514
Bad Phone #	46
No Knowledgeable R	10
Language Barrier	0
Adjusted sample	458
Refusal	8
Active	163
Completed Interviews	287
Cooperation Rate²⁴	62.7%
Response Rate²⁵	55.8%

In conjunction with the non-participant vendor survey, interviews were completed with 136 of the 244 design professionals and equipment vendors mentioned by customers during the participant surveys as being influential in the decision to install the efficient equipment (a 56 percent response rate).

²⁴ Completed Interviews/Adjusted Sample

²⁵ Completed Interviews/Total Sample



3. PARTICIPANT SURVEY QUESTIONS

This chapter summarizes the survey questions used to identify the primary decision maker and put the decision making in context by reviewing the project, and the questions used to estimate the extent of free-ridership and participant spillover. Particularly for the free-ridership questions, the skip patterns (which are dependent upon the response to one or more questions) are complex. To simplify discussion of the questions, we have only shown the questions and not the potential response categories or skip patterns. Appendix D of this document contains the detailed free-ridership survey questions for participants. Appendix D also contains the participant “like” spillover survey questions, a parallel version of the free-ridership survey suitable for designers/vendors who are the decision makers, and the non-participant designer/vendor spillover survey.

Prior to discussing the specific questions used to identify the key decision-maker and questions used to review the decision-making process, we discuss the format of the surveys.

3.1 FORMAT

The surveys for free-ridership (and spillover) contain a number of complex skip patterns, and repeat questions for each measure category installed. The surveys also automatically incorporate information about each participant (i.e., measures installed, incentive amount) into the appropriate questions.

The survey averaged 12 minutes in length depending on the customer surveyed and number of measures installed. Many customers, especially the smaller ones, skipped right to the consistency questions because they were initially zero percent free-riders. Others skipped questions if they had not had a significant technical assessment study done or if they had not participated in the programs in previous years.

Given that the same survey instrument was used for all PAs for the different programs, the survey instrument contains a number of areas where fills were used to customize the instrument. These fills are listed and explained in the table below:

Table 3-1. Survey Fills and Explanations

Fill	Explanation
PA	Program administrator
Program	Program name
Address	Street address of project
City	City of project
Date	Date project was completed
Customer	Name of PA customer
Measure Category 1	First measure installed through program
Measure Category 2	Second measure installed through program
All program assistance	All assistance provided by the program included rebates and technical assistance, as well as financing
Study	Indicator of whether the customer received a study funded by the program
Finance	Indicator of whether the customer received financing assistance from the program
Incentive	Amount of financial incentive
Project Cost	Total cost of project for customer



3.2 SUMMARY OF THE 2010 SURVEY QUESTIONS

In order to estimate free-ridership and spillover, the participant survey instrument contains eight key sections:

- Identification of key decision maker(s)
- Project and decision-making review
- Initial free-ridership questions
- Consistency check questions
- Influence of technical assessment (if applicable)
- Influence of past program participation
- Participant “like” spillover questions
- Participant “unlike” spillover questions.

3.2.1 Identification of key decision maker(s)

Identifying and surveying the key decision-maker(s) is critical for collecting accurate information on free-ridership and spillover. Therefore, the first part of the survey is devoted to identifying the appropriate decision-maker within the organization by asking if participants were involved in the decision to purchase the rebated measure and asking about the roles of others in the organization that may have been involved.

If the listed contact person was not the primary decision-maker, information is collected on the person within or outside the company who was the primary decision-maker and the survey is conducted with that individual. In cases where the customer tells the interviewer that a designer/vendor was the key decision-maker, the interviewer collected contact information for the designer/vendor. In these cases, the survey was still completed with the customer, although attempts were made to complete the designer/vendor survey with the designer/vendor. In cases where the designer/vendor agreed they were the most influential, their responses were used to estimate free-ridership for that customer. If the designer/vendor did not agree they were the most influential or if attempts to survey the designer/vendor failed, the customer’s responses were used to estimate free-ridership.

Once the appropriate respondent was identified, they were assured their responses would be kept confidential by the survey firm and National Grid.

The questions used to identify the key decision-maker(s) are detailed below.

- I1** Are you the person who was most involved in making the decision to get <ALL PROGRAM ASSISTANCE> through the <PROGRAM> in <DATE> at <ADDRESS> in <CITY>?
- I1A** Who was primarily responsible for making the decision to get <ALL PROGRAM ASSISTANCE> through the program?
- I2** Are you employed by <CUSTOMER> or are you a contractor who provides design and/or installation services for <CUSTOMER>?
- R1a** Were you involved in the decision-making process when the [EFFICIENCY IS APPLICABLE:: energy efficient] <MEASURE CATEGORY 1> or <MEASURE CATEGORY 2> was being considered for this facility?



- R1b** Aside from yourself, who else within your company or outside your company was involved in the decision of whether or not to purchase the [EFFICIENCY IS APPLICABLE: energy efficient] <MEASURE CATEGORY 1> or <MEASURE CATEGORY 2> through the <PROGRAM>?

3.2.2 Project and decision-making review

The interview then asks about corporate purchasing policies, important factors that he or she considers when purchasing any new equipment, and important factors for the specific rebated project. This section is intended to “prime” the participant by asking them to recall all the various factors that may have been important in the purchase decision. The question text is listed below.

- R3** Does your company have any corporate policies related to energy efficiency standards that you need to consider when purchasing new equipment or making improvements to this facility?
- R4** Which of the following best describes this policy: purchase energy efficient measures regardless of cost, purchase energy efficient measures if it meets payback or return on investment criteria, purchase standard efficiency measures that meet code, or something else?
- FR0** Please think back to the time when you were considering implementing the <MEASURE CATEGORY 1 and MEASURE CATEGORY 2> projects. What factors motivated your business to consider implementing new <MEASURE CATEGORY 1 and MEASURE CATEGORY 2> equipment?

3.2.3 Initial free-ridership questions

The instrument then asks what influence, if any, the program had on the decision to install equipment through the program. As there are several dimensions to the decision to purchase and install new equipment²⁶, the battery discusses the timing of the installation and the quantity and the efficiency level of the equipment installed. These questions reference both the overall effect of the program (including staff recommendations and any technical assistance) and the specific effect of the financial incentive. The questions are listed below. Please note that these questions are measure-specific and are repeated for up to two measure categories.

- FR5** According to our records, the total cost for the project implemented at your facility in <DATE> through the <PROGRAM> was about <TOTAL PROJECT COST>. <PROGRAM ADMINISTRATOR> paid about <INCENTIVE> of the total cost of the [IF EFFECIENCY APPLIES: ENERGY EFFICIENT] <MEASURE CATEGORY> project implemented through the program.

[IF NO <STUDY>: You may have also received some technical assistance from a <PROGRAM ADMINISTRATOR> rep, engineer, or equipment vendor.]

[IF <FINANCE> = Yes] <PA> also provided interest-free financing for up to 24 months for your portion of the project costs.

If <PROGRAM ADMINISTRATOR> had not paid a portion of the implementation cost OR provided any technical assistance or education [IF <FINANCE> = Yes: OR provided interest-free financing] through the <PROGRAM>, would your business have implemented any type of <MEASURE CATEGORY> project at the same time?

²⁶ The instrument is designed to handle both rebated equipment (e.g., lighting) and rebated services (e.g. delamping). However, as this study only addresses equipment, the memo does not include any references to rebated services.



- FR6A** Would you have implemented the <MEASURE CATEGORY> project earlier than you did, at a later date, or never?
- FR6B** How much [EARLIER/LATER] would you have implemented the <MEASURE CATEGORY> project?
- FR7A** Without the program incentive and technical assistance or education, would your business have implemented the exact same quantity of <MEASURE CATEGORY> equipment [IF FR5=YES OR DK: AT THAT SAME TIME; IF FR5=2: WITHIN (TIMEFRAME IN FR6B)]?
- FR7B** Compared to the amount of <MEASURE CATEGORY> that you implemented through the program, what percent of the project do you think your business would have purchased on its own during that timeframe?
- FR8A** You said your business would have installed [IF FR7A=YES: all; IF FR7A= NO: (FILL WITH FR7B %)] of the equipment on its own if the program had not been available.

Thinking about the <MEASURE CATEGORY> equipment you would have installed on your own, what percent of this equipment would have been of the same high efficiency as what was installed through the program?
- FR8B** (What percent would have been of) lower efficiency than what was purchased but higher than standard efficiency or code?
- FR8C²⁷** And of standard efficiency or code?

3.2.4 Consistency check questions

The instrument also included questions that would confirm or correct inconsistent responses. For example, if participants reported that they were likely to install the equipment without the program but also reported that they would not have installed the energy efficient equipment within four years, the interviewer asked them to confirm which statement was more accurate. These questions are listed below.

- FR1** On a scale of 0 to 10, with 0 being not at all likely and 10 being very likely, how likely is it that your business would have implemented the same [IF QUANTITY VARIES: QUANTITY AND] [IF EFFICIENCY APPLIES: EFFICIENCY OF] <MEASURE CATEGORY> at that same time if the <PROGRAM ADMINISTRATOR> had not provided the <PROGRAM ASSISTANCE>?
- C3** On a scale of 0 to 10, with 0 being no influence and 10 being a great deal of influence, how much influence did the <INC> you received from <PROGRAM ADMINISTRATOR> have on your decision to implement the [IF EFFICIENCY APPLIES: HIGH EFFICIENCY] <MEASURE CATEGORY> project?
- C4A** Now I want to focus on what it would have cost your business to install this equipment on its own without the program. On a scale of 0 to 10, with 0 being not at all likely and 10 being very likely, how likely is it that your business would have paid the additional <INC> on top of the amount you already paid, to implement the same quantity and efficiency of <MEASURE CATEGORY> equipment at that same time?
- C8** [ASK IF FR1 > 3 AND FR6b >24/48 MONTHS OR NEVER] Earlier in the interview, you said there was a [FR1 SCORE] in 10 likelihood that you would have implemented the same quantity

²⁷ For measures where quantity is not applicable but efficiency levels do vary, this question is combined into one item: FR8D.



and efficiency of <MEASURE CATEGORY> equipment at that same time in the absence of the program assistance. But you also said you would not have implemented the <MEASURE CATEGORY> project within 2/4 years of when you did. Which of these is more accurate?

- C9** I'd like to better understand your purchase decision. In your own words, please describe what impact, if any, the program had on your decision to install the energy efficient <MEASURE CATEGORY> equipment at the time you did and in the quantity you did?

As inputs into the algorithm, Tetra Tech constructed a scoring system based on the influence and consistency check questions above. The scoring calculates two scores: a quantity score and an efficiency score. The quantity score represents the percentage of the rebated equipment that would have been installed in absence of the program. The efficiency score is the percentage of savings *per unit installed* that would have occurred without the program. For equipment that is reported to be more efficient than standard but less efficient than what was installed through the program, we assume 50 percent of the savings for those measures. Multiplying these two scores together gives the percent of the rebated savings that would have occurred without the program. This percentage is the raw free-ridership estimate. Table 3-2 details these calculations.

Table 3-2. Quantity and Efficiency Scores

Score	Responses	Result
Quantity Score (FR_QTY)	If would have installed same quantity without program (FR7A = YES)	FR_QTY = 1
	If would have installed fewer quantity without program (FR7A = NO)	FR_QTY = FR7B
	If never would have installed (FR6A = never)	FR_QTY = 0
Efficiency Score (FR_EFF)	If would have installed at least some equipment on their own	FR_EFF = FR8A + (FR8B*.50)
	If never would have installed (FR6A = never)	FR_EFF = 0
Initial Free-ridership Score	The percent of the rebated savings that would have occurred without the program.	FR_EFF * FR_QTY

The product of these two scores is then adjusted by a timing factor. The timing factor adjusts the raw free-ridership estimate downward for all or part of the savings that would have occurred without the program, but not until much later. By doing so, the program is given credit for accelerating the installation of energy efficient equipment. For example, if the participant states that he or she would have installed equipment at the same time regardless of the program, the quantity-efficiency factor is not adjusted. However, if the participant states that, without the program, they would have completed the project more than 6 months later than they actually did, any free-ridership identified in the quantity-efficiency factor is adjusted downward²⁸. The degree of the adjustment depends on the program. As the equipment planning schedule for small businesses is likely shorter than the planning schedule for large businesses, small business programs receive a greater acceleration benefit. This reduced adjustment for small businesses reflects the increased effect the program has on the planning schedule. This adjustment is detailed in Table 3-3 and visualized in Figure 3-1.

²⁸ Projects that were accelerated by fewer than 6 months are not adjusted. As installation timelines are subject to shifting, we assume these projects are just as likely to have been installed at the same time.

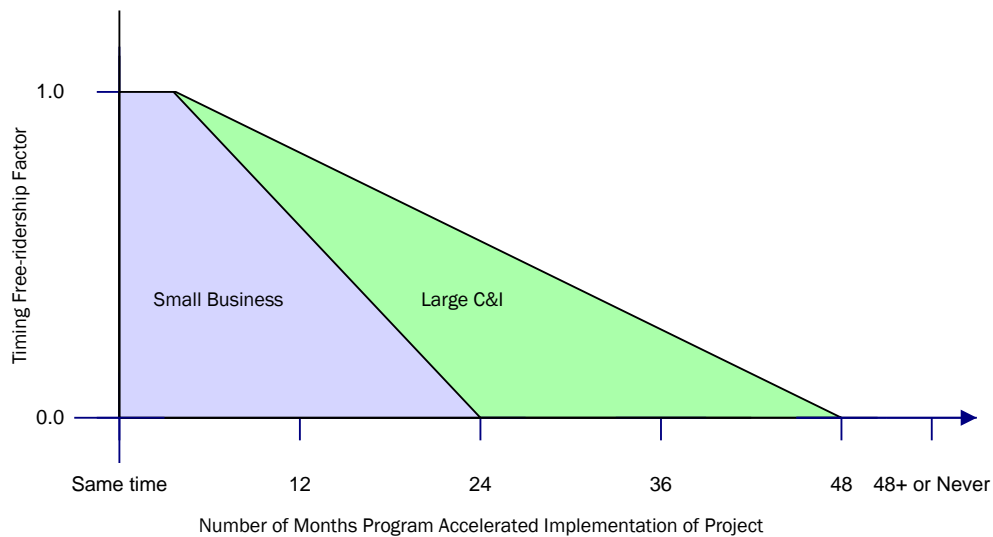


Table 3-3. Timing Factor Adjustment

Score	Responses	Result
Timing Factor— Small Business Programs (FR_TIMING)	Would have installed at the same time without the program (FR5 = Yes)	$FR_TIMING = 1$
	Would have installed within six months of when participant actually did without the program (FR6A ≤ 6 months)	$FR_TIMING = 1$
	Would have installed sometime between 7 and 24 months of when participant actually did without the program (FR6A > 6 months & < 24 months)	$FR_TIMING = 1 - ((FR6B - 6) * .056)$
	Would have installed sometime after 24 months of when participant actually did without the program (FR6A > 24 months)	$FR_TIMING = 0$
	Would have never installed without the program (FR6A = Never)	$FR_TIMING = 0$
Timing Factor— Large Business Programs (FR_TIMING)	Would have installed at the same time without the program (FR5 = Yes)	$FR_TIMING = 1$
	Would have installed within six months of when participant actually did without the program (FR6A ≤ 6 months)	$FR_TIMING = 1$
	Would have installed sometime between 7 and 48 months of when participant actually did without the program (FR6A > 6 months & < 48 months)	$FR_TIMING = 1 - ((FR6B - 6) * .024)$
	Would have installed sometime after 48 months of when participant actually did without the program (FR6A > 48 months)	$FR_TIMING = 0$
	Would have never installed without the program (FR6A = Never)	$FR_TIMING = 0$
<i>Adjusted Free-ridership Score</i>	<i>The raw free-ridership estimate adjusted for all or part of the savings that would have occurred without the program, but not until much later</i>	$FR_TIMING * \text{Initial Free-ridership Score}$



Figure 3-1. Timing Free-ridership Factor by Number of Months the Program Accelerated Implementation



This adjusted score is reviewed for consistency and, if applicable, for vendor influence via a follow-up interview with vendors that are rated influential by participants. Questions FR4 and C1 (below) are used to assess vendor influence. Details regarding the Influential Vendor survey are discussed in the next section.

- FR4** Who was MOST responsible for actually recommending or specifying the [IF EFFICIENCY IS APPLICABLE: high efficiency] <MEASURE CATEGORY> project that was implemented through the <PROGRAM>?
- C1** On a scale of 0 to 10, with 0 being no influence and 10 being a great deal of influence, how much influence did (FR4 response) have on your company's decision to implement the [IF EFFICIENCY IS APPLICABLE; high efficiency] <MEASURE CATEGORY> project so that it would qualify for the program?

3.2.5 Influence of technical assessment

The initial free-ridership score is further adjusted by the influence of any program-sponsored technical assistance or audit and by the influence of previous program participation. If a participant rates the influence of the technical assistance as high (7 or greater on a scale of 0-10), the free-ridership score is reduced by half. This reduction is necessary because the previous factors focus on the specific effect of the program incentive and the overall effect of the program. Without this adjustment, the influence of the technical assessment is under-represented.

- C2** On a scale of 0 to 10, with 0 being no influence and 10 being a great deal of influence, how much influence did the information provided by the <STUDY> have on your decision to implement the [IF EFFICIENCY IS APPLICABLE: high efficiency] <MEASURE CATEGORY> project?



3.2.6 Influence of past program participation

Likewise, if a participant has previously participated in the program, they are asked about the influence of that past participation on their perceptions and behaviors. Participants are asked to state whether they agree or disagree with four statements about the effect past participation has had on their decision-making. Based on the number of statements with which they agree, their free-ridership is reduced by 75 percent, 37.5 percent, or not reduced at all. This reduction is done to account for the influence positive program experiences have had on participants’ purchasing decision – with the program administrators, implementers, or the equipment incented.

PP3 I'm going to read you several statements. For each statement, please tell me whether you agree or disagree that this statement applies to your business. There are no right or wrong answers; we just want your honest opinion.

Our previous experience implementing energy efficient projects through the <PROGRAM>

- a. Has made our firm more likely to consider energy efficient equipment
- b. Has made our firm more likely to install energy efficient equipment
- c. Has given us more confidence in the financial benefits of energy efficient equipment
- d. Has given us more confidence in the nonfinancial benefits of energy efficient equipment

As mentioned previously, the previous program participation adjustment is made to account for the market effects associated with over 20 years of energy efficiency programs in Massachusetts. These market effects will result in net savings estimates that do not capture the full cumulative effect of the program. This methodology attempted to capture some of these market effects by making this adjustment for previous program participation. While it could be argued that the influence of previous participation should count as spillover rather than reduced free-ridership, the traditional definition of spillover does not count measures installed through a program as spillover. Table 3-4 details these adjustments.

Table 3-4. Adjustments for the Influence of Technical Assessments and Previous Participation

Adjustment	Responses	Result
Technical Assessment Adjustment	No technical assessment, audit, or study conducted	No adjustment
	Participant would have performed assessment, audit, or study without program assistance or it was not influential (C2 ≤ 6)	No adjustment
	Participant would not have performed assessment, audit, or study without program assistance and it was influential (C2 > 6)	Adjusted Free-ridership Score * .5
Previous Participation Adjustment	No previous participation in program	No adjustment
	Agrees with four statements regarding the positive influence of past participation (PP3)	Adjusted Free-ridership Score * .25
	Agrees with three statements regarding the positive influence of past participation (PP3)	Adjusted Free-ridership Score * .625
	Agrees with two or fewer statements regarding the positive influence of past participation (PP3)	No adjustment



Flowchart diagrams detailing these calculations have been included in Appendix G of this report.

3.2.7 Participant “like” spillover

The “like” spillover estimates are computed based on how much more of the same energy-efficient equipment the participant installed outside the program that were, in fact, influenced by the program. The following questions, in conjunction with the savings assigned to that same equipment by the program, are used to estimate possible spillover savings:

- S1A** Now I'd like you to think of the time since you participated in the <PROGRAM> in <DATE>. Has your company implemented any <MEASURE CATEGORY> projects for this or other facilities in Massachusetts **on your own**, that is without a rebate from <PA>?
- S1B** Was this equipment of the same efficiency level or a higher level of efficiency as the equipment you installed through the program?
- S1C** Was this equipment more energy efficient than standard efficiency or code equipment?
- S2A** About how many additional [IF EFF = 1: ENERGY EFFICIENT] <MEASURE CATEGORY> projects did your business implement on its own since participating in this program in 2010 compared to the amount you implemented through the program?

For respondents that answer “Yes” to S1A and S1B, spillover savings are calculated as the measure-specific savings identified by the program multiplied by the quantity identified in S2A. For respondents that answer “Yes” to S1A and S1C, spillover savings are calculated as 50 percent the measure-specific savings identified by the program multiplied by the quantity identified in S2A. If the respondent answers “No” to S1A or S1C, there are no identifiable “like” spillover savings.

For those measures, a program-attributable spillover rate is then calculated based on the following questions:

- S3A** Did a recommendation by the contractor, engineer, or designer who you worked with under the <PROGRAM> influence your decision to implement some or all of this [IF EFF = 1: EFFICIENT] <MEASURE CATEGORY> equipment on your own?
- S3B** Did your experience with the energy efficient projects implemented through the <PROGRAM> influence your decision to implement some or all of this [IF EFF = 1: EFFICIENT] <MEASURE CATEGORY> equipment on your own?
- S3C** Did your participation in any past program offered by <PROGRAM ADMINISTRATOR> influence your decision to implement some or all of this [IF EFF = 1: EFFICIENT] <MEASURE CATEGORY> equipment on your own?

If the respondent reports that the contractor influenced their decision to install the like equipment on their own, we attribute the program with 50 percent of those savings based on the influence the program has on the trade allies. If the respondent reports that either their experience with the program-sponsored project or past programs influenced their decision to implement the like equipment, we attribute the program with 100 percent of the spillover savings.



To summarize:

If (S3A=yes AND (S3B = no AND S3C = no)), spillover rate = 50%.

If (S3B=yes OR S3C = yes), spillover rate = 100%.

That rate, applied to the estimated spillover savings, results in the program-attributable spillover savings for that participants.

3.2.8 Participant “unlike” spillover

In addition to “like” spillover, the 2010 study also measured “unlike” spillover (i.e., end-uses outside of those installed through the program). To establish spillover savings, program eligibility was used as a proxy for energy efficiency. The following questions were used to identify “unlike” spillover.

- S5** Since participating in <PROGRAM>, had your company purchased, installed, or implemented any other type of energy efficient equipment on your own, that is without a rebate from <PA>?
- S6** What did you install (RECORD TYPE, QUANTITY, SIZE, and CAPACITY)?
- S7A** Would this project have qualified for an incentive through the <PROGRAM>?

Once identified, program influence needs to be established. Using the same methodology as with “like” spillover, we ask a series of questions to determine a program-attributable spillover rate:

- S7B** Did a recommendation by the contractor, engineer, or designer who you worked with under the <PROGRAM> influence your decision to implement some or this equipment on your own?
- S7C** Did your experience with the energy efficient projects implemented through the <PROGRAM> influence your decision to implement some or this equipment on your own?
- S7D** Did your participation in any past program offered by <PA> influence your decision to implement some or all of this equipment on your own?

As with “like” spillover, if the respondent reports that the contractor influenced their decision to install the like equipment on their own, we attribute the program with 50 percent of those savings based on the influence the program has on the trade allies. If the respondent reports that either their experience with the program-sponsored project or past programs influenced their decision to implement the “unlike” equipment, we attribute the program with 100 percent of the spillover savings.

However, given the difficulties in estimating savings for these installations using regular telephone interviewers, we present only indicators of “unlike” spillover and not savings estimates. The joint NEI/spillover study to be conducted later in 2011 and 2012 by expert interviewers will allow for better estimation of “unlike” spillover.



4. VENDOR/DESIGN PROFESSIONAL SURVEY QUESTIONS

4.1 OVERVIEW OF INFLUENTIAL VENDOR SURVEY QUESTIONS

As mentioned earlier, we attempted to contact vendors and design professionals identified by program participants as being most influential in their decision to install the energy saving measures through the program (Questions FR4 and C1 discussed above). A separate survey tailored to these designers/vendors was administered for the purposes of estimating free-ridership. (see Appendix D).

Design professionals'/vendors' responses to the free-ridership questions replaced participants' responses if the designer/vendor agreed they were most influential (VA3 = 4 or 5). If the designer/vendor did not agree they were the most influential (VA3 is less than 4), or if attempts to survey the designer/vendor failed, the customer's responses were used to estimate free-ridership.

4.1.1 Design professional/vendor's identification of decision-maker

Participant-identified design professionals/vendors were first asked a series of introductory questions designed to verify that they were most influential in the decision to install the equipment. The questions are shown below:

Table 4-1. Design Professional/Vendor's Identification of Decision-maker

Item	Text
V1A	First I'd like to ask you about your decisions to recommend <MEASURE CATEGORY> through the <PROGRAM>. Were you involved in the decision-making process at the design stage when the <MEASURE CATEGORY> equipment was specified and agreed upon for this facility?
V1B	(IF NO) At what point in the process did you become involved?
V1C	What was your role?
V3	On a scale of 0 to 10, with 0 being no influence and 10 being a great deal of influence, how much influence did your firm have on specifying the efficiency levels or features of <MEASURE CATEGORY> so that it would qualify for the program? (NOTE: THOSE WHO ANSWER 4 OR 5 TO THIS QUESTION WILL BE ASKED THE FREE-RIDERSHIP QUESTIONS, WHICH WILL REPLACE PARTICIPANTS' RESPONSES)

4.1.2 Design professional/vendor free-ridership questions

The design/vendor free-ridership survey questions are a parallel version of the customer survey questions and are not discussed here. Questions from the customer version of the survey that are inappropriate for designers/vendors were not asked.

4.2 OVERVIEW OF NON-PARTICIPANT SPILLOVER SURVEY QUESTIONS

Non-participant **spillover** refers to energy efficient measures installed by program non-participants due to the program's influence. The program can have an influence on design professionals and vendors as well as an influence on product availability, product acceptance, customer expectations, and other market effects, all of which may induce non-participants to buy high efficiency products.

An important issue related to the quantification of non-participant spillover savings is how to value the savings of measures installed outside the program. Experience has shown that customers cannot



provide adequate equipment-specific data on new equipment installed either through or outside a program to a telephone interviewer. Although they are usually able to report what type of equipment was installed, they typically cannot provide sufficient information about the quantity, size, efficiency, and/or operation of that equipment to make a determination about its program eligibility.

Thus, it was decided to survey design professionals and equipment vendors who were more knowledgeable about equipment and who were familiar with what is/is not program-eligible. Since there were kWh savings associated with design professionals or vendors (by measure category) in the program tracking system database for the PAs included in the study, we knew for each design professional/vendor the savings attributable to them for eligible equipment installed through the program.

To determine non-participant spillover, design professionals and equipment vendors were asked (by measure category) what percent of their sales to the customers of the PAs participating in the non-participant component of the study met or exceeded the program standards for each program measure category installed through the program(s) and what percent of these sales did not receive an incentive. They were then asked several questions about the program's impact on their decision to recommend/install this efficient equipment outside the program. Using the survey responses and measure savings data from the program tracking system, the potential non-participant spillover savings could be estimated for each design professional/vendor and the results extrapolated to the total program savings.

This method of estimating non-participant spillover is a *conservative* estimate for two reasons. First, not all design professionals and equipment vendors who are familiar with the programs will have specified and/or installed equipment through the program during the study period. Thus, we miss any non-participant spillover that is associated with these other design professionals/vendors (although it is less likely these design professionals/vendors had non-participant spillover if they are not involved with the programs).

Second, this method only allows extrapolation of non-participant spillover **for those same measure categories that a particular design professional/vendor is associated with in the program database**. Thus, if a vendor installed program-eligible equipment in other measure categories outside the program, but none through the program, this method does not capture non-participant spillover savings for that particular type of equipment. In essence, this method measures only "like" non-participant spillover; that is, spillover for measures like those installed through the program during the study period.

Four steps were used to determine non-participant "like" spillover:

1. For each design professional/vendor, the survey determined the percentage of all program-eligible equipment sold/installed outside the program in utilities' territories.
2. For each design professional/vendor, the survey determined whether the sale or installation of program-eligible equipment outside the program was due to the program (non-participant spillover).
3. For each design professional/vendor, savings associated with this "non-participant spillover" equipment were determined by examining the participant database and quantities installed.
4. Non-participant spillover savings were then extrapolated from the survey to the total program savings in the year.

Each of these steps is discussed in more detail below.



4.2.1 Step 1: Determine the percentage of all program-eligible equipment installed outside the program

Using the program database, we identified which measures design professionals/vendors installed, and how those measures fit into measure categories. For measure categories they installed through the program, design professionals/vendors were asked what percent of the equipment would have been eligible for the programs and what percent of that eligible equipment did not receive an incentive through the programs. Those who said some of the eligible equipment did not receive an incentive through the programs are included in Step 2 of the non-participant spillover analysis.

VNP1a Our records show that your firm specified, sold, and/or installed <MEASURE CATEGORY> to Commercial and Industrial customers in 2010 through <PROGRAM>. This includes equipment such as <DETAILED DESCRIPTION>. Is that correct? *(Read for each measure category identified; use detailed measure descriptions to further identify the measures installed in the broad measure category)*

VNP2 *(FOR EACH MEASURE CATEGORY RESPONDED YES)* Please think about all the program-eligible <MEASURE CATEGORY> you specified, sold and/or installed for <PA> customers in 2010. Did you specify, sell, and/or install any of this program-eligible <MEASURE CATEGORY> to customers of <PA> **without** the customer participating in a <PA> program??

VNP3 *(IF VNP2 = Yes)* What percent of all of this program-eligible <MEASURE CATEGORY> you specified, sold and/or installed for <PA> customers in 2010 did not receive an incentive through a <PA> program?

4.2.2 Step 2: Determine whether the program-eligible equipment specified/installed outside the program was due to the program

A number of additional questions were asked of design professionals/vendors who had program kWh savings associated with the types of program-eligible equipment specified/installed outside the program. These questions measured the causal effect of the program on design professionals/vendors actions. These questions and the preliminary non-participant “like” spillover rate are shown below.

VNP5 I’m going to read you 3 statements. For each statement, please tell me whether you agree or disagree that this statement applies to your company. There are no right or wrong answers; we just want your honest opinion.

Our past experience specifying or installing <MEASURE CATEGORY> through energy-efficiency programs has convinced us that this equipment is cost effective or beneficial even without a program incentive.

VNP6 Because of our previous experience with the performance of energy efficient equipment installed through energy-efficiency programs, and what we learned through working with <PA>, we are better able to identify opportunities to improve energy efficiency by using high efficiency <MEASURE CATEGORY>.



VNP7 Because of our previous experience with the performance of energy efficient equipment installed through energy-efficiency programs, and what we learned through working with <PA>, we are more likely to discuss energy efficient options with all of our customers when developing project plans for <MEASURE CATEGORY>.

Based on these responses, we calculated a preliminary non-participant “like” spillover rate, as shown in the table below.

Table 4-2. Preliminary Non-participant “Like” Spillover Rate

# of Agreements to VNP5–VNP7	Preliminary Non-participant “Like” Spillover Rate
3	100%
2	50%
1 or 0	0%

a. Non-participant spillover consistency checks

To improve the reliability of the non-participant spillover estimates, two consistency check questions were also asked:

VNP4 In 2010, you mentioned that about [VNP3] of the <MEASURE CATEGORY> you specified, sold, or installed would have been eligible for an incentive through a <PA> program, but did not receive an incentive.

What are the main reasons why your firm did not request a customer incentive from a utility for this energy saving equipment you specified/installed?

VNP8 Please describe what impact, if any, the <PROGRAM> had on your decision to specify or install energy efficient <MEASURE CATEGORY> outside of the program.

Note that in the preliminary “like” spillover questions, we asked the respondent to refer to program-eligible equipment. Therefore, we ideally would have no cases that provide the response “did not qualify” to VNP4. However, in the event this response was provided, the preliminary non-participant estimate is reduced by 50 percent. We did not completely exclude “did not qualify” measures as non-participant spillover since this response only suggested some uncertainty about the eligibility requirements.

The final consistency question was asked to ensure that the responses given to the first set of non-participant spillover questions were consistent. The response to this last question was visually examined. If the response to the last question contradicted the other responses, the adjusted non-participant spillover rate was reduced by one-half or doubled. For example, if a vendor agreed with all 3 statements about the impact of their past experience with the program on the installation of program-eligible equipment outside the program, they received a preliminary non-participant spillover estimate of 100 percent. If the main reason why they did not have the customer apply for the incentive was something other than “didn’t qualify” (e.g., wasn’t worth the paperwork hassle), the adjusted non-participant spillover rate remained at 100 percent. If, however, in the open-ended question the vendor said, “I would say that, let’s see, it really didn’t impact the business because our business is driven by more than rebates” or “I don’t think it’s had much” or “almost no” impact, the final non-participant spillover rate was reduced to 50 percent. These responses may indicate that the program influenced a number of installations/sales but the customer/vendor did not want to prepare the paperwork to get the incentive.



4.2.3 Step 3: Determine the savings associated with this non-participant spillover equipment

At the end of Step 2, respondents with non-participant spillover were assigned a non-participant spillover percent for one or more measure categories. As illustrated in the footnote at the bottom of this page, the third step associated kWh savings with each non-participant spillover measure for each respondent.²⁹

For example, assume a vendor had 200,000 kWh savings in the program tracking system database attributable to motor measures. If that vendor said that 25 percent of all their program-eligible motors were sold outside the program, the potential non-participant spillover savings would be $(200,000 \text{ kWh} * 0.25 / (1 - 0.25)) = 66,667 \text{ kWh}$. If this vendor was assigned (in Step 2) a non-participant spillover rate of 100 percent for motors, the non-participant spillover kWh savings for that vendor remains at 66,667 kWh. But if that same vendor was assigned (in Step 2) a non-participant spillover rate of only 50 percent for program-eligible motors, the non-participant spillover kWh savings for that vendor was $66,667 * 0.5 = 33,334 \text{ kWh}$. This type of calculation was made by measure category for each design professional and vendor who had a non-participant spillover rate of more than 0 percent.

As discussed earlier under the measurement of participant spillover, the participating customer survey and analysis included calculations of “like” spillover. “Like” spillover was defined as measures exactly like the participant’s measures installed through the program that the participant installed at a later time *and* for which they did not receive an incentive even though they said the program influenced their decision. To avoid double-counting the spillover for the same measures reported by both participants and their design professionals/vendors, we eliminated any savings that had been identified as “like” spillover by participants and that were also associated with a design professional or vendor who had demonstrated non-participant spillover for the same measure category. This conservative approach was based on the assumption that the same design professional or vendor was involved in the participant’s “like” spillover project.

4.2.4 Step 4: Extrapolate the survey non-participant spillover savings to the total vendor population savings during the study period

The last step in the non-participant spillover estimation involved extrapolating the results to all vendors in the program tracking system database for each measure category. This was done by first calculating

²⁹ The formula for calculating kWh savings for each measure was derived as follows:

Definitions:

- a = Gross kWh in program tracking system database (measures that received an incentive)
- b = Percent of program-eligible equipment that received no incentive (survey question)
- x = kWh non-participant spillover (spillover reported by design professional/vendor—“like” spillover by participants associated with design professional/vendor)

Solve for x:

- Total kWh for all program-eligible equipment = kWh savings for efficient equipment sold through program + kWh savings for efficient equipment sold outside the program = $a + x$
- $b = \text{non-participant spillover} / \text{total kWh} = x / (a + x)$

Therefore:

- $b = x / (a + x)$
- solving for x yields
- $x = b * a / (1 - b)$

Non-participant spillover = fraction of equipment receiving no incentive * kWh in database / (1 - fraction of equipment receiving no incentive).



the ratio of non-participant spillover as determined from the vendor survey. This ratio (the estimated spillover percent) was then applied to the kWh savings represented by vendors in the program tracking system database.

For example, if the survey covered a total of 75,857,814 kWh in measure category savings and the surveyed non-participant spillover totals 6,962,221 kWh for that measure category, surveyed non-participant spillover divided by the surveyed total kWh savings is 9.2 percent. This identified non-participant spillover savings was extrapolated to all vendors related to the programs by proportionally applying the identified savings to each program at the measure-level.

5. FREE-RIDERSHIP AND SPILLOVER STUDY RESULTS

This section presents the results of the 2010 free-ridership and spillover study. First, we present summary tables that include statewide figures both at a program level and an end-use level. Following the summary tables, we present detailed results for each PA. The detailed results include free-ridership and spillover rates by end-use and by program, along with corresponding error margins. We then present detailed statewide non-participant spillover results and indicators of participant “unlike” spillover for each PA.

5.1 STATEWIDE RESULTS

Table 5-1 summarizes the free-ridership and spillover estimates by PA and program, in addition to presenting overall rates by program type and statewide. The statewide free-ridership rate is 15.3 percent, the participant spillover rate is 8.8 percent, and the non-participant spillover rate is .6 percent, resulting in a statewide net-to-gross ratio (NTGR) of 94.1 percent.

Table 5-1. 2010 C&I Free-ridership and Spillover Results Summary

PA	Program	Free-ridership	Spillover	Non-participant Spillover	Overall Net-to-Gross ³⁰	Surveyed Accounts
Cape Light Compact	Medium and Large C&I Retrofit	12.5%	0.0%	3.4%	90.9%	4
	Medium and Large Government Retrofit	22.2%	0.0%	2.4%	80.2%	7
	New Construction	75.4%	0.0%	0.0%	24.6%	5
	Services & Products	40.1%	64.3%	0.0%	124.1%	6
	Retrofit	8.6%	5.3%	N/A	96.7%	97
National Grid	Energy Initiative	15.0%	5.4%	0.7%	91.1%	277
	Design 2000plus	22.5%	19.6%	0.6%	97.8%	214
	Small Business Services	4.6%	0.9%	N/A	96.3%	232
NSTAR	Business Solutions	16.6%	15.5%	0.8%	99.6%	299
	Construction Solutions	18.4%	10.1%	0.9%	92.6%	254
	Small Business Solutions	8.3%	6.0%	N/A	97.7%	301
Unitil	Large C&I Retrofit	23.9%	0.0%	6.1%	82.2%	5
	New Construction	30.6%	0.0%	3.6%	73.0%	7
	Small C&I Retrofit	7.3%	7.9%	N/A	100.6%	21
WMECO	Retrofit	17.7%	4.3%	0.0%	86.6%	38
	New Construction	19.5%	0.3%	0.0%	80.8%	41
	Small Business	9.8%	1.5%	N/A	91.7%	126
Large Retrofit programs		15.7%	9.1%	0.7%	94.1%	727
New Construction programs		20.0%	11.5%	0.8%	92.3%	521
Services & Products programs		40.1%	64.3%	0.0%	124.1%	6
Small Business programs		7.2%	3.7%	N/A	96.4%	680
Massachusetts Overall		15.3%	8.8%	0.6%	94.1%	1934

³⁰ NTG = (1-FR) + PSO + NPSO



Table 5-2 also presents statewide free-ridership and spillover rates for each end-use combined across all PAs and programs. Excluding the limited number of hot water end-uses, Combined Heat & Power (CHP) and refrigeration end-uses have the lowest level of free-ridership: 7.4 percent for both end-uses. Excluding the limited number of comprehensive design and building envelope projects, compressed air end-uses have the highest free-ridership rate.

Table 5-3 on the following page presents free-ridership and spillover rates by end-use and major program type across all PAs.

Table 5-2. 2010 Statewide C&I Free-ridership and Spillover Results by End-use (all PAs and all Programs)

End-use	Free-ridership	90% Error Margin	Participant "Like" Spillover	90% Error Margin	Non-participant Spillover	Net-to-Gross	Surveyed Accounts ³¹	Population of Accounts
Compressed Air	19.3%	± 4.9%	1.8%	± 1.7%	1.1%	83.6%	89	182
HVAC	17.1%	± 2.7%	9.0%	± 2.0%	0.0%	92.0%	320	795
Lighting	14.6%	± 1.7%	6.8%	± 1.2%	0.0%	92.2%	977	5690
Motors & Drives	13.0%	± 2.2%	4.6%	± 1.4%	7.5%	99.2%	296	575
Process	18.6%	± 5.2%	14.7%	± 4.7%	0.0%	96.1%	76	153
Refrigeration	7.4%	± 2.3%	27.9%	± 3.9%	0.0%	120.6%	247	792
Hot Water	0.0%	± 0.0%	97.9%	± 4.8%	0.0%	197.9%	6	8
Building Envelope	73.8%	± 29.5%	0.0%	± 0.0%	0.0%	26.2%	3	6
CHP	7.4%	± 15.7%	15.8%	± 21.9%	0.0%	108.4%	5	15
Comprehensive ³²	39.8%	± 26.6%	0.0%	± 0.0%	0.0%	60.2%	5	11

³¹ The sum of surveyed accounts at the end-use level is greater than the total number of surveys as some projects were split into two end-use categories.

³² Five National Grid projects were listed as "Comprehensive Design" projects and could not be assigned a single end-use.



Table 5-3. 2010 Statewide C&I Free-ridership and Spillover Results by End-use and Program Type

Program Type	End Use	Free-ridership	90% Error Margin	Spillover	90% Error Margin	Non-participant Spillover	Net-to-Gross	Surveyed Accounts	Population of Accounts
Large Retrofit	Compressed Air	7.0%	5.9%	0.0%	0.0%	1.5%	94.5%	22	39
	HVAC	13.4%	4.2%	6.4%	3.0%	0.0%	93.0%	98	212
	Lighting	16.9%	3.0%	8.4%	2.2%	0.0%	91.5%	319	1404
	Motors/Drives	9.6%	3.0%	6.0%	2.4%	7.7%	104.1%	128	256
	Process	25.7%	11.6%	11.1%	8.4%	0.0%	85.4%	22	52
	Refrigeration	8.7%	5.2%	36.0%	8.8%	0.0%	127.3%	51	140
	CHP	7.4%	15.7%	15.8%	21.9%	0.0%	108.4%	5	15
	Comprehensive	40.7%	33.0%	0.0%	0.0%	0.0%	59.3%	2	3
New Construction	Compressed Air	33.6%	7.0%	4.0%	2.9%	1.5%	71.9%	66	142
	HVAC	21.6%	4.2%	11.9%	3.3%	0.0%	90.3%	162	416
	Lighting	19.9%	4.5%	8.8%	3.2%	0.0%	88.9%	125	294
	Motors/Drives	22.5%	4.1%	1.4%	1.2%	7.7%	86.6%	113	191
	Process	9.7%	4.7%	19.3%	6.2%	0.0%	109.6%	44	74
	Refrigeration	12.5%	10.2%	34.5%	14.7%	0.0%	122.0%	11	18
	Building Envelope	75.0%	39.0%	0.0%	0.0%	0.0%	25.0%	2	5
	Comprehensive	10.8%	23.3%	0.0%	0.0%	0.0%	89.2%	3	8
Small Business	Compressed Air	10.0%	0.0%	0.0%	0.0%	N/A	90.0%	1	1
	HVAC	6.8%	4.5%	14.0%	6.2%	N/A	107.2%	54	149
	Lighting	7.8%	1.8%	2.8%	1.1%	N/A	95.0%	533	3,992
	Motors/Drives	6.1%	4.0%	0.7%	1.4%	N/A	94.6%	55	128
	Process	16.7%	15.4%	0.0%	0.0%	N/A	83.3%	10	27
	Refrigeration	2.2%	1.5%	9.2%	2.9%	N/A	107.0%	185	634
	Hot Water	0.0%	0.0%	97.9%	4.8%	N/A	197.9%	6	8
	Building Envelope	1.0%	0.0%	0.0%	0.0%	N/A	99.0%	1	1



5.2 DETAILED PROGRAM ADMINISTRATION RESULTS

5.2.1 National Grid results

Table 5-4 summarizes the free-ridership and spillover rates for the National Grid programs by end-use. Comprehensive design end-uses and industrial process end-uses have the highest levels of free-ridership: 39.8 percent and 22.1 percent respectively. However, industrial process end-uses also have the highest reported participant spillover rate of 27 percent. CHP projects reported no free-ridership.

Table 5-4. National Grid Free-ridership and Spillover Results by End-use

End-use	Free-ridership	90% Error Margin	Participant "Like" Spillover	90% Error Margin	Non-participant Spillover	Net-to-Gross	Surveyed Accounts	Population of Accounts
Compressed Air	14.7%	± 5.4%	0.0%	± 0.0%	1.1%	86.4%	62	131
HVAC	14.7%	± 3.7%	6.1%	± 2.5%	0.0%	91.5%	147	360
Lighting	14.8%	± 2.8%	4.3%	± 1.6%	0.0%	89.5%	363	2014
Motors/Drives	7.3%	± 2.6%	5.2%	± 2.2%	7.3%	105.2%	150	321
Process	22.1%	± 10.3%	27.0%	± 11.0%	0.0%	104.9%	23	48
Refrigeration	3.5%	± 3.5%	14.4%	± 6.8%	0.0%	110.9%	46	126
CHP	0.0%	± 0.0%	0.0%	± 0.0%	0.0%	100.0%	3	11
Comprehensive ³³	39.8%	± 26.6%	0.0%	± 0.0%	0.0%	60.2%	5	11

³³ Five National Grid projects were listed as "Comprehensive Design" projects and could not be assigned a single end-use.



Table 5-5 presents free-ridership and spillover for each legacy measure category by program. Overall, the Design 2000plus program has the highest free-ridership rate (22.5 percent), while the Small Business Services program has the lowest (4.6 percent). The Design 2000plus program also has the highest participant spillover rate (19.6 percent). Please note that for the National Grid programs, we are not presenting the results by DOER end-use. Instead, at the request of program staff, we present them using measure categories from past evaluation efforts (e.g. custom projects, new motors).

Table 5-5. National Grid Free-ridership and Spillover Results by Program and End-use

Program	Measure Category	Free-ridership	90% Error Margin	Participant "Like" Spillover	90% Error Margin	Non-participant Spillover	Net-to-Gross Rate	Surveyed Accounts	Population of Accounts
Design 2000plus	Custom	16.1%	6.4%	28.6%	7.9%	0.1%	112.6%	38	67
	New Motors	13.6%	7.0%	2.9%	3.4%	7.7%	96.9%	20	29
	Failed or Stock Motors	10.6%	7.4%	0.0%	0.0%	7.7%	97.1%	15	22
	Unitary HVAC	28.9%	10.7%	1.7%	3.1%	0.0%	72.8%	32	95
	Non-unitary HVAC	26.4%	10.9%	1.7%	3.2%	0.0%	75.3%	26	63
	VSD	25.4%	16.0%	0.0%	0.0%	7.7%	82.2%	10	20
	Lighting	32.8%	9.4%	16.0%	7.3%	0.0%	83.2%	38	86
	Compressed Air	31.7%	10.0%	0.0%	0.0%	1.5%	69.8%	35	86
	Total	22.5%	3.5%	19.6%	3.3%	0.6%	97.8%	214	468
Energy Initiative	Custom	14.0%	5.9%	8.2%	4.7%	0.8%	95.0%	69	272
	HVAC	10.9%	6.3%	3.6%	3.8%	0.0%	92.7%	31	58
	VSD	10.2%	4.5%	6.9%	3.8%	7.7%	104.3%	48	79
	Lighting	16.9%	5.2%	2.5%	2.2%	0.0%	85.7%	114	630
	Compressed Air	23.2%	10.6%	0.0%	0.0%	1.5%	78.3%	15	23
	Total	15.0%	3.0%	5.4%	1.9%	0.7%	91.1%	277	1,062
Small Business Services	Lighting	4.8%	2.4%	0.8%	1.0%	N/A	96.0%	186	1,188
	Other	1.9%	2.6%	1.6%	2.4%	N/A	99.7%	46	119
	Total	4.6%	2.1%	0.9%	0.9%	N/A	96.3%	232	1,307



5.2.2 NSTAR results

Table 5-6 summarizes the free-ridership and spillover rates for the NSTAR programs by end-use. Compressed air end-uses have the highest free-ridership rate (37 percent) and hot water and refrigeration end-uses have the lowest free-ridership rate (0 and 10 percent, respectively).

Table 5-6. NSTAR Free-ridership and Spillover Results by End-use

End-use	Free-ridership	90% Error Margin	Participant "Like" Spillover	90% Error Margin	Non-participant Spillover	Net-to-Gross	Surveyed Accounts	Population of Accounts
Compressed Air	37.0%	± 11.1%	9.5%	± 6.8%	1.1%	73.6%	25	49
HVAC	17.4%	± 4.1%	11.0%	± 3.4%	0.0%	93.6%	142	357
Lighting	14.1%	± 2.6%	10.4%	± 2.3%	0.0%	96.3%	414	2,818
Motors/Drives	17.6%	± 3.7%	4.6%	± 2.0%	7.7%	94.7%	125	224
Process	18.5%	± 8.2%	1.5%	± 2.5%	0.0%	83.0%	31	63
Refrigeration	10.0%	± 3.7%	38.8%	± 5.9%	0.0%	128.8%	125	398
Hot Water	0.0%	± 0.0%	100.0%	± 0.0%	0.0%	200.0%	5	6
CHP	25.0%	± 35.6%	53.7%	± 41.0%	0.0%	128.7%	2	4



Table 5-7 presents free-ridership and spillover rates for each end-use by program. The Construction Solutions program has the highest free-ridership rates (18.4 percent) while the Small Business Solutions program has the lowest (8.3 percent). Participant spillover is highest for the Business Solutions program (15.5 percent) and lowest for the Small Business Solutions program (6 percent).

Table 5-7. NSTAR Free-ridership and Spillover Results by Program and End-use

Program	End-use	Free-ridership	90% Error Margin	Participant "Like" Spillover	90% Error Margin	Non-participant Spillover	Net-to-Gross	Surveyed Accounts	Population of Accounts
Business Solutions Program	Compressed Air	50.0%	± 67.2%	0.0%	± 0.0%	1.1%	51.1%	1	3
	HVAC	13.3%	± 5.8%	6.1%	± 4.1%	0.0%	92.8%	50	109
	Lighting	17.7%	± 4.4%	16.5%	± 4.3%	0.0%	98.8%	147	563
	Motors/Drives	13.5%	± 5.0%	6.7%	± 3.6%	7.7%	100.9%	58	106
	Process	28.6%	± 18.6%	2.2%	± 6.1%	0.0%	73.6%	8	16
	Refrigeration	14.1%	± 7.2%	56.4%	± 10.3%	0.0%	142.3%	37	90
	CHP	25.0%	± 35.6%	53.7%	± 41.0%	0.0%	128.7%	2	4
	Total	16.6%	± 2.9%	15.5%	± 2.8%	0.8%	99.6%	303	891
Construction Solutions Program	Compressed Air	36.7%	± 11.2%	9.7%	± 6.9%	1.1%	74.1%	24	46
	HVAC	20.6%	± 6.0%	14.4%	± 5.2%	0.0%	93.8%	74	189
	Lighting	12.1%	± 4.9%	2.4%	± 2.3%	0.0%	90.2%	71	172
	Motors/Drives	23.4%	± 5.6%	1.5%	± 1.6%	7.6%	85.7%	67	118
	Process	9.5%	± 7.9%	0.8%	± 2.4%	0.0%	91.3%	13	20
	Refrigeration	14.4%	± 13.1%	41.5%	± 18.5%	0.0%	127.2%	7	11
	Total	18.4%	± 2.9%	10.1%	± 2.3%	0.9%	92.6%	256	556
Small Business Solutions Program	HVAC	9.6%	± 9.5%	26.6%	± 14.3%	N/A	117.1%	18	59
	Lighting	9.2%	± 3.2%	4.1%	± 2.2%	N/A	94.9%	196	2,083
	Process	16.7%	± 15.4%	0.0%	± 0.0%	N/A	83.3%	10	27
	Refrigeration	1.8%	± 2.1%	13.1%	± 5.3%	N/A	111.3%	81	297
	Hot Water	0.0%	± 0.0%	100.0%	± 0.0%	N/A	200.0%	5	6
	Total	8.3%	± 2.4%	6.0%	± 2.1%	N/A	97.7%	310	2,472



5.2.3 WMECO results

Table 5-8 presents the free-ridership and spillover rates for each end-use across all the WMECO programs. HVAC end-uses have the highest free-ridership rate (30.2 percent) and a low participant spillover rate (less than one percent).

Table 5-8. WMECO Free-rider-ship and Spillover Results by End-use

End-use	Free-ridership	90% Error Margin	Participant "Like" Spillover	90% Error Margin	Non-participant Spillover	Net-to-Gross	Surveyed Accounts	Population of Accounts
HVAC	30.2%	± 13.2%	0.7%	± 2.4%	0.0%	70.6%	20	52
Lighting	17.6%	± 4.6%	2.9%	± 2.1%	0.0%	85.4%	134	506
Process	6.1%	± 7.4%	0.1%	± 1.1%	0.0%	94.0%	16	36
Refrigeration	3.2%	± 4.5%	1.8%	± 3.4%	0.0%	98.5%	33	167
Hot Water	0.0%	± 0.0%	0.0%	± 0.0%	0.0%	100.0%	1	2

Table 5-9 presents free-ridership and spillover rates by end-use at the program level. The New Construction program has the highest free-ridership rate (19.5 percent) and the lowest participant spillover rate (less than one percent). The Small Business program has the lowest free-ridership rate (9.8 percent).

Table 5-9. WMECO Free-ridership and Spillover Results by Program and End-use

Program	End-use	Free-ridership	90% Error Margin	Participant "Like" Spillover	90% Error Margin	Non-participant Spillover	Net-to-Gross	Surveyed Accounts	Population of Accounts
New Construction Program	HVAC	30.2%	± 13.2%	0.7%	± 2.4%	0.0%	70.6%	20	52
	Lighting	59.1%	± 23.4%	0.0%	± 0.0%	0.0%	40.9%	7	17
	Process	7.1%	± 8.4%	0.1%	± 1.2%	0.0%	93.0%	14	31
	Total	19.5%	± 7.8%	0.3%	± 1.1%	0.0%	80.8%	41	100
Retrofit Program	Lighting	19.6%	± 8.9%	4.7%	± 4.8%	0.0%	85.1%	36	109
	Process	0.0%	± 0.0%	0.0%	± 0.0%	0.0%	100.0%	2	5
	Total	17.7%	± 8.3%	4.3%	± 4.4%	0.0%	86.6%	38	114
Small Business Program	Lighting	10.6%	± 4.6%	1.4%	± 1.8%	N/A	90.9%	91	380
	Refrigeration	3.2%	± 4.5%	1.8%	± 3.4%	N/A	98.5%	33	167
	Hot Water	0.0%	± 0.0%	0.0%	± 0.0%	N/A	100.0%	1	2
	Total	9.8%	± 3.8%	1.5%	± 1.6%	N/A	91.7%	125	549



5.2.4 Unutil results

Table 5-10 presents the free-ridership and spillover rates by end-use across all Unutil programs. Process and compressed air end-uses have the highest free-ridership rates of 84.8 percent and 80.3 percent, respectively. Caution should be used as these free-ridership rates are based on responses from very few participants.

Table 5-10. Unutil Free-ridership and Spillover Results by End-use

End-use	Free-ridership	90% Error Margin	Participant "Like" Spillover	90% Error Margin	Non-participant Spillover	Net-to-Gross	Surveyed Accounts	Population of Accounts
Compressed Air	80.3%	± 0.0%	0.0%	± 0.0%	0.8%	20.6%	2	2
HVAC	10.0%	± 0.0%	0.0%	± 0.0%	0.0%	90.0%	1	1
Lighting	4.8%	± 5.4%	8.7%	± 7.1%	0.0%	103.9%	18	31
Motors/Drives	7.1%	± 0.0%	0.0%	± 0.0%	7.2%	100.1%	6	6
Process	84.8%	± 0.0%	0.0%	± 0.0%	0.0%	15.2%	6	6

Table 5-11 presents the free-ridership and spillover rates by end-use at the program level. The New Construction program has the highest free-ridership rate (30.6 percent) while the Small C&I Retrofit program has the lowest rate (7.3).

Table 5-11. Unutil Free-ridership and Spillover Results by Program and End-use

Program	End-use	Free-ridership	90% Error Margin	Participant "Like" Spillover	90% Error Margin	Non-participant Spillover	Net-to-Gross	Surveyed Accounts	Population of Accounts
Large C&I Retrofit Program	Motors/Drives	4.8%	± 0.0%	0.0%	± 0.0%	7.7%	102.9%	3	3
	Process	100.0%	± 0.0%	0.0%	± 0.0%	0.0%	0.0%	2	2
	Total	23.9%	± 0.0%	0.0%	± 0.0%	6.1%	82.2%	5	5
New Construction Program	Compressed Air	100.0%	± 0.0%	0.0%	± 0.0%	1.1%	1.1%	1	1
	HVAC	10.0%	± 0.0%	0.0%	± 0.0%	0.0%	90.0%	1	1
	Motors/Drives	6.3%	± 0.0%	0.0%	± 0.0%	7.7%	101.5%	1	1
	Process	70.2%	± 0.0%	0.0%	± 0.0%	0.0%	29.8%	4	4
	Total	30.6%	± 0.0%	0.0%	± 0.0%	3.6%	73.0%	7	7
Small C&I Retrofit Program	Compressed Air	10.0%	± 0.0%	0.0%	± 0.0%	N/A	90.0%	1	1
	Lighting	4.8%	± 5.4%	8.7%	± 7.1%	N/A	103.9%	18	31
	Motors/Drives	35.7%	± 0.0%	0.0%	± 0.0%	N/A	64.3%	2	2
	Total	7.3%	± 5.8%	7.9%	± 6.0%	N/A	100.6%	21	34



5.2.5 Cape Light Compact results

Table 5-12 summarizes free-ridership and spillover rates for each end-use in the Cape Light Compact programs. Excluding building envelope end-uses due to the limited number of projects including in the study, HVAC end-uses have the highest free-ridership rate (26 percent) while refrigeration end-uses have the lowest rate (3.9 percent). Participant spillover was identified with both HVAC and lighting end-uses (5.3 percent and 5.8 percent respectively).

Table 5-12. Cape Light Compact Free-ridership and Spillover Results by End-use

End-use	Free-ridership	90% Error Margin	Participant "Like" Spillover	90% Error Margin	Non-participant Spillover	Net-to-Gross	Surveyed Accounts	Population of Accounts
HVAC	26.0%	± 17.7%	5.3%	± 9.1%	0.0%	79.4%	10	25
Lighting	9.9%	± 6.5%	5.8%	± 5.1%	0.0%	95.9%	48	321
Motors/Drives	21.5%	± 10.7%	0.0%	± 0.0%	6.4%	84.9%	15	24
Refrigeration	3.9%	± 3.7%	0.0%	± 0.0%	0.0%	96.1%	43	101
Building Envelope	75.0%	± 29.1%	0.0%	± 0.0%	0.0%	25.0%	3	6



Table 5-13 presents free-ridership and spillover rates by end-use at the program level. The New Construction program has the highest free-ridership rate (75.4 percent) and the Retrofit program has the lowest rate (8.6 percent). Due to the small number of participants in all but the Retrofit program, caution should be used when interpreting the results.

Table 5-13. Cape Light Compact Free-ridership and Spillover Results by Program and End-use

Program	End-use	Free-ridership	90% Error Margin	Participant "Like" Spillover	90% Error Margin	Non-participant Spillover	Net-to-Gross	Surveyed Accounts	Population of Accounts
Medium And Large C&I Retrofit	Lighting	12.5%	± 0.0%	0.0%	± 0.0%	0.0%	87.5%	3	3
	Motors/Drives	12.5%	± 0.0%	0.0%	± 0.0%	7.7%	95.2%	1	1
	Total	12.5%	± 0.0%	0.0%	± 0.0%	3.4%	90.9%	4	4
Medium And Large Government Retrofit	HVAC	25.0%	± 0.0%	0.0%	± 0.0%	0.0%	75.0%	1	1
	Lighting	0.0%	± 0.0%	0.0%	± 0.0%	0.0%	100.0%	1	1
	Motors/Drives	25.0%	± 39.0%	0.0%	± 0.0%	7.7%	82.7%	2	5
	Refrigeration	7.5%	± 0.0%	0.0%	± 0.0%	0.0%	92.5%	3	3
	Total	22.2%	± 7.2%	0.0%	± 0.0%	2.4%	80.2%	15	18
New Construction Program	HVAC	0.0%	± 0.0%	0.0%	± 0.0%	0.0%	100.0%	1	1
	Lighting	87.9%	± 32.1%	0.0%	± 0.0%	0.0%	12.1%	2	7
	Building Envelope	75.0%	± 39.0%	0.0%	± 0.0%	0.0%	25.0%	2	5
	Total	75.4%	± 24.9%	0.0%	± 0.0%	0.0%	24.6%	5	13
Retrofit Program	HVAC	23.3%	± 38.1%	0.0%	± 0.0%	N/A	76.7%	2	5
	Lighting	8.8%	± 6.7%	6.4%	± 5.8%	N/A	97.6%	42	310
	Motors/Drives	13.7%	± 9.4%	0.0%	± 0.0%	N/A	86.3%	12	18
	Refrigeration	3.7%	± 3.8%	0.0%	± 0.0%	N/A	96.3%	40	98
	Building Envelope	27.3%	± 0.0%	0.0%	± 0.0%	N/A	72.7%	1	1
	Total	8.6%	± 4.1%	5.3%	± 3.3%	N/A	96.7%	97	432
Services & Products Program	HVAC	40.1%	± 26.9%	64.3%	± 26.3%	0.0%	124.1%	6	18
	Total	40.1%	± 26.9%	64.3%	± 26.3%	0.0%	124.1%	6	18

5.3 DETAILED NONPARTICIPANT SPILLOVER RESULTS

The statewide non-participant spillover results for the medium and large commercial and industrial programs are based on surveys with 287 design professionals and vendors out of a population of 514 vendors. The analysis indicates that the combined non-participant spillover from the medium and large commercial and industrial programs amounted to 2,694,284 kWh in the 2010 program year, which is approximately one percent of the total savings produced by these programs combined (Table 5-14). This percentage is a slight decrease from 2009 (1.8 percent).



Table 5-14. Statewide Non-participant “Like” Spillover Results for Program Year 2010

A Survey Categories	B Vendor Population kWh Savings ³⁴	C		D Surveyed kWh Savings	E Surveyed Savings Coverage Rate (D/B)	F Non-participant Spillover from Surveyed Firms (kWh) ³⁵	G Estimated Spillover Percent (F/D)	H 90% Error Margin (+/-)	I Non-participant Spillover Extrapolated to Population (kWh) (B*G)
		Number of Firms in Program with kWh Savings	Number of Firms Surveyed with kWh Savings						
Motors	777,071	41	24	628,216	81%	289,497	46%	10.8%	358,092
HVAC	11,634,610	167	91	7,656,688	66%	0	0%	N/A	0
VSD	17,093,952	108	63	8,800,026	51%	1,150,783	13%	4.5%	2,235,383
Lighting	47,887,645	234	134	33,981,056	71%	0	0%	N/A	0
Compressed Air	3,504,693	24	17	2,563,469	73%	73,736	3%	3.6%	100,809
Refrigeration	115,571	11	4	15,715	14%	0	0%	N/A	0
Other ³⁶	110,957,904	186	110	64,777,170	58%	0	0%	N/A	0
Total	191,971,445	771	443	118,422,340	62%	1,514,015	1%	0.6%	2,694,284³⁷

The identified savings were proportionally attributed to each program at an end-use level. These savings divided by that program’s overall savings were used to determine that specific program’s overall non-participant spillover rate. This methodology weights non-participant spillover by the overall measure mix of particular programs.

5.4 “UNLIKE” SPILLOVER INDICATORS

The evaluation team included questions to address “unlike” spillover—energy efficient equipment installed by a participant due to program influence that is not identical to the equipment they received through the program. However, given the difficulties in estimating savings for these installations using regular telephone interviewers, we present only indicators of “unlike” spillover and not savings estimates. The joint NEI/spillover study to be conducted later in 2011 and 2012 by expert interviewers will allow for better estimation of “unlike” spillover. The following presents “unlike” indicators for each of the electric PAs.

³⁴ The vendor population kWh savings represents the total savings for all measures for Medium and Large C&I programs for actual vendors. Spillover is measured for each vendor associated with the program.

³⁵ Net of “like” spillover for the customers as identified from the participating customer survey.

³⁶ “Other” is a residual category consisting of measures remaining from “Custom” after equipment was reassigned to existing categories such as “Motors,” “HVAC,” or “Lighting,” as well as process equipment, process cooling equipment, and comprehensive chillers.

³⁷ This value is a sum of the measure-level spillover savings, not the savings that would result by applying the estimated spillover percentage towards the vendor population kWh savings.



a. National Grid

Of the 577 projects interviewed, 27 projects reported that they installed energy efficient equipment outside of any utility program and that National Grid’s programs were influential in the installation (the algorithm for “like” spillover influence was used to assess influence). Projects that would result in natural gas savings (e.g., boilers) and renewable projects are excluded from this count. Table 5-15 below details the measures identified by program, the estimated number of units installed, and an example of the description given by the respondent.

Table 5-15. National Grid Participant “Unlike” Spillover Results for Program Year 2010

Program ³⁸	Measure	Number of Units Installed	Example Description
Energy Initiative	Lighting	4,946	Lighting fixtures, occupancy sensors
	HVAC	12	Heat pumps, Rooftop units
	Motors	3	3-5 HP premium efficiency
	VFD	9	5 HP
	Other	4	Energy management systems
Small Business Services	HVAC	16	AC units
	Refrigeration	3	Energy efficient coolers

b. NSTAR

Of the 711 projects interviewed, 31 projects reported that they installed energy efficient equipment outside of any utility program and that NSTAR’s programs were influential in the installation (the algorithm for “like” spillover influence was used to assess influence). Projects that would result in natural gas savings (e.g., boilers) and renewable projects are excluded from this count. Table 5-16 below details the measures identified by program, the estimated number of units installed, and an example of the description given by the respondent.

Table 5-16. NSTAR Participant “Unlike” Spillover Results for Program Year 2010

Program	Measure	Number of Units Installed	Example
Business Solutions	Lighting	~750	Dual-ballast watt-stopper 300s
	Motors	6-7	.75 to 15 HP
Construction Solutions	Lighting	~600	Range from 7 watts to 30 watts replacing 10-100 watt bulbs.
	Motors	9	.75 to 15 HP
	Compressed Air	1	20 HP
	Other	1	Controls
Small Business Solutions	Lighting	40	Unknown
	HVAC	Unknown	AC

³⁸ No projects in the Design 2000plus program reported any “unlike” spillover.



c. *WMECO*

Of the 167 projects interviewed, five projects reported that they installed energy efficient equipment outside of any utility program and that WMECO’s programs were influential in the installation (the algorithm for “like” spillover influence was used to assess influence). Projects that would result in natural gas savings (e.g., boilers) are excluded from this count. Table 5-17 below details the measures identified by program, the estimated number of units installed, and an example of the description given by the respondent.

Table 5-17. WMECO Participant “Unlike” Spillover Results for Program Year 2010

Program	Measure	Number of Units Installed	Example
New Construction program	Lighting	Unknown	Unknown
	Motors	2	200 HP
	VSD	Unknown	Unknown
Retrofit program	HVAC	2	Chillers

d. *Unitil*

Of the 33 projects interviewed, none of the projects reported that they installed “unlike” energy efficient equipment outside of any utility program. Therefore, there are no “unlike” spillover estimates for Unitil programs.

e. *Cape Light Compact*

Of the 77 projects interviewed, two projects reported that they installed energy efficient equipment outside of any utility program and that Cape Light Compact’s programs were influential in the installation (the algorithm for “like” spillover influence was used to assess influence). Projects that would result in natural gas savings (e.g., boilers) and renewable projects are excluded from this count. Table 5-18 below details the measures identified by program, the estimated number of units installed, and an example of the description given by the respondent.

Table 5-18. Cape Light Compact Participant “Unlike” Spillover Results for Program Year 2010

Program	Measure	Example
Retrofit	Lighting	Lighting upgrade
	HVAC	Unspecified
	Controls	Thermostats



APPENDIX A: PARTICIPANT SAMPLING PLANS

A.1 NATIONAL GRID

This section presents our proposed sample plan for National Grid's 2010 free-ridership and spillover study.

The data file transferred to us by National Grid provides information for Massachusetts participants in the D2000, EI, and SBS programs. Each record in the data represents a measure installed through a program for a particular location. One account may have multiple applications, and one application may include multiple measure categories. Therefore, it is necessary to take steps to collapse – or aggregate – the data through the sampling process, yet retain all the measure-specific information for each account³⁹.

In this document we discuss the steps to be used in:

- Preparation of the data file and aggregation of the participant data
- Prioritization of accounts for sampling
- Selection of the sample
- Review of the sample to identify companies with multiple sampled accounts.

This is followed by:

- Characterization of the proposed sample plan.

The current sample plan estimates 760 completed surveys at the measure level and 573 completed surveys at the account level (some accounts represent multiple measures). We will only bill for the actual number of surveys completed at the account level.

A.1.1 Preparation of the Data File and Aggregation of the Participant Data

1. **Identify program and measure category participation.** The study estimates free-ridership at the measure category level. The first step in sample preparation is to assign measures to a measure category. Using the information provided in the data file⁴⁰, we identify the measure categories within the following programs:
 - a. D2000 program consists of the measure categories: Custom, New Motors, Failed / Stocked Motors, Unitary HVAC, Non-unitary HVAC, Variable Speed Drives, Lighting, Compressed Air, and Comprehensive⁴¹.
 - b. EI program consists of the measure categories: Custom, HVAC, Variable Speed Drives, Lighting, and Compressed Air.
 - c. SBS program consists of the measure categories: Lighting and Non-lighting.

³⁹ An account is defined as a unique CIS Account Number

⁴⁰ The fields used to identify measure categories are SubProgram, Motor Type, HVAC Type, and SBS Type.

⁴¹ The field used to identify Comprehensive program participants is Measure Code ID, where Measure Code ID equals "CC" or "CD."



2. **Aggregate the records by Program, Account Number, and Measure Category.** This aggregation sets the file up so that we have one record for each account for each measure category within a program. As we do the aggregation, we sum the kWh savings, kW savings, and authorized incentive so that the values are represented at an account level. The incentive aggregation is handled differently for SBS (see step 4 below). The detailed measure descriptions are retained. These descriptions are used when describing to customers what equipment is included in a measure category.
3. **Calculate total project costs.** Costs are associated with an application, not with a measure⁴². Therefore, it is not possible to sum the cost to the account level as we do in the above step for the energy impacts and incentives. To calculate the total project cost, we identify the cost per application and then aggregate the data to the account level, summing the identified application-level costs. Costs for SBS measures are multiplied by 1.25 to represent a market based cost.
4. **Calculate incentive amount for SBS.** SBS incentive information is reported at the application-level and not at the measure level. This differs from D2000 and EI, which report incentives at the measure-level. Therefore, we need to take steps similar to calculating total project costs for SBS participants' incentive calculations. First, we identify the incentive value associated with an application. Next, we capture total project incentives by aggregating the records by Account Number, summing the incentive amounts identified for each application associated with that account.
5. **Append the file with calculated values and create the flat file.** Once the costs and incentives are re-calculated, we append the file created in step 2 with the cost and incentive information. The next step is to create a flat file where one record represents one account within a program (an account may show up more than once in a dataset, but never more than one time in a program).

To do this, and retain all measure category-specific details, we have to create variables specific to each measure category. First, measure category information is captured using dichotomous variables. We start by creating variables that serve as indicators that an account received a measure through that category (i.e., mea1 = Measure Category 1, mea2a = Measure Category 2.1, etc.), and assign the variable a value of 1 if an account received that measure. For example, if Measure Category = 1 (Custom), then we assign mea1 a value of one. If Measure Category = 2.1, then we create a variable 2a and assign that variable a value of one. If the account did not receive any installments in that measure category, then the variable is assigned a value of zero.

We also create variables associated with kWh, incentive values, and costs assigned for each measure category (i.e., kWh1, kWh2a, inc1, inc2a, inc2b, etc.). The cost and savings details remain blank if the account did not receive installations in the appropriate measure category.

After these preparatory steps, the complete data file can then be aggregated a final time to an account and program level to create a flat file. The file now includes one record for each account participating in a program.

A.1.2 Prioritization of Accounts for Sampling

1. **Identify priority accounts.** When designing the sample plan, we identify which measure categories will be randomly sampled. We apply a prioritization scheme when selecting cases within these randomly sampled categories. All accounts flagged priority will be sampled with certainty, followed by a random sample of non-priority accounts. Accounts are flagged as priority if:
 - a. They are considered a multi-measure account (their participation in a program includes installations across more than 1 measure category), or

⁴² For example, Application A has five measures installed. The same total cost will be represented across each of the five measures.



- b. The kWh savings is within the top 10 percentile of kWh savings when it is reviewed by program, measure category, and state. Please **note that for EI and SBS lighting measures, we prioritized the top 5 percentile, rather than top 10 percentile, of kWh savings.** This change ensures that the sample includes both priority cases and non-priority cases in significant numbers.
 - c. All randomly sampled (non-priority) accounts are single-measure accounts.
2. **Develop sample plan and determine level of precision.** After determining the number of accounts associated with a measure category, we develop the sample plan and determine the level of precision at a 90% Confidence Interval. The sample plan describes the population of accounts by measure category, the number of accounts to be surveyed by measure category, and potential number of survey completes if we apply a 65% response rate. Note that precision levels are only applicable when a sample is drawn; therefore, we indicate “NA” for measure categories where the sample is a census of participants.

The results of these steps can be found in the Excel worksheet: *NGRID sampling plan tables (draft).xls*.

A.1.3 Selection of the Sample

The sample is selected using the Sample Plan (in the *SamplePlan* worksheet) as a guide. In general, we always want to pull the accounts identified as priority, and a census of measure categories with less than or equal to 50 accounts associated with them within a program. The sample plan identifies several measure categories with more than 50 accounts where we sampled a census as well.

In the interviews, we discuss no more than two measure categories for each account and program the account participated in. There are accounts that have measures installed in more than two measure categories. When this happens, we apply a set of rules to select which measure categories we want to include in the study.

1. First, select rare measure categories. Measure categories deemed rare (less than or equal to 50 accounts with installations in that measure category) are kept.
2. If we have not selected two measure categories in step 1, then we determine which measure category contributes the greatest ratio of energy savings in relation to the total program energy savings for that measure category⁴³. The measure categories with the highest ratios are kept until two measures are selected.
3. If more than two measure categories are selected in step 1 above (an account has more than two measure categories deemed rare), then we select the two rare measure categories that have the highest ratio of energy savings.

In addition, once sampled, we will screen the accounts that were contacted and completed surveys as part of the pretest of the 2010 methodology. These accounts will not be contacted again but we plan to use their results as part of the updated analysis.

A.1.4 Review of Sample to Identify Companies with Multiple Sampled Accounts

Prior to survey implementation, we attempt to identify records that appear in the sample more than one time (“multiples”). Records that appear to potentially be the same facility, the same company, or have the same contact point are grouped and flagged so they are attempted at the same time. We manually sort and review the sample on the following criteria:

⁴³ $KWh_x = kWh \text{ savings for the measure category for the account, where } x \text{ is the measure category \#}$
 $p_kWh_x = \text{total kWh savings for all installments in the program within the measure category } x$
 $ratio_x = KWh_x / p_kWh$



- Facility / Company name
- Contact name
- Telephone number
- Address.

All sample records are loaded into the Computer Assisted Telephone Interview (CATI) system. Any cases identified and flagged as “multiples” using the criteria above are put on hold. Senior interviewers are specially trained on how to deal with these multiples. Once we are a few days into the calling, our senior interviewers are responsible for calling multiples.

During our initial contact with the respondent, our first step is to verify whether the respondent is the appropriate person to provide information for each of the accounts. If not, we determine which accounts should be assigned to that respondent, and which should be discussed with someone else.

For contact persons associated with multiple accounts, we will ask these contacts about up to 2 measures per account for each program they participate in. Therefore, the interview may be slightly longer for these contacts.

A.1.5 Characterization of the Proposed Sample Plan and Sample

The proposed sample plan includes:

1. A census of accounts in the following program / measure categories:
 - a. Comprehensive
 - b. D2: Custom, Motors New, Motors Failed / Stock, HVAC Non-unitary, and VSD
 - c. EI: HVAC, VSD, and Compressed Air
2. A sample of accounts in the following program / measure categories:
 - a. D2: HVAC Unitary, Lighting, and Compressed Air
 - b. EI: Custom and Lighting
 - c. SBS: Lighting and Non-Lighting

Table A-1 outlines the sampling plan for National Grid’s 2011 study. A smaller percent of accounts that receive lighting measure will be randomly sampled when compared to the other measure categories. As lighting measures consist of large number of accounts, a smaller percentage needs to be sampled in order to achieve statistical precision. Drawing a sample of the priority accounts alone allows us to achieve the desired level of precision. The additional sample from non-priority cases ensures we have representation from the remaining, non-priority population.

Table A-1 also presents the sample details in terms of kWh savings, coverage, number of accounts, and level of precision. Data presented in Table A-1 can also be found in the Excel file (in the forMemo1 worksheet) sent along with this memorandum, discussed next.



Table A-1. National Grid Proposed Sample Plan

Program	Measure	Estimated Free-Ridership Percentage	Population of Measures	Sample of Measures	Population Gross kWh savings	Sampled Gross kWh Savings	Percent of Savings Sampled*	Expected Completed Measures from Survey**	+/- 90% Confidence Interval at Measure Level	
Comp	Custom	50.0%	8	8	1,895,313	1,895,313	100%	5	NA	
	Custom	17.7%	59	59	12,293,319	12,293,319	100%	38	NA	
D2	Motors New	44.4%	29	29	413,218	413,218	100%	19	NA	
	Motors Failed/ Stock	51.1%	22	22	179,337	179,337	100%	14	NA	
	HVAC Unitary	39.5%	95	70	1,065,793	945,307	89%	46	8.6%	
	HVAC Non-Unitary	12.1%	63	63	960,531	960,531	100%	41	NA	
	VSD	73.9%	20	20	1,048,769	1,048,769	100%	13	NA	
	Lighting	31.8%	87	64	6,368,785	5,650,812	89%	41	8.6%	
	Compressed Air	20.2%	86	69	1,838,458	1,687,825	92%	45	6.9%	
	Total			461	396	24,168,210	23,179,118	96%		
	EI	Custom	7.5%	272	112	68,068,094	51,792,504	76%	73	4.4%
HVAC		24.8%	58	58	6,744,387	6,744,387	100%	38	NA	
VSD		17.3%	79	79	6,402,221	6,402,221	100%	51	NA	
Lighting		11.9%	630	151	65,013,534	28,326,931	44%	98	5.0%	
Compressed Air		23.8%	23	23	905,606	905,606	100%	15	NA	
Total				1,062	423	147,133,842	94,171,650	64%		
SBS	Lighting	6.2%	1,188	245	23,180,602	10,425,373	45%	159	2.9%	
	SBS Non-Lighting	1.4%	119	98	1,711,827	1,486,314	87%	64	1.7%	
	Total		1,307	343	24,892,429	11,911,686	48%			
Grand Total			2,838	1,170	198,089,794	131,157,767	66%	760		

* Samples take 100% of priority accounts and a random sampling of non-priority accounts, which are single-measure accounts. Priority accounts are defined as top 10 percentile (top 5 percentile for EI and SBS lighting) and installed measures across more than 1 measure category within a program.

** Estimate based on 760 surveys: 5 Comp, 257 D2, 275 EI, and 223 SBS surveys, as detailed in the *SamplePlan* worksheet discussed later in this memorandum.



Along with this memorandum we are sending an Excel file (*NGRID sampling plan tables (draft).xls*) that summarizes program participation characteristics and our proposed sample plan. The file includes eight worksheets for your review.

1. **SamplePlan** presents the error band associated with free-ridership estimates at the program / measure category level for sampled measures. This worksheet also presents the projected number of customers to be surveyed for each measure category.

The error bands represented in this worksheet are calculated at the application level. The calculation of error takes a number of factors into account, including:

- **The number of applications for each measure category.** As the number of applications increases, the number of completed surveys needs to increase to achieve the same error band.
- **The expected free-ridership rate.** The required number of completed surveys increases as the estimated free-ridership rate gets closer to 50%. For example, a measure with an estimated free-ridership rate of 40% would require more completes to achieve the same error band as a measure with an estimated free-ridership rate of 10%. We estimated free-ridership rates by using data from 2009.
- **The expected response rate.** We used a 65% as an estimate.
- We project we'll be able to report results at the 90% confidence level with 10% precision for all sampled measures (Table 1). Where we sample a census, precision is not applicable.

2. The worksheet **SampleDetails** summarizes details of the pulled sample (assuming this plan is approved). For those measures where a random sample is being taken, the table shows an estimate of the kWh savings that will be sampled. The savings reported here is estimated by applying the percent sampled from non-priority applications to these applications' total savings, then adding this value to the kWh savings from priority sites. The results of this table are also presented in Table 1 of this memo.

Please note that in four of the census measure categories, some specific measures have not been included. These measures are associated with accounts that included more than two measures in a program and were not selected in the measure prioritization methodology discussed above.

3. **MeasCodeKWH** presents the total kWh savings achieved by each measure category in each program, broken out by State.
4. **MeasCodeCounts** presents the number of measure applications in each program and the number of participating customers by State.
5. The next 5 worksheets provide further detail on the measures being sampled (**Custom, HVAC Unitary, Lighting, Non-Lighting (SBS), and Compressed Air**). These measure-specific worksheets present the number of applications deemed priority (where Keep = "Yes"), the kWh savings coverage based on those priority cases, and the projected sample of applications and customers based on the percent of non-priority applications that will be randomly sampled.

A.2 NSTAR

This section presents our proposed sample plan for NSTAR's 2010 free-ridership and spillover study.

The data file transferred to us by NSTAR provides information for Massachusetts participants in the Business Solutions, Construction Solutions, and Small Business Solutions programs. Each record in the data represents a measure installed through a program for a particular location. One account may have multiple projects, and one project may include multiple measure categories. Therefore, it is necessary to take steps to



collapse – or aggregate – the data through the sampling process, yet retain all the measure-specific information for each account⁴⁴.

In this document we discuss the steps used in:

- Preparation of the data file and aggregation of the participant data
- Prioritization of accounts for sampling
- Selection of the sample
- Review of the sample to identify companies with multiple sampled accounts.

This is followed by:

- Characterization of the proposed sample plan.

The current sample plan estimates 852 completed surveys at the measure level and 678 completed surveys at the project level. We will only bill for the actual number of surveys completed at the project level.

A.2.1 Preparation of the Data File and Aggregation of the Participant Data

1. **Identify program and measure category participation.** The study estimates free-ridership at the measure category level. The first step in sample preparation is to assign measures to a measure category. Using the information provided in the data file⁴⁵, we identify the measure categories within the following programs:
 - a. Business Solutions program consists of the measure categories: custom (split into lighting and non-lighting subgroups), Motors, HVAC, VSD, prescriptive lighting, compressed air, and refrigeration
 - b. Construction Solutions program consists of the measure categories: custom (split into lighting and non-lighting subgroups), HVAC, VSD, prescriptive lighting, and compressed air
 - c. Small Business Solutions program consists of two measure categories: lighting and non-lighting.
2. **Aggregate the records by Program, Project ID, and Measure Category.** This aggregation sets the file up so that we have one record for each project for each measure category within a program. As we do the aggregation, we sum the kWh savings, kW savings, and authorized incentive so that the values are represented at an account level. The detailed measure descriptions are retained. These descriptions are used when describing to customers what equipment is included in a measure category. *Note that project cost and technical assessments information were not available in the project tracking database. Therefore, the survey questions will be edited to account for this missing information. In addition, NSTAR data did not track high bay lighting; our analysis will not be able to separate out free-ridership scores for those projects.*
3. **Append the file with calculated values and create the flat file.** The next step is to create a flat file where one record represents one project within a program (a project may show up more than once in a dataset, but never more than one time in a program).

To do this, and retain all measure category-specific details, we have to create variables specific to each

⁴⁴ An account is defined as a unique account number (“Acct #”) and a project is defined as a unique project number (“Project ID”).

⁴⁵ The fields used to identify measure categories were “Application Type” and “End Use”.



measure category. First, measure category information is captured using dichotomous variables. We start by creating variables that serve as indicators that an account received a measure through that category (i.e., mea1 = Measure Category 1, mea2 = Measure Category 2, etc.), and assign the variable a value of 1 if an account received that measure. For example, if Measure Category = 1 (Custom – Non-lighting), then we assign mea1 a value of one. If Measure Category = 2, then we create a variable 2 and assign that variable a value of one. If the account did not receive any installments in that measure category, then the variable is assigned a value of zero.

We also create variables associated with kWh and incentive values assigned for each measure category (i.e., kWh1, kWh2, inc1, inc2, etc.). The savings details remain blank if the account did not receive installations in the appropriate measure category.

After these preparatory steps, the complete data file can then be aggregated a final time to an account and program level to create a flat file. The file now includes one record for each account participating in a program.

A.2.2 Prioritization of Accounts for Sampling

1. **Identify priority accounts.** When designing the sample plan, we identify which measure categories will be randomly sampled. We apply a prioritization scheme when selecting cases within these randomly sampled categories. All accounts flagged priority will be sampled with certainty, followed by a random sample of non-priority accounts. Accounts are flagged as priority if:
 - a. They are considered a multi-measure account (their participation in a program includes installations across more than 1 measure category), or
 - b. The kWh savings is within the top 10 percentile of kWh savings when it is reviewed by program, measure category, and state. Please note that for Small Business Solutions lighting measures, we prioritized the top 5 percentile, rather than top 10 percentile, of kWh savings. This change ensures that the sample includes both priority cases and non-priority cases in significant numbers.
 - c. All randomly sampled (non-priority) accounts are single-measure accounts.
2. **Develop sample plan and determine level of precision.** After determining the number of accounts associated with a measure category, we develop the sample plan and determine the level of precision at a 90% Confidence Interval. The sample plan describes the population of accounts by measure category, the number of accounts to be surveyed by measure category, and potential number of survey completes if we apply a 65% response rate. Note that precision levels are only applicable when a sample is drawn; therefore, we indicate “NA” for measure categories where the sample is a census of participants.

The results of these steps can be found in the Excel worksheet: *NSTAR sampling plan tables (draft).xls*.

A.2.3 Selection of the Sample

The sample is selected using the Sample Plan (in the *Sampling Summary* worksheet) as a guide. In general, we always want to pull the accounts identified as priority, and a census of measure categories with less than or equal to 50 accounts associated with them within a program. The sample plan identifies several measure categories with more than 50 accounts where we sampled a census as well.

In the interviews, we discuss no more than two measure categories for each account and program the account participated in. There are accounts that have measures installed in more than two measure categories. When this happens, we apply a set of rules to select which measure categories we want to include in the study.

1. First, select rare measure categories. Measure categories deemed rare (less than or equal to 50 accounts with installations in that measure category) are kept.



2. If we have not selected two measure categories in step 1, then we determine which measure category contributes the greatest ratio of energy savings in relation to the total program energy savings for that measure category⁴⁶. The measure categories with the highest ratios are kept until two measures are selected.
3. If more than two measure categories are selected in step 1 above (an account has more than two measure categories deemed rare), then we select the two rare measure categories that have the highest ratio of energy savings.

These prioritization steps resulted in the removal of several measures that were included in the sample as part of a measure category census. For example, we took a census of Construction Solutions VSD measures. However, seven of these 50 accounts included at least two other measures that were deemed a higher priority due to their rarity or ratio of the project's energy savings to the overall population.

A.2.4 Review of Sample to Identify Companies with Multiple Sampled Accounts

Prior to survey implementation, we attempt to identify records that appear in the sample more than one time ("multiples"). Records that appear to potentially be the same facility, the same company, or have the same contact point are grouped and flagged so they are attempted at the same time. We manually sort and review the sample on the following criteria:

- Facility / Company name
- Contact name
- Telephone number
- Address

All sample records are loaded into the Computer Assisted Telephone Interview (CATI) system. Any cases identified and flagged as "multiples" using the criteria above are put on hold. Senior interviewers are specially trained on how to deal with these multiples. Once we are a few days into the calling, our senior interviewers are responsible for calling multiples.

During our initial contact with the respondent, our first step is to verify whether the respondent is the appropriate person to provide information for each of the accounts. If not, we determine which accounts should be assigned to that respondent, and which should be discussed with someone else.

For contact persons associated with multiple accounts, we will ask these contacts about up to 2 measures per account for each program they participate in. Therefore, the interview may be slightly longer for these contacts.

A.2.5 Characterization of the Proposed Sample Plan and Sample

The proposed sample plan includes:

1. A census of accounts in the following program / measure categories:
 - a. Business Solutions: HVAC, Compressed Air, and Refrigeration
 - b. Construction Solutions: Custom (both lighting and non-lighting sub-categories), Motors, VSDs, and Compressed Air
2. A sample of accounts in the following program / measure categories:

⁴⁶ $KWh_x = kWh \text{ savings for the measure category for the account, where } x \text{ is the measure category \#}$
 $p_kWh_x = \text{total kWh savings for all installments in the program within the measure category } x$
 $ratio_x = KWh_x / p_kWh$



- a. Business Solutions: Custom (both lighting and non-lighting sub-categories), VSDs, and Lighting
- b. Construction Solutions: HVAC and Lighting
- c. Small Business Solutions: Lighting and Non-Lighting.

Table A- 2 outlines the sampling plan for NSTAR's 2010 study. A smaller percent of accounts that receive lighting measures will be randomly sampled when compared to the other measure categories. As lighting measures consist of large number of accounts, a smaller percentage needs to be sampled in order to achieve statistical precision. Drawing a sample of the priority accounts alone allows us to achieve the desired level of precision. The additional sample from non-priority cases ensures we have representation from the remaining, non-priority population.

Table A-2 also presents the sample details in terms of kWh savings, coverage, number of accounts, and level of precision. Data presented in Table A-2 can also be found in the Excel file (in the *Sampling Summary* worksheet) sent along with this memorandum, discussed next.



Table A-2. NSTAR Proposed Sample Plan

Program	Measure	Population of Measures	Sample of Measures	Population Gross kWh savings	Sampled Gross kWh Savings	Percent of Savings Sampled*	Expected Completed Measures from Survey**	+/- 90% Confidence Interval at Measures Level**
Business Solutions	Custom - Other	150	81	34,391,171	26,558,648	77%	53	9.2%
	Custom - Lighting	245	89	25,397,058	17,531,474	69%	58	9.5%
	HVAC	37	37	2,531,415	2,531,415	100%	24	NA
	VSD	104	69	10,786,181	8,006,479	74%	45	9.3%
	Lighting	318	119	26,174,663	17,106,115	65%	77	8.2%
	Compressed Air	1	1	28,750	28,750	100%	1	NA
	Refrigeration	22	22	172,248	172,248	100%	14	NA
	Total	877	418	99,481,486	71,935,129	72%	272	
Construction Solutions	Custom - Other	67	60	34,882,277	30,985,874	89%	39	NA
	Custom - Lighting	12	12	4,977,850	4,977,850	100%	8	NA
	Motors	67	59	1,031,697	1,008,933	98%	38	NA
	HVAC	155	67	5,761,261	4,408,981	77%	44	10.6%
	VSD	50	43	6,387,126	6,063,500	95%	28	NA
	Lighting	160	79	9,239,357	7,153,233	77%	51	9.5%
	Compressed Air	43	43	1,601,709	1,601,709	100%	28	NA
	Total	554	363	63,881,277	56,200,080	88%	236	
Small Business Solutions	Lighting	2,083	319	32,138,167	14,591,673	45%	207	5.4%
	Non-lighting	362	211	4,883,873	3,195,934	65%	137	5.6%
	Total	2,445	530	37,022,040	17,787,607	48%	344	
Grand Total		3,876	1,311	200,384,803	145,922,816	73%	852	

* Samples take 100% of priority accounts and a random sampling of non-priority accounts, which are single-measure accounts. Priority accounts are defined as top 10 percentile (top 5 percentile for SBS lighting) and installed measures across more than 1 measure category within a program.

** Assuming a 50% free-ridership rate – the most conservative estimate for calculating confidence intervals.



Along with this memorandum we are sending an Excel file (*NSTAR Sampling tables (draft).xls*) that summarizes program participation characteristics and our proposed sample plan. The file includes 11 worksheets for your review.

1. **Sampling Summary** presents the error band associated with free-ridership estimates at the program / measure category level for sampled measures. This worksheet also presents the projected number of customers to be surveyed for each measure category. For those measures where a random sample is being taken, the table shows an estimate of the kWh savings that will be sampled. The savings reported here is estimated by applying the percent sampled from non-priority applications to these applications' total savings, then adding this value to the kWh savings from priority sites. *Please note that in three of the census measure categories, some specific measures have not been included. These measures are associated with accounts that included more than two measures in a program and were not selected in the measure prioritization methodology discussed above.*

The error bands represented in this worksheet are calculated at the application level. The calculation of error takes a number of factors into account, including:

- a. **The number of projects for each measure category.** As the number of applications increases, the number of completed surveys needs to increase to achieve the same error band.
 - b. **The expected free-ridership rate.** The required number of completed surveys increases as the estimated free-ridership rate gets closer to 50%. For example, a measure with an estimated free-ridership rate of 40% would require more completes to achieve the same error band as a measure with an estimated free-ridership rate of 10%. As previous data are not available, we estimated free-ridership rates at 50 percent – the most conservative estimate.
 - c. **The expected response rate.** We used a 65% as an estimate.
 - d. We project we'll be able to report results at the 90% confidence level with 10% precision for all sampled measures (Table 1). Where we sample a census, precision is not applicable.
2. **Measure Summary** presents the total number of projects for each measure and program and kWh savings achieved by each measure category in each program.
 3. The next 5 worksheets provide further detail on the measures being sampled (**Non-lighting Custom, Lighting Custom, Motors, HVAC, VSD, Lighting, SBS Non-Lighting, Compressed Air, and Refrigeration**). These measure-specific worksheets presents the number of applications deemed priority (where Keep = "Yes"), the kWh savings coverage based on those priority cases, and the projected sample of applications and customers based on the percent of non-priority applications that will be randomly sampled.

A.3 WMECO

This section details the proposed sampling procedures and sample plan for Western Massachusetts Electric Company (WMECO) 2010 Free-Ridership / Spillover Study.

The data file forwarded to us by WMECO provides information for participants in the Lost Opportunities, Retrofit, and Small Business Energy Advantage programs. WMECO provided program data in the following files:

- **custom wmeco study projects measure contacts 2011-01-27.xls** represents the custom and prescriptive measures received through the Retrofit and Lost Opportunity programs. There were three worksheets associated with this spreadsheet: *customer wmeco study projects 201*; *custom wmeco study measures 201*; and *custom wmeco study contacts 201*.
- **sbea_clmtrs_wmeco_project_measures 2011-01-27.xls** represents measures received via the Small Business program. The file contains two worksheets: *sbea_clmtrs_projects* and *sbea_clmtrs_measures*. Our analysis was done using the "Measures" tab.



As the size of the each program population is small, all accounts will be included in the sample except for lighting measures in the Retrofit and Small Business programs. For those programs, all high saving measures⁴⁷ are selected to be included in the sample. The remaining sample is drawn randomly.

Each record in the data represents a measure installed through the programs for a particular account. One account may have multiple projects, and one project may include measures installed through multiple measure categories. Therefore, it was necessary to take steps to collapse – or aggregate – the data through the sampling process, yet retain all the measure-specific information for each account.

The remainder of this document discusses the steps to be used in:

- Preparation of the data file and aggregation of the participant data
- Review of the sample to identify companies with multiple sampled accounts.

A.3.1 Preparation of the Data File and Aggregation of the Participant Data

a. IDENTIFY PROGRAM AND MEASURE CATEGORY PARTICIPATION

The study estimates free-ridership at the program and measure category level. The first step in sample preparation is to assign measures to a measure category. Using the information provided in the data file⁴⁸, we identify the following measure categories. The measure categories for each program are detailed in Table A-3.

Table A-3. Measure Category by Program

Program	Measure Description
Lost Opportunities	Process
	Motors
	Cooling
	Heating
	Lighting
	Refrigeration
	Other
Retrofit	Process
	Heating
	Lighting
	Other
Small Business	Lighting
	Other

Please note that two of the 189 Lost Opportunities measures and 55 of the 7,176 Small Business Energy Advantage measures with either no savings values or negative savings values were removed from the sample since these values are critical for the survey, analysis, and weighting.

⁴⁷ High saving measures are defined as measures with greater than 19 MWh annual kWh savings.

⁴⁸ The field “BNFT_TYPE_CD” was used to identify the measure categories within each program for the custom programs. The field “category” was used in the Small Business program.



b. AGGREGATE THE RECORDS BY ACCOUNT NUMBER AND MEASURE CATEGORY

This aggregation sets the file up so that we have one record for each account for each measure category. As we do the aggregation, we sum the kWh savings, cost⁴⁹, and incentive so that the values are represented at an account level.

For aggregation in the custom dataset, we used the variable “Acct_No”. The Small Business dataset contained two account numbers that could be used for unique aggregation, both of which had some missing data. The variable “C2_Bill_Account” was most complete. When an account was missing that item, we used “account_number” as the identifier. Analysis showed that there was no duplication between identifiers.

For the Small Business accounts, detailed descriptions of the measures installed were retained. These descriptions are used when describing to customers what equipment is included in a measure category. Interviewers will pay particular attention to directing respondents to the measures installed through the program.

c. CREATE THE FLAT FILE OF PARTICIPANTS

The next step is to create a flat file where one record represents one account for each program. To do this, and retain all measure category-specific details, we have to create variables specific to each measure category.

First, measure category information is captured using dichotomous variables. We start by creating variables that serve as indicators that an account received a measure through that category (i.e., m1 = Measure Category 1, m2 = Measure Category 2, etc.), and assign the variable a value of 1 if an account received that measure. For example, if Measure Category = 1 (Process), then we assign m1 a value of one. If Measure Category = 2 and the account received that measure, we assign m2 a value of one. If the account did not receive any installments in that measure category, then the variable is assigned a value of zero.

We also create variables associated with kWh, incentive values, and costs assigned for each measure category (i.e., kWh1, kWh2, inc1, inc2, inc3, etc.). The savings details remain blank if the account did not receive installations in the appropriate measure category.

After these preparatory steps, the complete data file can then be aggregated a final time to an account level within a program to create a flat file. The file now includes one record for each account participating in a program.

d. DEVELOP SAMPLE PLAN AND DETERMINE LEVEL OF PRECISION

After determining the number of accounts associated with a measure category, we can develop the sample plan and typically determine the level of precision at a 90% Confidence Interval. The sample plan describes the population of accounts by measure category, the number of accounts to be surveyed by measure category, and potential number of survey completes if we apply a 65% response rate. Precision levels are only applicable when a sample is drawn. Because a census of accounts will be taken for most measure categories in WMECO’s programs, precision levels are only applicable for the Retrofit and Small Business lighting measures.

e. SAMPLE ACCOUNTS IN PROGRAMS WITH LARGE POPULATIONS

As there are large quantities of lighting measures for both Retrofit and Small Business programs, a sample needs to be drawn to survey these populations cost-effectively. As per previous conversations with WMECO, accounts with greater than 19 MWh savings are automatically included in our sample in order to represent a

⁴⁹ Per previous discussions with WMECO, total cost value is calculated as two times the incentive value.



large portion of the overall savings. The remaining sample is made up of a random selection of accounts. Enough accounts are randomly sampled in order to achieve 90/10 precision in our analysis.

f. *SELECT MEASURES WITHIN SAMPLED ACCOUNTS*

To minimize respondent burden, the telephone surveys ask about no more than two measure categories for each account and program the account participated in. WMECO only has four accounts that installed more than two types of measures within the same program. In our sampling, we prioritized the measures that made up a larger portion of the program savings for that measure.

The measures and annual kWh savings associated with these four accounts are detailed in Table A-4. The measures included from the sample are in bolded text.

Table A-4. Measure Breakdown for Four Accounts with > 2 Measures

Program	Measure Installed	Account Measure-Specific Savings	Population	Percentage of Overall Program Savings	Include in Sample?
Lost Opportunity	Motors	177	6	0%	Yes
	Cooling	965	48	0%	No
	Lighting	91,118	17	9%	Yes
Lost Opportunity	Process	871,778	30	16%	Yes
	Cooling	127,259	48	13%	Yes
	Other	20,061	4	9%	No
Lost Opportunity	Motors	11,198	6	2%	No
	Cooling	527,181	48	18%	Yes
	Lighting	170,515	17	17%	No
	Other	114,929	4	49%	Yes
Retrofit	Process	533,688	5	57%	Yes
	Cooling	407,980	7	39%	Yes
	Lighting	147,919	109	2%	No

g. *CHARACTERIZATION OF THE FINAL SAMPLE PLAN AND SAMPLE*

Table A-5 outlines the sampling plan for WMECO’s 2010 study. Table A-5 also presents the sample details in terms of kWh savings, coverage, number of accounts, and projected number of completed surveys based on a 65 percent response rate.



Table A-5. WMECO 2010 Free-Ridership / Spillover Sample Details

Program	Measure	Population of Accounts	High Savers ⁵⁰	Randomly selected	Sampled Number of Accounts	Projected Completes at 65% RR ⁵¹	Population kWh	Sampled kWh	Percent of Coverage
Lost Opportunity	Process equipment	30	-	-	30	20	5,580,021	5,580,021	100%
	Motors	6	-	-	6	4	603,751	603,751	100%
	Cooling equipment	48	-	-	48	32	2,973,900	2,973,900	100%
	Heating equipment	1	-	-	1	1	54,102	54,102	100%
	Lighting equipment	17	-	-	17	12	993,459	993,459	100%
	Refrigeration equipment	6	-	-	6	4	272,896	272,896	100%
	Other equipment	4	-	-	4	3	234,771	234,771	100%
	Total	112	-	-	112	76	10,712,900	10,712,900	100%
Retrofit	Process equipment	5	-	-	5	4	941,363	941,363	100%
	Heating equipment	2	-	-	2	2	21,178	21,178	100%
	Lighting equipment	109	65	20	85	56	8,923,679	8,715,223	98%
	Other equipment	7	-	-	7	5	1,036,878	1,036,878	100%
	Total	123	65	20	99	67	10,923,098	10,714,642	98%
Small Business Energy Advantage	Lighting equipment	375	115	20	135	88	8,384,961	6,474,329	77%
	Other equipment	96	-	-	96	63	1,117,893	1,117,893	100%
	Total	471	115	20	231	151	9,502,853	7,592,222	80%
Grand Total	706	180	40	442	294	31,138,851	29,019,764	93%	

A.3.2 Review of Sample to Identify Companies with Multiple Sampled Accounts

Prior to survey implementation, we attempt to identify records that appear in the sample more than one time (“multiples”). Records that appear to be potentially the same facility, the same company, or have the same contact point are grouped and flagged so they are attempted at the same time. We manually sort and review the sample on the following criteria:

- Facility / Company name
- Contact name
- Telephone number
- Address.

⁵⁰ Defined as measures with greater than 19 MWh savings.

⁵¹ As some interviews will include two measures, we estimate that we will complete 244 interviews in total.



All sample records are loaded into the Computer Assisted Telephone Interview (CATI) system. Any cases identified and flagged as “multiples” using the criteria above are put on hold. Senior interviewers are specially trained on how to deal with these multiples. After several days into the fielding, our senior interviewers are responsible for calling multiples.

During our initial contact with the respondent, our first step is to verify whether the respondent is the appropriate person to provide information for each of the accounts. If not, we determine which accounts should be assigned to that respondent, and which should be discussed with someone else.

For contact persons associated with multiple accounts, we will ask these contacts about up to two measures per account. Therefore, the interview may be slightly longer for these contacts.

A.4 UNITIL

This section details the sampling procedures and draft sample plan for Unitil's 2010 Free-Ridership / Spillover Study.

The sample source is an Excel data file⁵² forwarded to Tetra Tech by Unitil on March 1, 2011. This file provides information for participants in the Large C&I New Construction, Large C&I Retrofit, and Small C&I Retrofit programs. We used the fields labeled “Program Name” and “End Use” to identify program and end use. Likewise, savings, incentive amounts, and project costs were identified in fields “Gross Annual kWh”, “Unit Rebate”, and “Unit Price” respectively.

Given the small number of participants in these three programs, we will be surveying a census of participants (49 unique participants by end use and program).

Prior to survey implementation, we attempt to identify records that appear in the sample more than one time (“multiples”). Records that appear to potentially be the same facility, the same company, or have the same contact point are grouped and flagged so they are attempted at the same time. We manually sort and review the sample on the following criteria:

- Customer ID / Customer name
- Contact name
- Telephone number
- Address.

All sample records are loaded into the Computer Assisted Telephone Interview (CATI) system. Any cases identified and flagged as “multiples” using the criteria above are put on hold and are handled by specially trained senior interviewers.

Table 6 details the sample plan and the sample details in terms of kWh savings and number of accounts.

⁵² “Unitil 2010 Data to Tetrattech.xlsx” delivered March 1, 2011

**Table A-6. Util Free-Ridership / Spillover Sample Details**

Program	Measure Category	Number of accounts	Population kWh savings	Sampled # of accounts	Projected # of survey completes ⁵³
Large C&I New Construction	Total	7	611,702	7	5
	Compressed Air	1	40,239	1	1
	HVAC	2	163,459	2	1
	Motors & Drives	1	283,046	1	1
	Process	3	124,958	3	2
Large C&I Retrofit	Total	8	1,057,549	8	6
	Envelope	1	123,396	1	1
	HVAC	1	140,499	1	1
	Lighting	2	129,108	2	1
	Motors & Drives	3	643,863	3	2
	Process	1	20,683	1	1
Small C&I Retrofit	Total	34	785,366	34	22
	Compressed Air	1	11,302	1	1
	Lighting	31	712,830	31	20
	Motors & Drives	2	61,234	2	1
Grand Total		49	2,454,617	49	33

We suggest reporting the results at the utility level due to the small number of measures installed at the program level. This will provide more stable results than data reported at the measure category level.

A.5 CAPE LIGHT COMPACT

This memorandum presents the draft sample plan, and characterizes the sample pulled for Cape Light Compact's 2010 C&I free-ridership and spillover study.

In this document, we discuss the steps to be used in:

- Preparation of the data file and aggregation of the participant data
- Prioritization of accounts for sampling
- Development of the sample plan and determine level of precision.
- Selection of the sample (including a characterization of the final sample plan)
- Review of Sample to Identify Companies with Multiple Sampled Accounts.

⁵³ Assuming 65% response rate.



A.5.1 Preparation of the Data File and Aggregation of the Participant Data

The data file forwarded to us by Cape Light Compact provides information for participants in the following programs:

- New Construction (C&I and government⁵⁴)
- Commercial & Industrial Products and Services
- Medium and Large Retrofit (C&I and government)
- Small Retrofit (C&I and government).

Each record in the data represents a measure installed through a program for a particular location. One account may have multiple work orders, and one work order may include measures installed through multiple measure categories, sometimes referred to as end-uses⁵⁵ for regulatory reporting purposes. Therefore, it is necessary to take steps to collapse – or aggregate – the data through the sampling process, yet retain all the measure-specific information for each account⁵⁶. The steps taken to do this are detailed in this section.

a. IDENTIFY PROGRAM AND MEASURE CATEGORY PARTICIPATION

The study estimates free-ridership at the measure category level. The first step in sample preparation is to assign measures to a measure category. Using the information provided in the data file⁵⁷, we identify the measure categories within the following programs:

- a. New Construction programs (C&I and government) consists of three measure categories: Building Envelope, HVAC, and Lighting.
- b. Commercial and Industrial Product & Services program consists of three measure categories: Motors & Drives, HVAC, and Lighting.
- c. Medium and Large Retrofit (C&I and government) program consists of four measure categories: Motors & Drives, HVAC, Refrigeration, and Lighting.
- d. Small Retrofit (C&I and government) program consists of five measure categories: Building Envelope, Motors & Drives, HVAC, Refrigeration, and Lighting.

Fifteen lighting records with energy saving values of zero were removed from the data at this point. In addition, all records categorized as “fees” were removed with the exception of “consulting services”. Consulting Services records were flagged as Technical Assistance and retained in the dataset if the account that received technical assistance also received incentives for measures installed.

b. AGGREGATE THE RECORDS BY PROGRAM, ACCOUNT NUMBER, AND MEASURE CATEGORY

This aggregation sets the file up so that we have one record for each account for each measure category within a program. As we do the aggregation, we sum the kWh savings, cost, and incentive so that the values

⁵⁴ As the government and C&I programs all fall under the C&I sector

⁵⁵ End-uses include: building envelope, lighting, HVAC, motors & drives, and refrigeration,

⁵⁶ Account is the electric account and is used as the unique location identifier rather than work order. Multiple work orders may pertain to a single account, whereas the account number identifies a location participating in the program.

⁵⁷ The field “Measure Category” was used to identify the measure categories within each program.



are represented at an account level. The detailed descriptions, which were modified slightly to be more readable for the interview, are retained. These descriptions are used when describing to customers what equipment is included in a measure category.

c. APPEND THE FILE WITH CONSULTING DETAILS AND CREATE THE FLAT FILE

The next step is to create a flat file where one record represents one account within a program (an account may show up more than once in a dataset, but never more than one time in a program). To do this, and retain all measure category-specific details, we have to create variables specific to each measure category.

First, measure category information is captured using dichotomous variables. We start by creating variables that serve as indicators that an account received a measure through that category (i.e., mea1 = Measure Category 1, mea2 = Measure Category 2, etc.), and assign the variable a value of 1 if an account received that measure. For example, if Measure Category = 5 (Lighting), then we assign mea5 a value of one. If Measure Category = 2, then we create the variable mea2 and assign that variable a value of one. If the account did not receive any measure installations in that measure category, then the variable is assigned a value of zero.

We also create variables associated with annual kWh savings, incentive values, and costs assigned for each measure category (i.e., kWh1, kWh2, inc1, inc2, inc3, etc.). The cost and savings details remain blank if the account did not receive measure installations in the appropriate measure category.

After these preparatory steps, the complete data file can then be aggregated a final time to an account and program level to create a flat file. The file now includes one record for each account participating in a program.

A.5.2 Design Sample Plan

The next two points discuss additional preparatory steps taken to inform the sample plan.

a. PRIORITIZATION OF ACCOUNTS FOR SAMPLING

When designing the sample plan, we identify which measure categories will be randomly sampled (discussed in the next section). We apply a prioritization scheme when selecting cases within these randomly sampled categories. All accounts flagged priority will be sampled, followed by a random sample of non-priority accounts. Accounts are flagged as priority if:

1. They are considered a multi-measure account (their participation in a program includes installations across more than one measure category), or
2. The kWh savings is within the top ten percentile of kWh savings when it is reviewed by program and measure category.

All randomly sampled (non-priority) accounts are single-measure accounts. For the 2010 study, only lighting measures installed through Small Retrofit program were randomly sampled. The remaining measures under the programs were sampled with certainty.

b. DEVELOP SAMPLE PLAN AND DETERMINE LEVEL OF PRECISION

After determining the number of accounts associated with a measure category, we can develop the sample plan and determine the level of precision at a 90% Confidence Interval. The sample plan describes the population of accounts by measure category, the number of accounts to be surveyed by measure category, and potential number of survey completes if we apply a 65% response rate. Note that precision levels are only applicable when a sample is drawn; therefore, we indicate "NA" for measure categories where the sample is a census of participants.



The results of these steps can be found Table 1 at the end of this document.

c. *SELECTION OF THE SAMPLE*

In general, we always want to pull the accounts identified as priority, and a census of measure categories with less than or equal to 50 accounts associated with them within a program. The interviews discuss no more than two measure categories for each account and program the account participated in. When account contains more than two measure categories, we apply a set of rules to select which categories we want to include in the study.

1. First, select rare measure categories. Measure categories deemed rare (less than or equal to 50 accounts with installations in that measure category) are kept.
2. If we have not selected two measure categories in step 1, then we determine which measure category contributes the greatest ratio of energy savings in relation to the total program energy savings for that measure category. The measure categories with the highest ratios are kept until two measures are selected.
3. If more than two measure categories are selected in the step 1 above (an account has more than two measure categories deemed rare), then we select the two rare measure categories that have the highest ratio of energy savings.

Only five accounts installed equipment associated with more than two measure categories. Four accounts are within the Small Retrofit program, and received HVAC, Motors & Drives, Refrigeration, and Lighting measures. Given HVAC, Drives, and Refrigeration are the rarest measures, the surveys will not address the Lighting installations for these accounts. One account is in the Medium and Large Retrofit program and received Motors & Drives, HVAC, and Refrigeration. The Motors & Drives measure category was removed from the sample.

Table A-7 details the sample plan resulting from the process described above. Table A-7 also presents the sample details in terms of kWh savings, coverage, and number of accounts. Highlighted measures are sampled.



Table A-7. Cape Light Compact 2010 C&I Free-Ridership / Spillover Sample Details

Measure Category	# of accounts	Population kWh savings	Top 10 Percent or Multiple Measures	Random Sample	Sampled # of accounts ⁵⁸	Sampled kWh savings	Sampled Coverage (% kWh)	Projected # of survey completes ⁵⁹	+/- 90% CI
New Construction	13	663,907	-	-	13	663,907	100%	8	NA
10 Building Envelope	5	595,006	-	-	5	595,006	100%	3	NA
3 HVAC	1	7,178	-	-	1	7,178	100%	1	NA
5 Lighting	7	61,723	-	-	7	61,723	100%	5	NA
C&I Products and Services	21	156,871	-	-	21	156,871	100%	14	NA
2 Motors and Drives	1	513	-	-	1	513	100%	1	NA
3 HVAC	18	86,110	-	-	18	86,110	100%	12	NA
5 Lighting	2	70,248	-	-	2	70,248	100%	1	NA
Medium and Large Retrofit	14	1,748,457	-	-	13	1,391,607	80%	8	NA
2 Motors and Drives	6	585,876	-	-	5	229,026	39%	3	NA
3 HVAC	1	871,825	-	-	1	871,825	100%	1	NA
4 Refrigeration	3	30,551	-	-	3	30,551	100%	2	NA
5 Lighting	4	260,205	-	-	4	260,205	100%	3	NA
Small Retrofit	432	3,885,115	-	-	231	2,736,949	70%	150	NA
10 Building Envelope	1	375	-	-	1	375	100%	1	NA
2 Motors and Drives	18	114,923	-	-	18	114,923	100%	12	NA
3 HVAC	5	71,690	-	-	5	71,690	100%	3	NA
4 Refrigeration	98	451,973	-	-	98	451,973	100%	64	NA
5 Lighting	310	3,246,154	89	20	109	2,097,988	65%	71	4.6%
Total	480	6,454,350			278	4,949,334		181	

⁵⁸ The sampled number of accounts and projected number of survey completes at a program and total level is slightly lower than the sum of sampled and projected completed accounts at a measure category level. This is because one account may have installed measures in multiple measure categories.

⁵⁹ At 65% response rate.



You will note that most measure categories have fewer than ten accounts associated with them. These categories have too few accounts to report findings at a measure category level with any level of precision. We suggest reporting the results at a program-level, which will provide more stable results than data reported at the measure category level.

A.5.3 Review of Sample to Identify Companies with Multiple Sampled Accounts

Prior to survey implementation, we attempt to identify records that appear in the sample more than one time (“multiples”). Records that appear to potentially be the same facility, the same company, or have the same contact point are grouped and flagged so they are attempted at the same time. We manually sort and review the sample on the following criteria:

- Facility / Company name
- Contact name
- Telephone number
- Address.

All sample records are loaded into the Computer Assisted Telephone Interview (CATI) system. Any cases identified and flagged as “multiples” using the criteria above are put on hold. Senior interviewers are specially trained on how to deal with these multiples. Once we are a few days into the calling, our senior interviewers are responsible for calling multiples. We tend to over-group cases and let the interviewers verify differences in contacts during their first run through the groupings, rather than find out later we didn’t group enough and we have to call someone back about another case.

During our initial contact with the respondent, our first step is to verify whether the respondent is the appropriate person to provide information for each of the accounts. If not, we determine which accounts should be assigned to that respondent, and which should be discussed with someone else.

For contact persons associated with multiple accounts, we will ask these contacts about up to two measures per account for each program they participate in. Therefore, the interview may be slightly longer for these contacts.



APPENDIX B: VENDOR SAMPLING PLAN

B.1 OVERVIEW

This details the sampling procedures for the vendor survey for the 2010 Free-Ridership / Spillover Study. Vendors identified in program databases are contacted to assess non-participant “like” spillover.

A census of vendors that participated in PAs’ medium or large C&I programs are eligible to be surveyed. As discussed further in the document, not all PAs will have their vendors represented due to insufficient data.

B.2 VENDORS AND PAS INCLUDED IN THE STUDY

For this survey, a vendor is defined as a company that has been identified in the program tracking database as design professional, subcontractor, installation contractor, or project expeditor for the energy efficiency project. Vendors identified as a technical assistant were not included in the sample frame if an installation contractor existed. Contacting organizations that provided a technical assistance for a customer for whom we are already contacting an installation contractor would double-count the savings associated with that measure for the participant.

Small business projects were eliminated from the sample. Few unique contractors work with small business projects, and those that do are heavily invested in the program (e.g., Rise). Therefore, the analysis only represents practices with medium to large commercial and industrial customers.

Vendors are asked a series of questions about their installation or specification activities of the same type of program-qualifying equipment they installed through the program. Because we are asking them about the same or similar type of program qualifying equipment, it is important that the preparation process retain the type of equipment installed and savings related to those projects.

Three PAs provided sufficient enough vendor data that could be linked to participants: National Grid, NSTAR, and Unitol. Cape Light Compact and WMECO vendors are not specifically included, although there may be overlap in their vendors with the three PAs for which we do have sample.

B.3 SAMPLE PREPARATION

The vendors will only be contacted once regardless of the number of programs in which they provided energy efficiency services or number of programs they participated in. Each vendor will be asked only about the measure categories for which they provided services and for which we have savings information.

All PAs’ program data was cleaned so that vendors’ names are recorded the same (there was variance even within each PAs’ databases). In addition to cleaning the sample names, flags were added to the dataset to indicate through which PA and program vendors provided services. This step ensures that vendors are only contacted once, regardless of the number of times they appear in the sample or number.

In addition to cleaning vendor names, we also cleaned vendor contact name and phone information so they were consistent within and between PAs’ databases as there were often multiple contacts for a single vendor. These contacts were organized giving priority to those vendors with the highest number of projects associated with their name. In effect, those individuals with the most projects associated with them are contacted first. Contacts with the same number of projects are randomly assigned first and second contact.

Last, flags are added to indicate what measures were installed via the program so that interviewers could direct respondents’ attention to similar measures sold outside of the program. Because we want vendors to think about specific measures, we recode most of the custom measures to specific measure categories based



on the detailed descriptions provided by PAs. The measure categories, for the most part, are consistent with those detailed in the participant samples.

B.4 SAMPLE CHARACTERIZATION

Table B-1 shows the resulting vendor sample sizes and savings values after aggregating the PAs' vendor data. In total, 771 vendors are included in the sample representing over 191 Million kWh savings.

Table B-1. National Grid, NSTAR, and Unitol Vendor Sample Characteristics

Survey Categories	Vendor Population kWh Savings Sampled	Number of Firms in Sample
Motors	777,071	41
HVAC	11,634,610	167
VSD	17,093,952	108
Lighting	47,887,645	234
Compressed Air	3,504,693	24
Refrigeration	115,571	11
Other ⁶⁰	110,957,904	186
Total	191,971,445	771

⁶⁰ "Other" is a residual category consisting of measures remaining from "Custom" after equipment was reassigned to existing categories such as "Motors," "HVAC," or "Lighting," as well as process equipment, process cooling equipment, and comprehensive chillers.



APPENDIX C: WEIGHTING METHODOLOGY

This appendix outlines the steps necessary to prepare the free-ridership data for analysis.

C.1 CALCULATING THE SAMPLE WEIGHT (PHASE 1 WEIGHT)

Unless a census of all measures and customers is sampled **and** all customers respond to the survey, completed surveys must be weighted to represent population savings. This was not achieved for all measure categories.

The data was first weighted to correct for disproportional sampling and non-response to the survey. These weights—hereafter referred to as measure weights—were applied when analyzing the participant free-ridership and spillover results.

Because our population of interest was technically the savings, we used *measure category savings* to determine the weight that should be applied to each case. The measure category savings were stratified by priority and non-priority cases⁶¹. Priority cases were sampled at 100 percent. Including this stratification in the weighting scheme ensured the accounts sampled at 100 percent were not overrepresented, and the sampled accounts (sampled at less than 100 percent) were represented appropriately.

The following table is an example of weights applied to a sample stratified by measure category. The measure-related savings in the program tracking system database are listed in the population column. The corresponding savings accounted for by completed surveys and weights are listed under the “Complete” and “Measure Weight” columns, respectively. To calculate the “Measure Weight” for a given “Strata,” we divided the “Population of Savings” by the “Surveyed Savings”.

Table C-1. Examples of Weighting Calculations Using Five Measure Categories

Measure Category	Strata (priority/non-priority)	Population of Savings	Percent of Measure Category Population	Surveyed Savings	Percent of Savings Surveyed	Measure Weight
1 Custom	Priority	10,654,345	69.5%	6,273,424	75.7%	1.7
	Non-priority	4,675,943	30.5%	2,019,136	24.3%	2.3
	<i>Total</i>	<i>15,330,288</i>	<i>100.0%</i>	<i>8,292,560</i>	<i>100.0%</i>	
2.1 Motor: New	Census	233,603	100.0%	191,420	81.9%	1.2
3.1 HVAC: Unitary	Priority	1,624,981	79.8%	1,259,891	91.6%	1.3
	Non-priority	412,100	20.2%	115,069	8.4%	3.6
	<i>Total</i>	<i>2,037,082</i>	<i>100.0%</i>	<i>1,374,960</i>	<i>100.0%</i>	
3.2 HVAC: Non-unitary	Census	1,047,818	100.0%	620,139	59.2%	1.7
5 Lighting	Priority	5,828,297	66.7%	5,174,365	81.3%	1.1
	Non-priority	2,915,645	33.3%	962,567	18.7%	3.0
	<i>Total</i>	<i>8,743,943</i>	<i>100%</i>	<i>5,136,933</i>	<i>100.0%</i>	

⁶¹ As discussed in the sampling plan, priority cases are accounts that reside in New Hampshire, cases that are considered multi-measure accounts, and accounts that represent the top 10 percentile of kWh savings.



C.2 EXTRAPOLATING THE DATA TO THE EXPECTED SAVINGS (PHASE 2 WEIGHT)

The next step in preparing for the analysis is extrapolating the weight to the expected savings. To do this, the measure weight is multiplied by the kWh savings per account surveyed. The data is then analyzed taking into account the kWh savings.

Conducting this next step determines the net free-ridership rate, and ensures the overall free-ridership rates are computed taking into consideration the kWh savings for each individual account. The free-ridership rate would be skewed if the savings were not taken into account when determining free-ridership. This also means that large energy savers can have significant impacts on the overall free-ridership rates, particularly when the sample sizes are small.

Below we illustrate the preparation procedures, and affect of the procedures, using two cases.

Case A:	Case B:
Situation	
Received Custom measures	Received Custom measures
Flagged as a priority case	Flagged as non-priority
Has a free-ridership rate of 75 percent	Has a free-ridership rate of 25 percent
Recorded a savings of 10,000 kWh	Recorded a savings of 1,000 kWh
Step 1: Determine measure weights (discussed in prior section)	
Measure weight = 0.9	Measure weight = 1.3
Step 2: Compute measure category-weighted kWh	
Adjusted kWh = 10,000 * 0.9 = 9,000	Adjusted kWh = 1,000 * 1.3 = 1,300
Step 3: Calculate kWh associated with the free-ridership based on the measure category weighted kWh, calculated in Step 2	
FR savings = 9,000 * .75 = 6,750	FR savings = 1,300 * .25 = 325
Step 4: Sum the free-ridership attributed savings and population savings.	
Total FR attributed savings:	6,750 + 325 = 7,075 kWh
Population savings:	9,000 + 1,300 = 10,300 kWh



Step 5: Divide the Total FR attributed savings by population savings to determine free-ridership rate.

$$\text{Net free-ridership rate} = 7,075/10,300 = 68.7 \text{ percent}$$

As illustrated above, the net free-ridership rate takes into account the kWh savings of each account. As such, the estimates are *weighted for the disproportionate probability of being sampled and measure category kWh savings*.

C.3 CREATING A ONE-STAGE WEIGHTING SCHEME

Creating two weighting variables introduces the risk of error in reporting the data. To eliminate the risk, the analysis syntax only includes one weighting variable. This variable multiplies the weight calculated in Phase 1 with the kWh associated with that measure and account.

$$\text{Measure weight} = \text{sample weight} * \text{individual kWh savings}$$

The measure weight was applied when running any analysis to determine net free-ridership and spillover rates.



APPENDIX D: SURVEY INSTRUMENTS

D.1 MASSACHUSETTS CROSS-CUTTING-FREE-RIDERSHIP AND SPILLOVER SURVEY USING CUSTOMER SELF REPORT APPROACH – MARCH 2011

D.1.1 Variable List

<INTERVIEWER> = Interviewer Name

<CONTACT> = Customer Contact Name

<PROGRAM> = Program Name

<PA> = Program Administrator

<PA CONTACT INFORMATION> = PA Contact Name and Phone Number.

<CUST> = Customer/Facility Name

<DATE> = Date of participation

<YEAR> = Year of participation

<FUEL> = electric or natural gas

<ADDR> = Service address where measure was installed

<MEASCAT1, MEASCAT2> = End-use Category (i.e. lighting)

<QTY1, QTY2>

0 = quantity is not applicable for this measure category (measure count = 1 or quantity is not relevant as in delamping, recycling)

1 = quantity greater than 1

<EFF1, EFF2>

0 = efficiency is not applicable for this measure category (e.g., insulation, VFD, delamping, recycling, occupancy sensors)

1 = efficiency is applicable

<EQUIP1, EQUIP2> = 0 if installed measure is not equipment that is operational (e.g., insulation), 1=if installed measure is operational

<MEAS1a-MEAS1h>, <MEAS2a-MEAS2h> = detailed measure descriptions

<STUDY> = Technical Assessment Study, Technical Feasibility Study, Audit

<TA%> = Percent of study costs paid by PA

<TACOST> = Total cost paid for study

<TOINC> = Total incentive

<INC1, INC2> = PA incentive for specific measure categories

<TOTCOST> = Total project cost (customer cost+PA cost) for an account (by program)

<ALL ASSISTANCE> = Description of all technical assistance, financing, and rebates for measures installed through program

<FINANCE> = project received interest-free financing

NOTE: For all questions, "DON'T KNOW" and "REFUSED" will be coded if offered as a response. Interviewers will probe as needed to minimize the amount of missing data.

For any case where the interview terminates early, respondent doesn't recall measures, measures are not installed, or the contact no longer work at the company and we cannot locate a knowledgeable respondent, the case will be pulled and sent to the PA for review.



D.1.2 Introduction

Hello, my name is <INTERVIEWER>, and I'm calling on behalf of <PA> regarding your firm's participation in their <PROGRAM>. May I please speak with <CONTACT>?

- 1 Yes
- 2 No [ATTEMPT TO CONVERT. MENTION ADVANCE LETTER THEY SHOULD HAVE RECEIVED REGARDING THE CALL.]

I1. Are you the person who was most involved in making the decision to get <ALL ASSISTANCE> through the <PROGRAM> in <DATE> at <ADDR> in <CITY>?

- 1 Yes [SKIP TO I2]
- 2 No [SKIP TO I1A]
- D (DK) [PROBE TO IDENTIFY SOMEONE RESPONSIBLE FOR MAKING DECISIONS ABOUT ENERGY USING EQUIPMENT AT THAT FACILITY; IF DK, THANK AND TERMINATE]
- R (REFUSED) [THANK AND TERMINATE]

I1a. Who was primarily responsible for making the decision to get <ALL ASSISTANCE> through the program?

[RECORD NAME AND DISPOSITION]

- 1 Transfers you
- 2 Can only give contact information [RECORD CONTACT INFO; THANK AND TERMINATE]
- D (DK) [THANK AND TERMINATE]
- R (REFUSED) [THANK AND TERMINATE]

I2. Are you employed by <CUST> or are you a contractor who provides design and/or installation services for <CUST>?
(INTERVIEWER NOTE: CODE UNPAID MEMBERS OF AN ADVISORY BOARD OR COMMITTEE AS EMPLOYEES)

- 1 Work directly for company/Employee/Volunteer
- 2 Vendor/Contractor [TERMINATE and USE VENDOR SURVEY]

INTRO1.

I'm with Tetra Tech, an independent research firm. On behalf of <PA>, we are following up with customers who participated in the <PROGRAM> in <YEAR> to learn about their experiences. You or someone at your facility may have received a letter from <PA> letting you know to expect this call. I'm not selling anything, I'd just like to ask about the energy efficiency project you implemented through this program at <ADDR>. Your individual responses will be kept confidential by Tetra Tech and <PA> This should take about 15 minutes.



Before we start, I would like to inform you that for quality control purposes, this call will be recorded and monitored.

READ FOLLOWING ONLY AS NEEDED:

(Sales concern: I am not selling anything; I simply want to understand what factors were important to your company when deciding to implement this new energy efficiency project and receive an incentive through this program. Your responses will be kept confidential by our firm and <PA>. If you would like to talk with someone from <PA>, you can call <PA CONTACT INFORMATION>.)

(Who is doing this study: <PA> has hired our firm to evaluate the program. As part of the evaluation, we're talking with customers that participated in the program to better understand their experiences with the program.)

(Why are you conducting this study: Studies like this help <PA> better understand customers' need for and interest in energy efficiency programs and services, and to improve the effectiveness of their programs.)

(Timing: This survey should take about 15 minutes of your time. Is this a good time for us to speak with you? IF NOT, SET UP CALL BACK APPOINTMENT OR OFFER TO LET THEM CALL US BACK AT 1-800-454-5070.)

D.1.3 Decision Making

INTRO2.

In the remainder of this interview, I'd like to focus on the <MEASCAT1, MEASCAT2> you implemented through the <PROGRAM>.

REPEAT R1A THROUGH R1D FOR MEASCAT1 AND MEASCAT2.

R1a. According to our records, the [EFFICIENCY IS APPLICABLE (IF EFF1, EFF2 = 1): energy efficient] <MEASCAT1, MEASCAT2> project you implemented through the program included <MEAS1a-MEAS1h, MEAS2a-MEAS2h>.

Were you involved in the decision-making process when the [EFFICIENCY IS APPLICABLE (IF EFF1, EFF2 = 1): energy efficient] <MEASCAT1, MEASCAT2> was being considered for this facility?

- 1 Yes
- 2 No
- D (DK)
- R (REFUSED)



R1b. Aside from yourself, who else within your company or outside your company was involved in the decision of whether or not to purchase the [EFFICIENCY IS APPLICABLE (IF EFF1, EFF2 = 1): energy efficient] <MEASCAT1, MEASCAT2> through the <PROGRAM>?

(PROBE: IF MORE THAN ONE DECISION MAKER, ASK R WHO WAS RESPONSIBLE FOR MAKING THE ULTIMATE DECISION)

- 1 No one else
- 2 (SPECIFY):

Name	Title	Phone number	Probe for role:

R1c. Is this <MEASCAT1, MEASCAT2> equipment still at least partially installed [IF INSTALLED MEASURE IS OPERATIONAL; (IF EQUIP1, EQUIP2=1): and operating] at this facility?

- 1 Yes [SKIP TO NEXT MEASURE]
- 2 No
- D (DK)
- R (REFUSED)

R1d. Why is the <MEASCAT1, MEASCAT2> equipment no longer installed [IF INSTALLED MEASURE IS OPERATIONAL; (IF EQUIP1, EQUIP2=1): or no longer operating] at this facility?

(RECORD VERBATIM RESPONSE)

(IF RESPONDENT WAS MOST INVOLVED IN THE DECISION AND MEASURE IS STILL OPERATING, ASK FREE RIDERSHIP QUESTIONS RELATED TO MEASCAT1, MEASCAT2)

(IF NOT PRIMARY DECISION MAKER FOR EITHER MEASURE, SKIP TO I1 AND DIAL THE MAIN DECISION MAKER IN R1b)

R3. Does your company have any corporate policies related to energy efficiency standards that you need to consider when purchasing new equipment or making improvements to this facility?

- 1 Yes
- 2 No [SKIP TO R6]
- D (DK) [SKIP TO R6]
- R (REFUSED) [SKIP TO R6]



R4. Which of the following best describes this policy? (READ LIST)

- 1 Purchase energy efficient measures regardless of cost
- 2 Purchase energy efficient measures if it meets payback or return on investment criteria
- 3 Purchase standard efficiency measures that meet code
- 4 Something else (SPECIFY)
- D (DK)
- R (REFUSED)

R6i.⁶² (ASK IF PA = NSTAR) Did your company receive a technical assessment as part of your participation in the <PROGRAM>?

- 1 Yes [STUDY = Yes, STUDYTYPE = "technical assessment"]
- 2 No
- D (DK)
- R (REFUSED)

[IF NO <STUDY>, SKIP TO R9]

R6. <PA> paid <TA%> of the <TACOST> to conduct a <STUDY> at your facility to determine the cost-effectiveness of installing energy efficient <MEASCAT1 and MEASCAT2> equipment.

If <PA> had not paid a portion of the cost, would your company have paid <TACOST> to have a similar <STUDY> done at that same time?

- 1 Yes [SKIP TO R9]
- 2 No
- D (DK) [SKIP TO R9]
- R (REFUSED) [SKIP TO R9]

R7. Would you have paid to have the study done earlier than you did, at a later date, or never?

- 1 Earlier
- 2 Same time (REPEAT R6)
- 3 Later
- 4 Never
- D (DK)
- R (REFUSED)

R8. [IF R7 = EARLIER OR LATER (IF R7 = 1 OR 3)] How much [earlier/later] would you have had the study done?

___ YEARS (AND/OR) ___ MONTHS

- D (DK)
- R (REFUSED)

⁶² Added as NSTAR did not include technical assessment information as part of sample. Confirmed during interview.



C2. [IF <PA> HAD NOT PAID A PORTION OF THE COST OF THE <STUDY>, COMPANY WOULD HAVE PAID FOR STUDY (R6=NO)] On a scale of 0 to 10, with 0 being no influence and 10 being a great deal of influence, how much influence did the information provided by the <STUDY> have on your decision to implement the [IF EFFICIENCY IS APPLICABLE; *IF EFF1, EFF2 = 1*: high efficiency] <MEASCAT1,MEASCAT2> project? (REPEAT FOR EACH MEASURE)

_____ (ENTER INFLUENCE RANKING)
D (DK)
R (REFUSED)

R9. Did you receive interest-free financing from <PA> which allowed you to pay for your portion of the project cost over time?

1 Yes
2 No
D (DK)

D.1.4 Free-Ridership

FR0. Please think back to the time when you were considering implementing the specific <MEASCAT1 and MEASCAT2> projects in <YEAR>.

What factors motivated your business to consider implementing new <MEASCAT1 and MEASCAT2> equipment? (PROBE: What other factors did you consider?)

DO NOT READ LIST. PLEASE CHOOSE ALL THAT APPLY.

- 1 (Old equipment failed)
- 2 (Old equipment working poorly)
- 3 (Old equipment scheduled for replacement)
- 4 (Wanted to reduce maintenance costs)
- 5 (The incentive being offered through the program)
- 6 (The technical assistance offered through the program)
- 7 (Wanted to reduce energy bills)
- 8 (Wanted to save energy)
- 9 (Recommendation of third party contractor/engineer/design professional)
- 10 (Recommendation of <PA> staff)
- 11 (Recommendation of internal staff)
- 12 (Past experience with the program)
- 13 (Other - specify)
- D (DK)
- R (REFUSED)



START OF MEASURE LOOP

FR1-C9 will be asked of each measure category recalled that are still installed and operating - up to TWO measure categories.

INTRO3a

Now, I'd like to ask you about your decision to implement the <MEASCAT1> project. [IF THERE IS ALSO A SECOND MEASURE: Then, I'll repeat these questions for <MEASCAT2>].

INTRO3b

[IF SECOND MEASURE] Now I'd like to review the <MEASCAT2> project you implemented.

FR1. On a scale of 0 to 10, with 0 being not at all likely and 10 being very likely, how likely is it that your business would have implemented the same [IF QUANTITY IS GREATER THAN (IF QTY1, QTY2 = 1): quantity] [IF EFFICIENCY IS APPLICABLE (IF EFF1, EFF2 = 1): and efficiency of] <MEASCAT1, MEASCAT2> at that same time if the <PA> had not provided the <ALL ASSISTANCE>?

- ___ (0 TO 10)
- D (DK)
- R (REFUSED)

FR2. Did your company have any funds allocated to implement the <MEASCAT1, MEASCAT2> project before you talked with anyone about the program?

- 1 Yes
- 2 No [SKIP TO FR4]
- D (DK) [SKIP TO FR4]
- R (REFUSED) [SKIP TO FR4]

FR3a. Was it necessary to change the timing of the implementation, [IF QUANTITY IS GREATER THAN 1 (if QTY1, QTY2 = 1): the quantity of equipment] [IF EFFICIENCY IS APPLICABLE (IF EFF1, EFF2 = 1): or the efficiency level] of the <MEASCAT1, MEASCAT2> in order to qualify for the <PROGRAM>?

- 1 Yes
- 2 No [SKIP TO FR4]
- D (DK) [SKIP TO FR4]
- R (REFUSED) [SKIP TO FR4]



FR3b. What changes were necessary? [DO NOT READ; SELECT ALL THAT APPLY]

- 1 (Installation occurred SOONER than planned)
- 2 (Installation occurred LATER than planned)
- 3 (Installed MORE equipment than planned)
- 4 (Installed LESS equipment than planned)
- 5 (Equipment was MORE efficient than planned)
- 6 (Equipment was LESS efficient than planned)
- 7 (Removed MORE equipment than planned)
- 8 (Removed LESS equipment than planned)
- 9 (Other) (SPECIFY)
- D (DK)
- R (REFUSED)

FR4. Who was MOST responsible for actually recommending or specifying the [IF EFFICIENCY IS APPLICABLE (IF EFF1, EFF2 = 1): high efficiency] <MEASCAT1, MEASCAT2> project that was implemented through the <PROGRAM>?

DO NOT READ LIST, RECORD ONLY ONE

- 1 Respondent
- 2 Someone else in company (SPECIFY AND PROBE TO SEE IF SHOULD BE SPEAKING WITH THIS R)
- 3 Third-party design professional
- 4 Third-party engineer
- 5 Contractor
- 6 Manufacturer's representative
- 7 <PA> account manager
- 8 Someone else (SPECIFY)
- D (DK)
- R (REFUSED)

C1. [IF FR4= THIRD-PARTY DESIGN PROFESSIONAL, THIRD-PARTY ENGINEER, CONTRACTOR MANUFACTURER'S REPRESENTATIVE, OR <PA> ACCOUNT MANAGER (IF FR4=3, 4, 5, 6 OR 7)]

On a scale of 0 to 10, with 0 being no influence and 10 being a great deal of influence, how much influence did (FR4 response) have on your company's decision to implement the [IF EFFICIENCY IS APPLICABLE; IF EFF1, EFF2 = 1: high efficiency] <MEASCAT1,MEASCAT2> project so that it would qualify for the program?

- _____ (ENTER INFLUENCE RANKING)
- D (DK)
 - R (REFUSED)



FR5. I'd like to go over all the assistance you received from <PA>.

According to our records, the total cost for the project implemented at your facility in <DATE> through the <PROGRAM> was about <TOTCOST>. <PA> paid about <INC1, INC2> of the total cost of the [IF EFFICIENCY IS APPLICABLE; IF EFF1, EFF2 = 1: energy efficient] <MEASCAT1, MEASCAT2> project implemented through the program.

[IF NO <STUDY>: You may have also received some technical assistance from a <PA> rep, engineer, or equipment vendor.]

[IF <STUDY>: As I previously mentioned, <PA> paid <TACOST> for a <STUDY>.]

[IF <FINANCE> = Yes] <PA> also provided interest-free financing for up to 24 months for your portion of the project costs.

If <PA> had not paid a portion of the implementation cost OR provided any technical assistance or education [IF <FINANCE> = Yes: OR provided interest-free financing], would your business have implemented any type of <MEASCAT1, MEASCAT2> project at the same time?

- 1 Yes [SKIP TO FR7a]
- 2 No
- D (DK)
- R (REFUSED)

FR6a. Would you have implemented the <MEASCAT1, MEASCAT2> project earlier than you did, at a later date, or never?

- 1 Earlier
- 2 Same time [REPEAT FR5]
- 3 Later
- 4 Never [SKIP TO C3]
- D (DK) [SKIP TO C3]
- R (REFUSED) [SKIP TO C3]

FR6b. How much [earlier/later] would you have implemented the <MEASCAT1, MEASCAT2> project?

- ___ YEARS
- ___ MONTHS
- D (DK)
- D (REFUSED)



[IF QUANTITY IS NOT APPLICABLE FOR THIS MEASURE CATEGORY (IF QTY1, QTY2 = 0), SKIP TO FR8D]

FR7a. Without the program incentive, technical assistance, or financing, would your business have implemented the exact same quantity of <MEASCAT1, MEASCAT2> equipment [IF FR5=YES or DK: at that same time; IF FR5=2: within (TIMEFRAME IN FR6b)]?

- 1 Yes [SKIP TO FR8]
- 2 No
- D (DK) [SKIP TO C3]
- R (REFUSED) [SKIP TO C3]

FR7b. Compared to the amount of <MEASCAT1, MEASCAT2> that you implemented through the program, what percent of the project do you think your business would have purchased on its own during that timeframe?

(PROBE: Would you have purchased about one-fourth (25%), one-half (50%), three fourths (75%) of what you installed through the program?)

- _____ (ENTER PERCENTAGE: 1-99%)
- D (DK)
- R (REFUSED)

[IF EFFICIENCY IS NOT APPLICABLE FOR THIS MEASURE CATEGORY (IF EFF1, EFF2 = 0), SKIP TO C3]

FR8. You said your business would have installed [IF FR7A=YES: all; IF FR7A= NO: (FILL WITH FR7B %)] of the equipment on its own if the program had not been available. [ALL] Thinking about the <MEASCAT1, MEASCAT2> equipment you would have installed on your own, what percent of this equipment would have been . . . ?

(PROBE: Would about one-fourth (25%), one-half (50%), three fourths (75%) been of equal efficiency?)

- a. of the same high efficiency as what was installed through the program? _____
(ENTER PERCENTAGE: 0-100%)
D (DK)
- b. lower efficiency than what was purchased but higher than standard efficiency or code?
_____ (ENTER PERCENTAGE: 0-100%)
D (DK)
- c. standard efficiency or code
_____ (ENTER PERCENTAGE: 0-100%)
D (DK)

(CHECK THAT THE THREE % SUM TO 100%; PROBE TO CLARIFY).



[IF QUANTITY IS GREATER THAN 1 (IF QTY1, QTY2 = 1), SKIP TO C3]

FR8d. Thinking about the <MEASCAT1, MEASCAT2> project you would have implemented on your own if the program had not been available, would it have been of the same high efficiency as what was installed through the program, lower efficiency than what was purchased but higher than standard efficiency, or standard efficiency or code?

- 1 Of the same high efficiency as what was installed through the program?
- 2 Lower efficiency than what was purchased but higher than standard efficiency
- 3 Standard efficiency or code
- D (DK)
- R (REFUSED)

C3. On a scale of 0 to 10, with 0 being no influence and 10 being a great deal of influence, how much influence did the <INC1,INC2> you received from <PA> have on your decision to implement the [IF EFFICIENCY IS APPLICABLE; IF EFF1, EFF2 = 1: high efficiency] <MEASCAT1,MEASCAT2> project?

- _____ (ENTER INFLUENCE RANKING)
- D (DK)
 - R (REFUSED)

D.1.5 Consistency Check Prompts

a. 100% FREE RIDERSHIP CONSISTENCY CHECK

[IF WOULD HAVE PURCHASED AT THE SAME TIME, IN THE SAME QUANTITY, AND OF THE SAME EFFICIENCY LEVEL; IF FR5=1 AND FR7a=1 AND (FR8a=100% or FR8d = 1), ASK C4a-C7c, ELSE SKIP TO C8]

C4a. Now I want to focus on what it would have cost your business to install this equipment on its own without the program. On a scale of 0 to 10, with 0 being not at all likely and 10 being very likely, how likely is it that your business would have paid the additional <INC1,INC2> on top of the amount you already paid, to implement the same quantity and efficiency of <MEASCAT1,MEASCAT2> equipment at that same time?

- _____ (0 TO 10)
- D (DK)
 - R (REFUSED)

C4b. (ASK IF C4a < 8) You said that you would have installed the same quantity and efficiency of equipment at that same time, but you also just said that there was a (FILL WITH C4a SCORE) in 10 likelihood of you paying the additional incentive provided by the <PA> program. Which of these is more accurate?

- 1 Installed same quantity & efficiency at same time [SKIP TO C9]
- 2 Likelihood of installing this without the program assistance was (C4a SCORE)
- 3 Something else (SPECIFY)



C5. How would your project have changed if <PROGRAM> had not contributed to the cost of the <MEASCAT1, MEASCAT2>? (INDICATE ALL THAT APPLY) (DO NOT READ)

- 1 (Would not have changed) [SKIP TO C8]
- 2 (Would have postponed the project) (SPECIFY # MONTHS)
- 3 (Would have cancelled the project altogether)
- 4 (Would have repaired existing equipment)
- 5 (Kept using existing equipment)
- 6 (Purchased less efficient equipment) (ASK C7)
- 7 (Purchased fewer quantity) (ASK C6)
- 8 (Installed DIFFERENT type of equipment than planned) (SPECIFY)
- 9 (Other) (SPECIFY)
- D (DK)
- R (REFUSED)

C6. [IF C5=PURCHASED FEWER QUANTITY; IF C5=7] Compared to the amount of <MEASCAT1, MEASCAT2> that you implemented through the program, what percent do you think your business would have purchased on its own at that same time?
(PROBE: Would you have purchased about one- fourth (25%), one-half (50%), three fourths (75%) of what you installed through the program?)

- ____ (ENTER PERCENTAGE: 1-99%)
- D (DK)
- R (REFUSED)

C7. [IF C5=PURCHASED LESS EFFICIENT EQUIPMENT; IF C5=6] Thinking about the equipment you would have implemented on your own, what percent of this equipment would have been . . . ?

(PROBE: Would about one-fourth (25%), one-half (50%), three fourths (75%) been of equal efficiency?)

a. of the same high efficiency as what was installed through the program?

- ____ (ENTER PERCENTAGE: 0-100%)
- D (DK)

b. lower efficiency than what was purchased but higher than standard efficiency or code?

- ____ (ENTER PERCENTAGE: 0-100%)
- D (DK)

c. standard efficiency or code

- ____ (ENTER PERCENTAGE: 0-100%)
- D (DK)

(CHECK THAT THE THREE % SUM TO 100%; PROBE TO CLARIFY).



b. 0% FREE RIDERSHIP CONSISTENCY CHECK

C8 (IF SMALL BUSINESS - ASK IF AT LEAST SOMEWHAT LIKELY TO HAVE INSTALLED THE MEASURE WITHOUT THE PROGRAM BUT LATER STATES WOULD HAVE WAITED AT LEAST TWO YEARS (FR1 > 3 AND FR6b > 24 MONTHS OR NEVER)

(IF MED/LARGE C&I - ASK IF AT LEAST SOMEWHAT LIKELY TO HAVE INSTALLED THE MEASURE WITHOUT THE PROGRAM BUT LATER STATES WOULD HAVE WAITED AT LEAST FOUR YEARS (FR1 > 3 AND FR6b > 48 MONTHS OR NEVER) Earlier in the interview, you said there was a (FR1 SCORE) in 10 likelihood that you would have implemented the same quantity and efficiency of <MEASCAT1, MEASCAT2>equipment at that same time in the absence of the program assistance. But you also said you would not have implemented the <MEASCAT1, MEASCAT2> project within <2/4> years of when you did. Which of these is more accurate?

- 1 The likelihood of installing this without the program assistance was (FR1 SCORE)
2 Would not have installed anything within 2/4 years
3 Something else (SPECIFY)
D (DK)
R (REFUSED)

c. ADDITIONAL CONSISTENCY CHECK

C9. (IF 100% FREE-RIDER; IF FR5=1 AND FR7a=1 AND (FR8a=100% or FR8d = 1) AND C4b = 1 AND (C2 > 6 OR C3 > 6)) PROMPT: "Previously you stated that you would have installed the exact same equipment at the same time without the program. But, you also stated that the ...

- (IF C2 > 6 FILL: program-sponsored study)
(IF C3 > 6 FILL: program incentive and financing options)
(IF C2 > 6 & C3 > 6 FILL: program-sponsored study, incentive, and financing options)

... was influential in your decision.)

(IF 0% FREE-RIDER: IF FR6a = NEVER OR DK AND (C2 < 5 OR C3 < 5) PROMPT: "Previously you stated that you would not have installed any equipment without the program. You also stated that the ...

- (IF C2 < 5 FILL: program-sponsored study)
(IF C3 < 5 FILL: program incentive and financing options)
(IF C2 < 5 & C3 < 5 FILL: program-sponsored study, incentive, and financing options)

... was not influential in your decision.)

(ASK OF ALL) I'd like to better understand your purchase decision. In your own words, please describe what impact, if any, all the assistance you received through the program had on your decision to install the amount of energy efficient <MEASCAT1, MEASCAT2> equipment at the time you did?

(RECORD VERBATIM RESPONSE)



SKIP1

(REPEATS QUESTIONS BEGINNING FROM INTRO3B FOR SECOND MEASURE – IF NO OTHER MEASURES – CONTINUE)

[IF MEAS2 = 1 GO TO INTRO3B]

[IF MEAS2 = 0 GO TO PP1]

D.1.6 Impact of Previous Program Participation

[IF NEVER WOULD HAVE INSTALLED OR ALL EQUIPMENT WOULD HAVE BEEN OF STANDARD EFFICIENCY AND UNLIKELY TO HAVE PURCHASED WITHOUT PROGRAM ((IF FR6A = NEVER OR FR8A = 0% OR FR8D <> 1) AND FR1 < 4) SKIP TO COM]

PP1. Had your business participated in <PA>'s <PROGRAM> before you implemented the energy efficient project in <DATE>?

- 1 Yes
- 2 No [SKIP TO S1a]
- D (DK) [SKIP TO S1a]
- R (REFUSED) [SKIP TO S1a]

PP2. On a scale of 0 to 10, with 0 being 'not at all important and 10 being 'very important', how important was your previous experience with a <PA> program when making the decision to implement the <MEASCAT1, MEASCAT2> project at this facility around <DATE>?

- 0 – 10
- D (DK)

PP3. I'm going to read you several statements. For each statement, please tell me whether you agree or disagree that this statement applies to your business. There are no right or wrong answers; we just want your honest opinion. (REPEAT IF NECESSARY)

- 1 Agree
- 2 Disagree
- D (DK)
- R (REFUSED)

- Our previous experience implementing energy efficient projects through the <PROGRAM>
- a. Has made our firm more likely to consider energy efficient equipment
 - b. Has made our firm more likely to install energy efficient equipment
 - c. Has given us more confidence in the financial benefits of energy efficient equipment
 - d. Has given us more confidence in the nonfinancial benefits of energy efficient equipment



D.1.7 “Like” spillover⁶³

START OF MEASURE LOOP

S1a-S4b will be asked of each measure category recalled - up to TWO measure categories.

S1a. Now I'd like you to think of the time since you participated in the <PROGRAM> in <DATE>.

Has your company implemented any <MEASCAT1, MEASCAT2> projects for this or other facilities in Massachusetts **on your own**, that is without a rebate from <PA>?

- 1 Yes
- 2 No [SKIP TO SKIP2]
- D (DK) [SKIP TO SKIP2]

[IF EFFICIENCY IS NOT APPLICABLE; IF EFF1, EFF2 = 0, SKIP TO S2a]

S1b. Was this equipment of **the same efficiency level or a higher level of efficiency** as the equipment you installed through the program?

- 1 Yes [SKIP TO S2a]
- 2 No
- D (DK)

S1c. Was this equipment more energy efficient than standard efficiency or code equipment?

- 1 Yes
- 2 No [SKIP TO SKIP2]
- D (DK) [SKIP TO SKIP2]

S2a. Thinking of the <MEASCAT 1, MEASCAT 2> equipment that you installed on your own, how does the quantity compare to what you installed through the program? Did you install more, less or the same amount of <MEASCAT 1, MEASCAT 2>?

(PROBE: We're looking for a percent compared to the amount installed through the program. For example, was it about one- fourth of what you installed through the program, one-half of what you installed through the program, the same (100%) amount as you installed through the program, twice as much as what you installed through the program (200%) or some other amount?)

- 1 More (How much more? Enter percentage: 0-100%)
- 2 Less (How much less? Enter percentage: 0-100%)
- 3 Same
- D (DK)

⁶³ As these surveys are being conducted soon after implementation, estimates of like and “like” spillover “unlike” spillover are likely to be limited as participants have not had adequate time to install additional equipment.



S2b. [IF S2a <> SAME AMOUNT OF <MEASCAT 1, MEASCAT 2>; IF S2a <> 3] So the additional energy efficient equipment you bought on your own was <percentage from S2a> as much as you got through the program?

- 1 Yes
- 2 No [correct S2a]

S3a. Did a recommendation by the contractor, engineer, or designer who you worked with under the <PROGRAM> influence your decision to implement some or all of this [IF EFFICIENCY IS APPLICABLE; (IF EFF1, EFF2 = 1): efficient] <MEASCAT1, MEASCAT2> equipment on your own?

- 1 Yes
- 2 No
- D (DK)
- R (REFUSED)

S3b. Did your experience with the energy efficient projects implemented through the <PROGRAM> influence your decision to implement some or all of this [IF EFFICIENCY IS APPLICABLE; (IF EFF1, EFF2 = 1): efficient] <MEASCAT1, MEASCAT2> equipment on your own?

- 1 Yes
- 2 No
- D (DK)
- R (REFUSED)

S3c. Did your participation in any past program offered by <PA> influence your decision to implement some or all of this [IF EFFICIENCY IS APPLICABLE; (IF EFF1, EFF2 = 1): efficient] <MEASCAT1, MEASCAT2> equipment on your own?

- 1 Yes
- 2 No
- D (DK)
- R (REFUSED)

S3d. On a scale of 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence”, how much influence did your participation in the <PA> program have on your decision to install this equipment without an incentive?

- ___ 0-10 rating
- D (DK)



S4a. Why didn't you implement this <MEASCAT1, MEASCAT2> project through a <PA> program?

[DO NOT READ - SELECT ALL THAT APPLY]

- 1 (Too much paperwork)
- 2 (Cost savings not worth the effort of applying)
- 3 (Takes too long for approval)
- 4 (The equipment would not qualify)
- 5 (Vendor does not participate in program)
- 6 (Outside <PA>'s service territory)
- 7 (No time - needed equipment immediately)
- 8 (Thought the program ended)
- 9 (Didn't know the equipment qualified under another program)
- 10 (Just didn't think of it)
- 11 (Unable to get rebate--unsure why)
- 12 (Other) (SPECIFY)
- D (DK)

S4b. [IF S4a = THE EQUIPMENT WOULD NOT QUALIFY; IF S4a = 4) Why wouldn't the equipment qualify?

(RECORD VERBATIM RESPONSE)

SKIP2

(REPEATS SPILLOVER QUESTIONS FOR SECOND MEASURE – IF NO OTHER MEASURES – CONTINUE)

[IF MEAS2 = 1 GO TO S1A]

[IF MEAS2 = 0 GO TO S5]

D.1.8 “Unlike” spillover

S5. Since participating in <PROGRAM>, had your company purchased, installed, or implemented any other type of energy efficiency equipment **on your own**, that is without a rebate from <PA>?

- 1 Yes
- 2 No [SKIP TO NE1]
- D (DK) [SKIP TO NE1]

S6. What did you install?

Record type: _____

Record quantity: _____

Record size or capacity: _____



S7a. Would this project have qualified for an incentive through the <PROGRAM>?

- 1 Yes
- 2 Yes, implemented through a program [SKIP TO NE1]
- 2 No [SKIP TO NE1]
- D (DK) [SKIP TO NE1]

S7b. Did a recommendation by the contractor, engineer, or designer who you worked with under the <PROGRAM> influence your decision to implement some or this equipment on your own?

- 1 Yes
- 2 No
- D (DK)
- R (REFUSED)

S7c. Did your experience with the energy efficient projects implemented through the <PROGRAM> influence your decision to implement some or this equipment on your own?

- 1 Yes
- 2 No
- D (DK)
- R (REFUSED)

S7d. Did your participation in any past program offered by <PA> influence your decision to implement some or all of this equipment on your own?

- 1 Yes
- 2 No
- D (DK)
- R (REFUSED)

S7e. On a scale of 0 to 10, where 0 is “no influence at all” and 10 is “a great deal of influence”, how much influence did your participation in the <PA> program have on your decision to install this equipment without an incentive?

- ___ 0-10 rating
- D (DK)



S8a. Why didn't you implement this project through a <PA> program?

DO NOT READ - SELECT ALL THAT APPLY

- 1 (Too much paperwork)
- 2 (Cost savings not worth the effort of applying)
- 3 (Takes too long for approval)
- 4 (The equipment would not qualify)
- 5 (Vendor does not participate in program)
- 6 (Outside <PA>'s service territory)
- 7 (No time - needed equipment immediately)
- 8 (Thought the program ended)
- 9 (Didn't know the equipment qualified under another program)
- 10 (Just didn't think of it)
- 11 (Unable to get rebate--unsure why)
- 12 (Other) (SPECIFY)
- D (DK)

S8b. [IF S8a = EQUIPMENT WOULD NOT QUALIFY (IF S8a = 4)] Why wouldn't the project qualify?

(RECORD VERBATIM RESPONSE)

D.1.9 Expected NEI

NE1. Prior to participating in the program, did you expect any impacts other than energy savings?

- 1 Yes
- 2 No [SKIP TO COM]
- D (DK) [SKIP TO COM]

NE2. Did you view these effects as a negative or positive benefit?

- 1 Negative [SKIP TO COM]
- 2 Positive
- D (DK)

NE3. What were the positive benefits? (SELECT ALL THAT APPLY)

- 1 Sales
- 2 Production/productivity
- 3 Equipment life
- 4 Maintenance costs
- 5 Waste generation
- 6 Personnel needs
- 7 Injury or illness
- 8 Other (SPECIFY)



NE4. [IF POSITIVE BENEFIT, NE2 = 2] Did the expected positive benefits influence your decision to participate in the program?

- 1 Yes
- 2 No
- D (DK)

NE5. Did the program influence your expectations of the positive benefits?

- 1 Yes
- 2 No
- D (DK)

D.1.10 Wrap-up

COM. Do you have any comments or suggestions for the program?

(RECORD VERBATIM RESPONSE)

QRNAME.

For verification purposes, would you spell your first and last name for me?

(RECORD VERBATIM RESPONSE)

CLARIFY.

If we would need to clarify some of the information I asked you, would it be alright if we called you back?

- 1 Yes
- 2 No

A4. [ASK IF C1 > 6]

We would like to talk to the person who was most influential in recommending or specifying the efficient <MEASCAT1, MEASCAT2> equipment to install through the program. Earlier you mentioned that this was [FILL WITH FR4 RESPONSE]. Could you give me the name and telephone number of this person?

- 1 Yes (Record contact information)
- 2 No, REFUSED to give this information
- 3 No, no outside advisor involved
- 4 [IF SECOND MEASURE] (SAME CONTACT INFO AS PREVIOUS MEASURE)
- D (DK)

END

Those are all the questions I have for you. I'd like to thank you for your time with this important evaluation.



D.2 INFLUENTIAL DESIGN PROFESSIONAL/VENDOR FREE-RIDERSHIP SURVEY

D.2.1 Variable List

<CONTACT>	Customer Contact Name
<CUST>	Customer/Facility Name
<ADDR>	Service address where equipment was installed
<MEASCAT1, MEASCAT2>	End-use Category (i.e. lighting)
<MEASCAT1a-MEASCAT1h>	Detailed measure descriptions
<MEASCAT2a-MEASCAT2h>	Detailed measure descriptions
<TA>	"1" if a Technical Assessment Study was conducted
<TA%>	Percent of TA study paid by utility/sponsor (by program)
<TACOST>	Total cost paid by utility/sponsor for TA study (by program)
<INC1, INC2>	Utility/sponsor incentive for Measure categories
<QTY1, QTY2>	0=quantity is not applicable for this measure category (measure qty = 1 or quantity is not relevant as in delamping, recycling), 1=quantity greater than 1
<EFF1, EFF2>	0=efficiency is not applicable for this measure category (e.g., insulation, VFD, delamping, recycling), 1=efficiency is applicable
<EQUIP1, EQUIP2>	0 if installed measure isn't equipment that is operational (e.g., insulation), 1=if installed measure is operational
<TOTCOST>	Total project cost (customer cost+utility cost) for an account (by program)
<PROGRAM>	Utility/sponsor programs the vendor has been involved with
<PA>	Utility/sponsor name



D.2.2 Procedure

The customer-identified vendors will be exported from each PA study and combined into a single sample file. This file will be checked for missing contact information and we will fill in phone numbers where possible. Cases will then be sorted by company, contact, and phone number to identify “multiples”. Cases with the same contact names will be called together and the contact will be alerted that they have been referred by more than one customer. This set of sample cases will receive the free-rider questions only.

D.2.3 Introduction

INTRO

Hello, my name is __, and I am calling on behalf of <PA >. We are talking with some of the design professionals and contactors who were involved with the <PROGRAM> in 2010. I’m not selling anything; I’d just like to ask you about the types of equipment that your firm recommended, sold, or installed through this/these program(s) in 2010.

Before we start, I would like to inform you that for quality control purposes, this call will be recorded and monitored.

(Timing: This survey will take less than 15 minutes of your time. IF NOT A GOOD TIME, SET UP CALL BACK APPOINTMENT OR OFFER TO LET THEM CALL US BACK AT 1-800-454-5070)

(Sales concern: I am not selling anything. Your responses will be kept confidential by our firm and the <PA>. If you would like to talk with someone from there, you can call [CONTACT NAME AND PHONE NUMBER FOR SPONSORS INCLUDED IN THIS CALL].

D.2.4 Free-Ridership Questions

INTRO2

I'd like to review the <MEASCAT1, MEASCAT2> you recommended or specified through the <PROGRAM> for <PA>.

VR1 Do you recall recommending <MEASCAT1>, which included <DESC1> for <CUST> at <ADDR> through the <PROGRAM> in 2010?

- 1 Yes [SKIP TO V1a]
- 2 No
- 3 This equipment was never installed [IF NUMBER OF MEASURE CATEGORIES=2, SKIP TO VR2; ELSE SKIP TO END]
- D (DK)
- R (Refused)



VR1a Is there someone else at your firm who would be more familiar with this equipment?

- 1 Yes - Continue [ENTER CONTACT INFO & TRANSFER. GO THROUGH INTERVIEW WITH OTHER CONTACT IF AVAILABLE, OTHERWISE SET CALLBACK AND UPDATE CONTACT INFORMATION.]
- 2 Yes – Not available [ENTER CONTACT INFO & EXIT]
- 3 No [SKIP TO NEXT MEASURE]

V1a First I'd like to ask you about your decisions to recommend <MEASCAT1> through the <PROGRAM>. Were you involved in the decision-making process at the design stage when the <MEASCAT1> equipment was specified and agreed upon for this facility?

- 1 Yes [IF # OF MEASURE CATEGORIES = 2, SKIP TO VR2, ELSE SKIP TO VP0a]
- 2 No
- D (DK)

V1b At what point in the process did you become involved?

(RECORD VERBATIM RESPONSE)
(DK)
(REFUSED)

V1c What was your role?

(RECORD VERBATIM RESPONSE)
(DK)
(REFUSED)

[IF NO SECOND MEASURE, SKIP TO VP0a]

VR2 Do you recall recommending <MEASCAT2> which included <DESC2> for <CUST> at <ADDR> through the <PROGRAM> in 2010?

- 1 Yes [SKIP TO V2a]
- 2 No
- 3 This equipment was never installed [SKIP TO VP0a IF INSTALLED MEASURE CATEGORY 1; ELSE SKIP TO END]
- D (DK)

VR2a Is there someone else at your firm who would be more familiar with this equipment?

- 1 Yes - Continue [ENTER CONTACT INFO & TRANSFER IF NOT CONTACT FOR MEASURE 1]
- 2 Yes – Not available [ENTER CONTACT INFO & EXIT IF NOT CONTACT FOR MEASURE 1]
- 3 No – Continue
- 4 Contact no longer with the company

[IF DIDN'T RECALL MEASURES 1 AND 2, MEASURES 1 AND 2 WERE NOT INSTALLED, OR R WAS NOT THE CONTACT FOR MEASURES 1 AND 2, SKIP TO END; ELSE SKIP TO VP0a AND ONLY ASK QUESTIONS FOR MEASURE 1]



V2a Were you involved in the decision-making process at the design stage when the <MEASCAT2> equipment was specified and agreed upon for this facility?

- 1 Yes
- 2 No
- D (DK)

V2b At what point in the process did you become involved?

(RECORD VERBATIM RESPONSE)
(DK)
(REFUSED)

V2c What was your role?

(RECORD VERBATIM RESPONSE)
(DK)
(REFUSED)

[IF STUDY=0 SKIP TO VR9]

VP0a According to our records, <PA> paid a portion of the <TACOST> to conduct a <STUDYTYPE> for <CUST> to determine the cost-effectiveness of installing <MEASCAT1, MEASCAT2> equipment.

If <PA> had not paid a portion of the cost, do you think <CUST> would have paid <TACOST> to have a similar <STUDY> done at the same time?

- 1 Yes
- 2 No
- D (DK)

VC2 [IF VP0a = No, DK] On a scale of 0 to 10, with 0 being no influence and 10 being a great deal of influence, how much influence did the information provided by the <STUDYTYPE> have on your decision to recommend the [IF EFF1, EFF2 = 1: high efficiency] <MEASCAT1, MEASCAT2> project?

_____ (ENTER INFLUENCE RANKING)
D (DK)
R (REFUSED)

VR9 To the best of your knowledge, did <CUSTOMER> receive interest-free financing from <PA> which allowed them to pay for their portion of the project cost over time?

- 1 Yes
- 2 No

[INTERVIEWER: START OF MEASURE LOOPS. VA1 THROUGH VF9 WILL BE ASKED OF EACH MEASURE CATEGORY RECALLED - UP TO TWO MEASURES.]

INTRO3a [FIRST MEASURE]



Now, I'd like to ask you some questions about your decision to recommend <MEASCAT1> equipment. [IF THERE IS ALSO A SECOND MEASURE: Then, I'll repeat these questions for <MEASCAT2> equipment.]

INTRO3b [IF SECOND MEASURE]

Now I'd like to review the <MEASCAT2> equipment you recommended.

VA1 On a scale of 0 to 10, with 0 being no influence and 10 being a great deal of influence, how much influence did your firm have on specifying the efficiency levels or features of <MEASCAT1, MEASCAT2> so that it would qualify for the program?

- (0-10)
- D (DK)

(IF VA1 < 7 AND NO OTHER MEASURE, SKIP TO END; IF VA1<7 AND ANOTHER MEASURE CATEGORY, REASK VA1 OF SECOND MEASURE CATEGORY; ELSE SKIP TO VP1a)

FR The next set of questions ask about <CUST>'s planning and installation decisions through <PROGRAM> in 2010.

VP1a As far as you know, did <CUST> have funds allocated to install any of this equipment before you talked with them about the program?

- 1 Yes
- 2 Yes, but don't remember specifics [SKIP TO ATXT3]
- 3 No [SKIP TO ATXT3]
- D (DK) [SKIP TO ATXT3]
- R (Refused) [SKIP TO ATXT3]

VP1b (IF YES) What plans existed?

- (RECORD VERBATIM RESPONSE)
- (DK)
- (REFUSED)

VP2a Was it necessary to change the timing of the installation, the quantity of equipment installed or the efficiency level of the <MEASCAT1, MEASCAT2> equipment installed in order to qualify for the <PROGRAM>?

- 1 Yes
- 2 Yes, but don't remember specifics [SKIP TO ATXT3]
- 3 No [SKIP TO ATXT3]
- D (DK) [SKIP TO ATXT3]
- R (Refused) [SKIP TO ATXT3]



VP2b What changes were necessary? [INDICATE ALL THAT APPLY]

- 1 (Installation occurred SOONER than planned)
- 2 (Installation occurred LATER than planned)
- 3 (Installed MORE equipment than planned)
- 4 (Installed LESS equipment than planned)
- 5 (Equipment was MORE efficient than planned)
- 6 (Equipment was LESS efficient than planned)
- 7 (Other - specify)
- D (Don't know)
- R (Refused)

ATXT3

According to our records, the total cost for all equipment installed at <CUST>'s facility was about <CST1, CST2>. <PA> paid about <INC1, INC2> of the total cost of the <MEASCAT1, MEASCAT2>.

<CUST> may have also received some technical assistance from <PA> or a contribution toward the cost of a technical assessment study.

VF1 If <PA> had not paid a portion of the implementation cost, would your company have recommended or specified any type of <MEASCAT1, MEASCAT2> equipment to <CUST> at the same time?

- 1 Yes
- 2 No [SKIP TO VC3]
- D (DK) [SKIP TO VC3]

[IF QTY1, QTY2 = 0, SKIP TO VF3d]

VF2a Without the program incentive, technical assistance, or education, would your company have recommended or specified the exact same quantity of <MEASCAT1, MEASCAT2> for <CUST> at the same time?

- 1 Yes [SKIP TO VF3]
- 2 No
- D (DK)

VF2b Compared to the amount that you recommended through the program, what percentage of the overall quantity of <MEASCAT1, MEASCAT2> equipment do you think your company would have recommended or specified without assistance from <PA>?

(PROBE: Would you have recommended/specified about one-fourth (25%), one-half (50%), three fourths (75%) of what was installed through the program?)

____ ENTER PERCENTAGE (0-100%, 998=DK)



[IF VF2b = 0, SKIP TO VC3
[IF EFF1, EFF2 = 0, SKIP TO VC3]

VF3 You said you would have recommended or specified [IF VF2a=1: all the] [IF VF2a=2 OR D SHOW: at least some] <MEASCAT1, MEASCAT2> for <CUST> if the program had not been available.

What percent of the equipment that you would have recommended would have been...

- a. _____ of the same high efficiency as what was installed through the program?
 _____ (ENTER PERCENTAGE: 0-100%)
 D (DK)
- b. _____ lower efficiency than what was purchased but higher than standard efficiency or code?
 _____ (ENTER PERCENTAGE: 0-100%)
 D (DK)
- c. _____ standard efficiency or code?
 _____ (ENTER PERCENTAGE: 0-100%)
 D (DK)

[IF QTY1, QTY2 = 1, SKIP TO VC3]
[IF EFF1, EFF2 = 0, SKIP TO VC3]

VF3d Thinking about the <MEASCAT1, MEASCAT2> equipment you would have recommended if the program had not been available, would it have been of the same high efficiency as what was installed through the program, lower efficiency than what was purchased but higher than standard efficiency, or standard efficiency or code?

- 1 Of the same high efficiency as what was installed through the program?
- 2 Lower efficiency than what was purchased but higher than standard efficiency
- 3 Standard efficiency or code
- D (DK)
- R (REFUSED)

VC3 On a scale of 0 to 10, with 0 being no influence and 10 being a great deal of influence, how much influence did the <INC1,INC2> <CUST> received from <PA> have on your decision to recommend the [IF EFF1, EFF2 = 1:high efficiency] <MEASCAT1,MEASCAT2> project?

- _____ (ENTER INFLUENCE RANKING)
- D (DK)
- R (REFUSED)



(IF VF1=1 AND VF2a=1 AND VF3a=100%, ASK VF4-VF7; ELSE SKIP TO VF8)

VF4 Now I want to focus on what it would have cost <CUST> to install this equipment on its own without the program. On a scale of 0 to 10, with 0 being not at all likely and 10 being very likely, how likely would they have been to pay the additional <INC1,INC2> on top of the amount they already paid, to implement the same quantity and efficiency of <MEASCAT1, MEASCAT2> equipment at that same time?

- ___ (0 TO 10)
- D (DK)
- R (REFUSED)

(IF VF4 > 7 SKIP TO VF8)

VF5 How would their project have changed if <PROGRAM> had not contributed to the cost of the <MEASCAT1, MEASCAT2>?
(INDICATE ALL THAT APPLY) (DO NOT READ)

- 1 Would not have changed [SKIP TO VF8]
- 2 (Would have postponed the project) (SPECIFY # MONTHS)
- 3 (Would have cancelled the project altogether)
- 4 (Would have repaired existing equipment)
- 5 (Kept using existing equipment)
- 6 (Purchased less efficient equipment) (ASK VF7)
- 7 (Purchased fewer quantity) (ASK VF6)
- 8 (Installed DIFFERENT type of equipment than planned) (SPECIFY)
- 9 (Other) (SPECIFY)
- D (DK)
- R (REFUSED)

VF6 (IF VF5=7) Compared to the amount of <MEASCAT1, MEASCAT2> that <CUST> implemented through the program, what percent do you think they would have purchased on their own at that same time?

(PROBE: Would you have purchased about one- fourth (25%), one-half (50%), three fourths (75%) of what you installed through the program?)

- ___ (ENTER PERCENTAGE: 0-99%)
- D (DK)
- R (REFUSED)

[IF VF6 = 0 SKIP TO VF8]
[IF QTY1, QTY2 = 0 SKIP TO VF8]



VF7 (IF VF5=6) Thinking about the equipment <CUST> would have implemented on their own, what percent of this equipment would have been . . . ?

(PROBE: Would about one-fourth (25%), one-half (50%), three fourths (75%) been of equal efficiency?)

a. of the same high efficiency as what was installed through the program?
_____ (ENTER PERCENTAGE: 0-100%)
D (DK)

b. lower efficiency than what was purchased but higher than standard efficiency or code?
_____ (ENTER PERCENTAGE: 0-100%)
D (DK)

c. standard efficiency or code
_____ (ENTER PERCENTAGE: 0-100%)
D (DK)

(CHECK THAT THE THREE % SUM TO 100%; PROBE TO CLARIFY).

VF8 On a scale of 0 to 10, with 0 being 'not at all important and 10 being 'very important', how important was your previous experience with a <PA> program when making the decision to recommend or install <MEASCAT1, MEASCAT2>for this customer?

_____ (DK)
N NA – No previous program experience

VF9 (IF VF1=1 AND VF2a=1 AND (VF3a=100% or VF3d = 1) AND VF5 = 1 AND (VC2 > 6 OR VC3 > 6) PROMPT: “Previously you stated that you would have recommended the exact same equipment at the same time without the program. But, you also stated that the ...

(IF VC2 > 6 FILL: program-sponsored study)
(IF VC3 > 6 FILL: program incentive)
(IF VC2 > 6 & VC3 > 6 FILL: program-sponsored study and incentive)

... was influential in your decision to make the recommendations that you did.)

(IF VF1 = NO OR DK AND (VC2 < 5 OR VC3 < 5) PROMPT: “Previously you stated that <CUST> would not have installed any equipment without the program. You also stated that the ... (IF VC2 < 5 FILL: program-sponsored study)

(IF VC3 < 5 FILL: program incentive)
(IF VC2 < 5 & VC3 < 5 FILL: program-sponsored study and incentive)

... was not influential in their decision.)

I'd like to better understand <CUST>'s purchase decision. Please describe what impact, if any, the program had <CUST>'s decision to install the energy efficient <MEASCAT1,MEASCAT2> equipment at the time they did?

(RECORD VERBATIM RESPONSE)
(DK)
(REFUSED)



END We are almost finished calling customers about their experience with the program. If another customer identifies you as being influential in their decision to install energy efficient equipment, would it be alright for us to call you back for just a couple of questions?

- 1 YES
- 2 NO

VRNAME

For verification purposes, would you spell your first and last name for me?

(RECORD VERBATIM RESPONSE)

COMMENTS

That is all the questions I have for you. Thank you for your participation. Do you have any comments?

(RECORD VERBATIM RESPONSE)



D.3 DESIGN PROFESSIONAL/VENDOR NON-PARTICIPANT SPILLOVER SURVEY

D.3.1 Variable List

<CONTACT>	Customer Contact Name
<CUST>	Customer/Facility Name
<ADDR>	Service address where equipment was installed
<PA>	Sponsors the vendor has worked with on energy efficiency projects
<PROGRAM>	Utility/sponsor programs the vendor has been involved with
<ME1-ME14>	Types of equipment specified/sold as part of spillover questions

D.3.2 Procedure

The vendors identified in the sponsor databases will be asked the non-participant spillover questions. We will focus on reaching the contacts listed in the database.

D.3.3 Introduction

INTRO4

Hello, my name is _____, and I am calling from Tetra Tech on behalf of **<PA>**. We are talking with some of the design professionals and contactors who were involved with the **<PROGRAM>** in 2010. I'm not selling anything; I'd just like to ask you about the types of equipment that your firm recommended, sold, or installed through this/these program(s) in 2010.

Before we start, I would like to inform you that for quality control purposes, this call will be recorded and monitored.

(Timing: This survey will take less than 15 minutes of your time. IF NOT A GOOD TIME, SET UP CALL BACK APPOINTMENT OR OFFER TO LET THEM CALL US BACK AT 1-800-454-5070)

(Sales concern: I am not selling anything. Your responses will be kept confidential by our firm and **<PA>**. If you would like to talk with someone from there, you can call [CONTACT NAME AND PHONE NUMBER FOR SPONSORS INCLUDED IN THIS CALL].

[VNP1a-VNP8 WILL BE ASKED FOR EACH MEASURE WHERE MEx=1 where x=measure category number defined above].

VNP1a Our records show that your firm specified, sold, and/or installed **<MEx>** to commercial and industrial customers in 2010 through the **<PROGRAM>**. This includes equipment such as **<DESC>**.

Is that correct?

[INTERVIEWER: PLEASE VERIFY EACH TYPE OF EQUIPMENT THAT SHOWS FOR THE VENDOR]

- 1 Yes
- 2 No
- D Don't know
- R Refused
- ME2 = Motors
- ME2a = Motors: New
- ME2b = Motors: Failed/Stock
- ME3 = HVAC equipment



- ME3a = HVAC: Unitary
- ME3b = HVAC: Non-unitary
- ME4 = Variable speed drives
- ME5 = Lighting equipment
- ME6 = Non-Lighting equipment
- ME7 = Transformers
- ME8 = Compressed air
- ME9 = Refrigeration
- ME10 = Process equipment and system
- ME11 = Process cooling equipment
- ME12 = VSDs on non-HVAC systems
- ME13 = Comprehensive Chillers
- ME14 = Equipment converting electric DHW to gas, Comprehensive design projects, O&M projects
- ME15 = Comprehensive lighting systems

Note: The measure categories listed above will closely match measure categories as defined in the customer sample. When asking vendors about each measure category, we will reference the specific measure-level descriptions noted in the database.

VNP1b Prior to participating in the <PA> program, in what percentage of your commercial projects did you install high efficiency <ME_x>?

- ___ ENTER PERCENTAGE
- 888 DON'T KNOW
- 999 REFUSED

VNP1c And during the past year, in what percentage of your commercial projects did you install high efficiency <ME_x>?

- ___ ENTER PERCENTAGE
- 888 DON'T KNOW
- 999 REFUSED

VNP2 Please think about all the program-eligible <ME_x> you specified, sold and/or installed for <PA> customers in 2010. Did you specify, sell and/or install any of this program-eligible <ME_x> to customers of <PA> without the customer participating in a <PA> program??

- 1 Yes
- 2 No [SKIP TO NEXT CATEGORY]
- D Don't know [SKIP TO NEXT CATEGORY]
- R Refused [SKIP TO NEXT CATEGORY]

VNP3 (IF VNP2 = Yes) What percent of all of this program-eligible <ME_x> you specified, sold and/or installed for <PA> customers in 2010 did not receive an incentive through a <PA> program?

- ___%
- 888 Don't know
- 999 Refused



(ASK VNP4-VNP8 OF EACH MEASURE WHERE VNP3 > 1%)

VNP4 In 2010, you mentioned that about [___%] of the <MEx> you specified and/or installed would have been eligible for an incentive through a <PA> program, but did not receive an incentive. What are the main reasons why your firm did not request a customer incentive for this energy saving equipment you specified/installed?
(DO NOT READ—INDICATE ALL THAT APPLY; PROBE, WHAT ELSE?)

- 1 Not worth the paperwork for our firm to help the customer apply for the incentive
- 2 Customer did not want the hassle of applying for the incentive
- 3 Takes too long for approval
- 4 Reached the maximum amount I could install through the program
- 5 The equipment would not qualify→ [Why not? (SPECIFY)]
- 6 Vendor does not participate in program
- 7 Outside [retail company] service territory
- 8 No time – needed equipment immediately
- 9 Thought the program ended
- 10 Didn't know the equipment qualified under another program
- 11 Just didn't think of it
- 12 Unable to get rebate (unsure why)
- 13 Other (SPECIFY)
- 14 Don't know

VNP5 I'm going to read you 3 statements. For each statement, please tell me whether you agree or disagree that this statement applies to your company. There are no right or wrong answers; we just want your honest opinion.
Our past experience specifying or installing <MEx> through energy efficiency programs has convinced us that this equipment is cost effective or beneficial even without a program incentive.

- 0 Agree
- 1 Disagree

VNP6 We are better able to identify opportunities to improve energy efficiency by using high efficiency <MEx> because of our previous experience with the performance of energy efficient equipment installed through energy efficiency programs, and what we learned through working with <PA>.

- 0 Agree
- 1 Disagree

VNP7 We are more likely to discuss energy efficient options with all of our customers when developing project plans for <MEx> because of our previous experience with the performance of energy efficient equipment installed through energy efficiency programs, and what we learned through working with <PA>.

- 0 Agree
- 1 Disagree

VNP8 Please describe what impact, if any, the <PROGRAM> had on your decision to specify or install energy efficient <MEx> outside of the program.

(RECORD VERBATIM RESPONSE)



END We are almost finished calling customers about their experience with the program. If a customer identifies you as being influential in their decision to install energy efficient equipment, would it be alright for us to call you back for just a couple of questions?

- 1 YES
- 2 NO

VRNAME

For verification purposes, would you spell your first and last name for me?

COMMENTS

Those are all the questions I have for you. Thank you for your participation. Do you have any comments?



APPENDIX E: CUSTOMER ACCOUNT AND PROGRAM SAVINGS COVERAGE

E.1 DETAILED RESPONSE RATES

Table E-1. National Grid Response Rate

Status	Energy Initiative	Design 2000plus	Small Business Services	Total
Total Sample	362	348	370	1080
Bad phone #s	19	10	11	40
No knowledgeable respondent	35	46	17	98
Language Barrier	0	1	2	3
Adjusted Sample	308	291	340	939
Refusal	8	15	26	49
Active Sample	89	99	125	313
Complete	211	177	189	577
Cooperation Rate	68.5%	60.6%	55.6%	61.4%
Response Rate	58.3%	50.9%	51.1%	53.4%

Table E-2. NSTAR Response Rate

Status	Business Solutions	Construction Solutions	Small Business Solutions	Total
Total Sample	351	368	504	1223
Bad phone #s	7	18	28	53
No knowledgeable respondent	24	40	47	111
Language Barrier	0	0	6	6
Adjusted Sample	320	310	423	1053
Refusal	6	12	28	46
Active Sample	63	84	149	296
Complete	251	214	246	711
Cooperation Rate	78.4%	69.0%	58.2%	67.5%
Response Rate	71.5%	58.2%	48.8%	58.1%



Table E-3. WMECO Response Rate

Status	Retrofit	New Construction	Small Business	Total
Total Sample	94	96	185	375
Bad phone #s	18	13	8	39
No knowledgeable respondent	5	4	21	30
Language Barrier	0	1	0	1
Adjusted Sample	71	78	156	305
Refusal	1	0	6	7
Active Sample	32	39	59	130
Complete	38	39	91	168
Cooperation Rate	53.5%	50.0%	58.3%	55.1%
Response Rate	40.4%	40.6%	49.2%	44.8%

Table E-4. Unitil Response Rate

Status	Large C&I Retrofit	New Construction	Small C&I Retrofit	Total
Total Sample	8	7	34	49
Bad phone #s	0	0	0	0
No knowledgeable respondent	1	0	0	1
Language Barrier	0	0	0	0
Adjusted Sample	7	7	34	48
Refusal	0	0	5	5
Active Sample	2	0	8	10
Complete	5	7	21	33
Cooperation Rate	71.4%	100.0%	61.8%	68.8%
Response Rate	62.5%	100.0%	61.8%	67.3%



Table E-5. Cape Light Compact Response Rate

Status	Medium and Large C&I Retrofit	Medium and Large Government Retrofit	Retrofit	New Construction	Services & Products	Total
Total Sample	4	6	146	11	20	187
Bad phone #s	0	2	42	3	4	51
No knowledgeable respondent	0	0	6	2	1	9
Language Barrier	0	0	0	0	0	0
Adjusted Sample	4	4	98	6	15	127
Refusal	0	0	5	0	2	7
Active Sample	0	0	34	3	6	43
Complete	4	4	59	3	7	77
Cooperation Rate	100.0%	100.0%	60.2%	50.0%	46.7%	60.6%
Response Rate	100.0%	66.7%	40.4%	27.3%	35.0%	41.2%

E.2 MEASURE AND SAVINGS COVERAGE

TableE-6. Measure and Savings Coverage by PA and Program

PA	Program	Measure	Population kWh	Surveyed kWh	kWh Coverage	Population	Surveys
National Grid	Design 2000plus program	Custom	14,188,632	8,470,469	59.7%	67	38
		New Motors	413,218	294,578	71.3%	29	20
		Failed or Stock Motors	179,337	112,983	63.0%	22	15
		Unitary HVAC	1,065,793	342,726	32.2%	95	32
		Non-unitary HVAC	960,531	452,003	47.1%	63	26
		VSD	1,048,769	446,586	42.6%	20	10
		Lighting	6,368,785	2,692,825	42.3%	86	38
		Compressed Air	1,838,458	934,429	50.8%	86	35
	Energy Initiative Program	Custom	68,068,094	30,579,335	44.9%	272	69
		HVAC	6,744,387	3,255,164	48.3%	58	31
		VSD	6,402,221	3,973,959	62.1%	79	48
		Lighting	65,013,533	19,063,003	29.3%	630	114
		Compressed Air	905,606	681,796	75.3%	23	15
	Small Business Services Program	Lighting	23,180,602	6,875,084	29.7%	1,188	186
Other		1,711,827	937,022	54.7%	119	46	
NSTAR	Business Solutions program	Custom	34,391,171	19,194,551	55.8%	150	52
		Custom Lighting	25,397,058	12,709,694	50.0%	245	61
		HVAC	2,531,415	1,947,860	76.9%	37	27
		VSD	10,786,181	6,584,590	61.0%	104	58



PA	Program	Measure	Population kWh	Surveyed kWh	kWh Coverage	Population	Surveys
		Lighting	26,174,663	12,726,552	48.6%	318	86
		Refrigeration	172,248	75,985	44.1%	22	15
	Construction Solutions program	Custom	34,882,277	26,877,617	77.1%	67	42
		Custom Lighting	4,977,850	3,454,702	69.4%	12	7
		Motors	1,031,697	539,495	52.3%	67	38
		HVAC	5,761,261	2,959,015	51.4%	155	53
		VSD	6,387,126	4,538,282	71.1%	50	28
		Lighting	9,239,357	5,348,269	57.9%	160	64
		Compressed Air	1,601,709	971,661	60.7%	43	22
	Small Business Solutions program	Lighting	32,138,167	8,952,680	27.9%	2,083	196
Other		4,883,873	1,610,910	33.0%	362	105	
WMECO	New Construction Program	HVAC	3,028,002	1,258,762	41.6%	49	20
		Lighting	993,459	324,585	32.7%	17	7
		Other	234,771	99,426	42.4%	4	1
		Process	5,580,021	2,617,551	46.9%	30	13
	Retrofit program	Lighting	8,923,679	5,740,363	64.3%	109	36
		Process	941,363	332,166	35.3%	5	2
	Small Business program	Lighting	8,384,961	3,433,049	40.9%	375	87
Other		1,117,893	368,109	32.9%	96	39	
Unitil	Large C&I Retrofit Program	Custom	514,838	514,838	100.0%	2	2
		HVAC	140,499	140,499	100.0%	1	1
		VSD	149,708	149,708	100.0%	2	2
	New Construction Program	Custom	287,634	287,634	100.0%	2	2
		HVAC	163,459	163,459	100.0%	2	2
		Compressed Air	40,239	40,239	100.0%	1	1
		Process	120,370	120,370	100.0%	2	2
	Small C&I Retrofit Program	VSD	61,234	61,234	100.0%	2	2
		Lighting	712,830	406,115	57.0%	31	18
Compressed Air		11,302	11,302	100.0%	1	1	
Cape Light Compact	Medium and Large C&I Retrofit	VSD	90,228	90,228	100.0%	1	1
		Lighting	110,193	110,193	100.0%	3	3
	Medium and Large Government Retrofit	HVAC	871,825	871,825	100.0%	1	1
		VSD	495,648	20,524	4.1%	5	2
		Lighting	150,012	150,012	100.0%	1	1
		Refrigeration	30,551	30,551	100.0%	3	3
	New Construction Program	HVAC	7,178	7,178	100.0%	1	1
		Lighting	61,723	10,988	17.8%	7	2
		Building Envelope	595,006	327,547	55.0%	5	2



PA	Program	Measure	Population kWh	Surveyed kWh	kWh Coverage	Population	Surveys
	Retrofit program	HVAC	71,690	3,223	4.5%	5	2
		VSD	114,923	43,448	37.8%	18	12
		Lighting	3,246,154	750,209	23.1%	310	42
		Refrigeration	451,973	166,855	36.9%	98	40
		Building Envelope	375	375	100.0%	1	1
	Services & Products program	Motors	513	0	0.0%	1	0
		HVAC	86,110	58,264	67.7%	18	6
		Lighting	70,248	0	0.0%	2	0



APPENDIX F: EXAMPLE OF THE DESIGN PROFESSIONAL AND VENDOR SPILLOVER CALCULATION

As an example, assume a vendor had 200,000 kWh savings in the program tracking system database attributable to premium efficiency motors. If that vendor said that 25 percent of all their premium efficiency motors were sold outside the program, the potential non-participant spillover savings would be $(200,000 \text{ kWh} * 0.25 / (1 - 0.25)) = 66,667 \text{ kWh}$. If this vendor was assigned a non-participant spillover rate of 100 percent for premium efficiency motors, the non-participant spillover kWh savings for that vendor was 66,667 kWh. If that same vendor was assigned a non-participant spillover rate of only 50 percent for premium efficiency motors, the non-participant spillover kWh savings for that vendor was $66,667 * 0.5 = 33,334 \text{ kWh}$. This type of calculation was made for each design professional and equipment vendor (by measure category) who had a non-participant spillover rate of more than 0 percent.

Table F-1. Non-participant Premium Efficiency Motor Spillover Rate Calculation

% Sold Outside Program (A)	Savings from program tracking system database (B)	Assigned Spillover Rate (C)
25%	200,000	50%

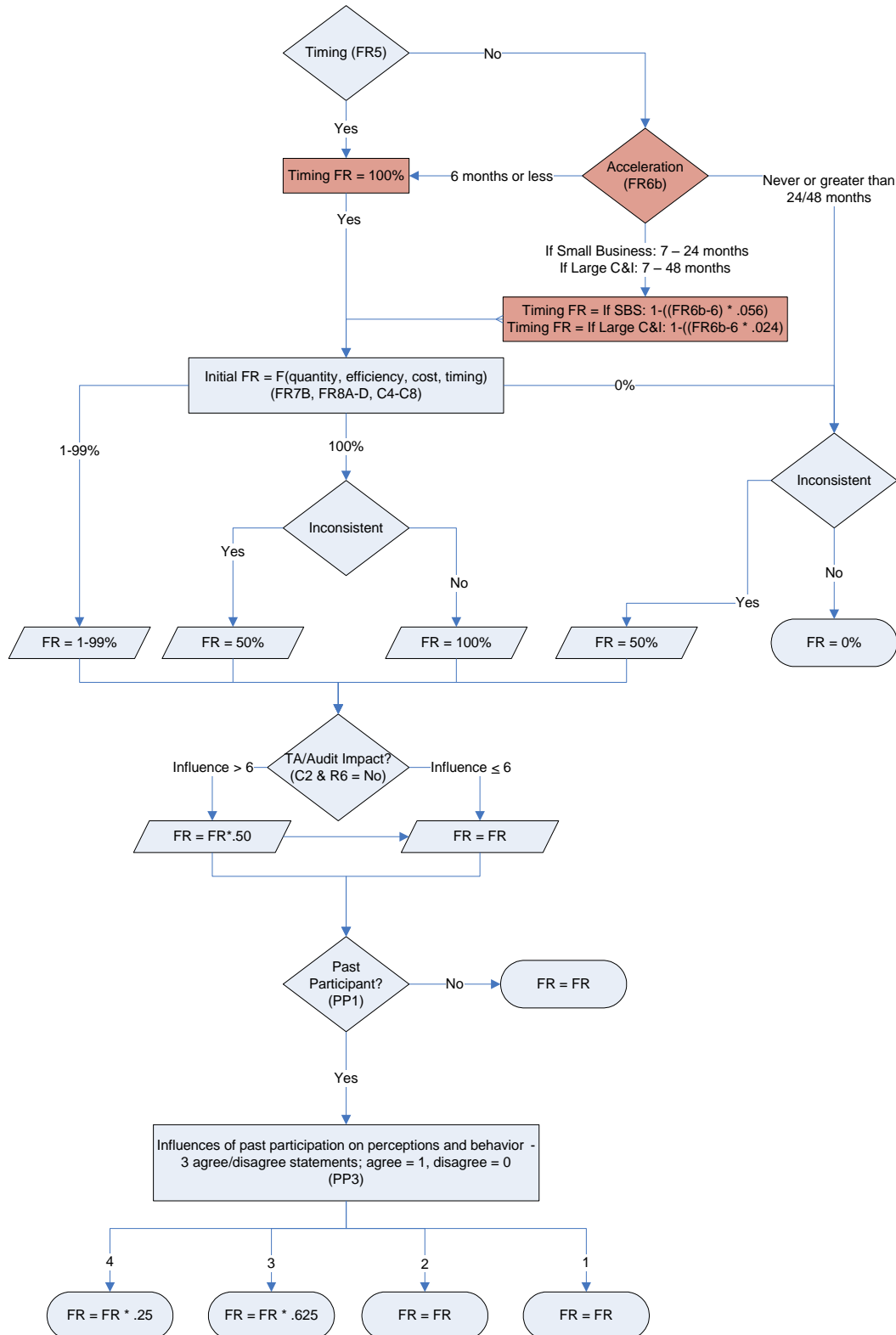
$$\begin{aligned} \text{Potential non-participant spillover savings} &= B * A / (1 - A) \\ &= 200,000 \text{ kWh} * 0.25 / (1 - 0.25) \\ &= 66,667 \text{ kWh} \end{aligned}$$

$$\begin{aligned} \text{Non-participant spillover savings} &= \text{potential savings} * C \\ &= 66,667 * 0.5 \\ &= 33,334 \text{ kWh} \end{aligned}$$



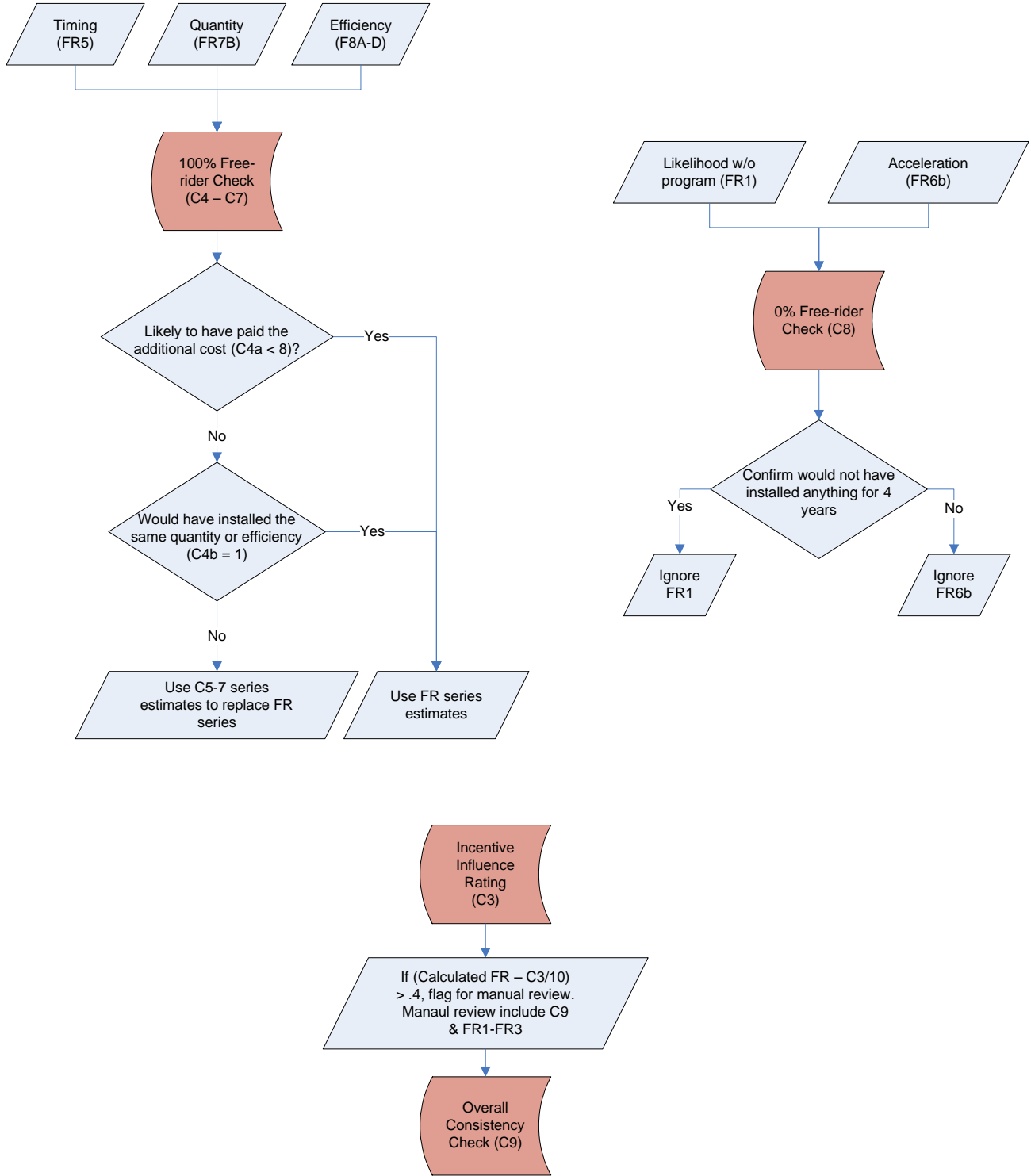
APPENDIX G: SCORING FLOW CHARTS

2010 Free-Ridership Scoring



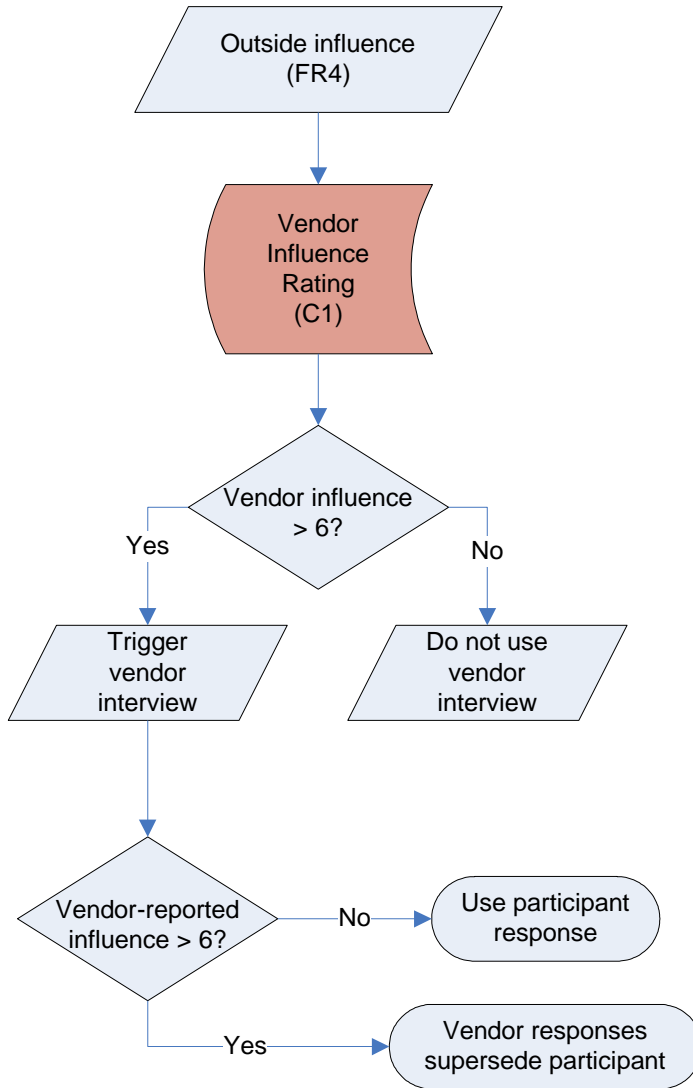


2010 Free-Ridership Consistency Checks





Vendor Trigger for Free-Ridership Survey





Non-participant Spillover Scoring

