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Multifamily Home Energy Savings Program Process and Net-to-Gross Evaluation

Program Years 2005-2006

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1

Executive Summary

This section summarizes the study approach and major findings. All of the findings presented in this report are based on program standards documents, program tracking data and telephone interviews conducted with 79 participating building owners and property managers.

Surveyed participants installed measures over an 18 month period ending in October of 2006. The available participant contacts for this survey were limited, and for this reason the survey sample design is a census.

1.1 Program Accomplishments

The distribution of measures, sites, and energy savings achieved by the program over the 18 month period ending in October of 2006 are shown below in Table 1-1. This table provides an illustration of typical 2005/2006 participation patterns, and reveals windows to be a key program measure.

Table 1-1: Program Accomplishments Program Years 2005 and 2006[1]

Measure	kWh Savings	Percent of Total kWh Savings	Therm Savings	Percent of Total Therm Savings
Ceiling Insulation	494,011	5%	18,450	31%
Wall Insulation	61,829	1%	2,775	5%
Floor Insulation	652,553	7%	12,401	21%
Insulated Door	60,783	1%	21	0%
Lighting	1,818,015	19%	-	-
Custom Lighting	30,929	0%	-	-
Showerhead	402,186	4%	1,358	2%
Electric Water Heater	3,643	0%	-	-
Faucet Restrictor	39,540	0%	-	-
Faucet Aerator	332,600	4%	925	2%
Windows	5,592,102	59%	22,950	38%
Gas Furnace	-	-	322	1%
Duct Sealing	-	-	961	2%
Total	9,488,191	100%	60,163	100%

1.2 Process Assessment

Customers were asked to rate their satisfaction with various program elements on a scale of 1 to 5, where 5 is extremely satisfied and 1 is extremely unsatisfied. Specifically, participant respondents were asked to rate the following elements:

- The quality and completeness of information provided by the Energy Trust about the Multifamily Home Energy Savings Program.
- The helpfulness of the Energy Trust representative.
- Ease of applying for financial incentives from the Energy Trust
- Program standards and requirements.
- Satisfaction with any issue that needed resolution.
- Overall program experience.
- Overall program energy savings.

[1] Participation shown here reflects 18 months of program activity ending October of 2006.

Participant satisfaction ratings are overwhelmingly positive, as summarized in Table 1-2 below. Satisfaction ratings for Program information, the ETO representative, overall Program Experience and Energy Savings achieve a mean value of 4.5 or higher.

Table 1-2: Satisfaction with Program Delivery, Customer Service and Energy Savings

Satisfaction Rating	Information (%)	ETO Repre-sentative (%)	Application Process (%)	Program Standards (%)	Resolution of Issues (%)	Program Experience (%)	Energy Savings (%)
5, Extremely Satisfactory	65	73	41	35	41	58	46
4	24	20	35	44	27	33	23
3	4	4	16	10	10	8	3
2	3	0	5	4	1	1	0
1, Extremely Unsatisfactory	1	0	1	1	0	0	0
Don't Know	4	3	1	5	0	0	29
No Resolution Needed	-	-	-	-	22	-	-
Mean	4.5	4.7	4.1	4.1	4.4	4.5	4.6
N	79	79	79	79	79	79	79

1.3 Net-to-Gross Findings

In general free ridership appears very low, particularly among the measures that are installed for free. A summary of final free ridership and spillover estimates are shown in Table 1-3 below. Despite virtually zero spillover, the program has very high estimated net-to-gross ratios, ranging from 81 percent for insulation to 100 percent for CFLs.

Table 1-3: Summary of Net-to-Gross Results by Program Measure

Program Measure	Free Ridership	Spillover	Final Net-to-Gross Ratio
Insulation	19%	0%	81%
Windows	15%	0%	85%
CFL	2%	2%	100%
Showerhead	4%	0%	96%
Faucet Aerator	8%	0%	92%

1.3.1 Free Ridership Analysis

This section provides an overview of each measure-specific free ridership result. More detailed methods and analysis are presented in Chapter 4.

Insulation Free Ridership Results

Insulation free ridership results are summarized in Table 1-4 below. The influence of the cash incentive on the decision to install insulation was very strong, with 69 percent of respondents reporting that the cash incentive was "very influential" in their decision to install insulation. The final estimated free ridership score for insulation is 19 percent, which is consistent with other findings presented in Chapter 4.

Table 1-4: Insulation Free Ridership Results

Would have installed insulation anyway?	Installed later?	Would have installed fewer types of insulation?	How influential was the incentive?	Frequency	Score
no	n/a	n/a	Very influential	12	0
no	n/a	n/a	Somewhat influential	2	0
yes	Don't Know	no	Very influential	2	0
yes	More than 1 year later	no	Very influential	7	0
yes	More than 1 year later	no	Somewhat influential	1	0
yes	At the same time	no	Very influential	3	0
yes	At the same time	no	Somewhat influential	3	0.5
yes	At the same time	no	Not at all influential	4	1
yes	At the same time	no	Don't Know	2	1
yes	Within 1 year	no	Very influential	3	0
Total Free Ridership Score					**19%**

Window Free Ridership Results

Table 1-5 below summarizes the windows free ridership results and shows the final estimated free ridership rate of 15 percent. Fifty-eight percent of surveyed participants report that in the absence of the program they were "somewhat" or "not at all" likely to have installed new windows at all. The influence of the cash incentive is strong among windows participants, with 61 percent of respondents reporting the cash incentive was "very influential" in their decision to install windows; eighteen percent report the cash incentive was "not at all influential".

Table 1-5: Window Free Ridership Results

What Would Have Been Purchased in the Absence of the Program?					
Likelihood of Purchasing New Windows	**When?**	**Efficiency Relative to Program Windows**	**How Influential was the Cash Incentive**	**Frequency**	**Free Ridership Score**
Not at all likely	N/A	N/A	Very influential	12	0
Not at all likely	N/A	N/A	Somewhat influential	1	0
Not at all likely	N/A	N/A	Not at all influential	1	0
Somewhat likely	At the same time	Less efficient	Very influential	2	0
Somewhat likely	At the same time	Same efficiency	Somewhat influential	1	0.25
Somewhat likely	Within a year	Less efficient	Very influential	2	0
Somewhat likely	Within a year	Less efficient	Somewhat influential	1	0.13
Somewhat likely	More than a year later	Less efficient	Very influential	10	0
Somewhat likely	More than a year later	Less efficient	Not at all influential	1	0
Somewhat likely	More than a year later	Same efficiency	Very influential	3	0
Somewhat likely	More than a year later	Same efficiency	Somewhat influential	2	0
Somewhat likely	More than a year later	Same efficiency	Not at all influential	1	0
Somewhat likely	More than a year later	Same efficiency	Don't know	1	0
Somewhat likely	More than a year later	Don't know	Somewhat influential	1	0
Somewhat likely	Don't know	Same efficiency	Very influential	1	0
Somewhat likely	Don't know	Same efficiency	Somewhat influential	1	0.25
Somewhat likely	Don't know	Same efficiency	Not at all influential	2	0.50
Very likely	At the same time	Less efficient	Very influential	2	0
Very likely	At the same time	Less efficient	Somewhat influential	1	0.25
Very likely	At the same time	Same efficiency	Very influential	2	0
Very likely	At the same time	Same efficiency	Somewhat influential	5	0.50
Very likely	At the same time	Same efficiency	Not at all influential	5	1
Very likely	At the same time	Refused	Not at all influential	1	1
Very likely	At the same time	Don't know	Very influential	1	0
Very likely	Within a year	Same efficiency	Very influential	1	0
Very likely	Within a year	Same efficiency	Somewhat influential	1	0.50
Very likely	More than a year later	Less efficient	Very influential	4	0
Very likely	More than a year later	Less efficient	Somewhat influential	1	0
Very likely	More than a year later	Same efficiency	Very influential	3	0
Very likely	More than a year later	Same efficiency	Not at all influential	2	0
Very likely	More than a year later	Don't know	Very influential	1	0
Very likely	Don't know	Don't know	Very influential	1	0
TOTAL Free Ridership Score for Windows					**15%**

CFL Free Ridership Results

Final free ridership results for CFL participants are shown in Table 1-6 below. The estimated free ridership rate is quite low, at 2 percent, mostly due to the strong influence of the offer of free installation on the decision to install.

Table 1-6: CFL Free Ridership Results

Would have installed CFLs anyway?	**Installed later?**	**Would have installed fewer CFLs?**	**How influential was the incentive?**	**Frequency**	**Score**
no	n/a	n/a	Don't know	1	0
no	n/a	n/a	Not at all influential	1	0
no	n/a	n/a	Very influential	31	0
yes	Within 1 year	no	Not at all influential	1	1
yes	Within 1 year	yes	Very influential	1	0
yes	More than 1 year later	no	Very influential	2	0
yes	More than 1 year later	yes	Very influential	1	0
yes	Within 1 year	no	Very influential	2	0
yes	Within 1 year	yes	Very influential	6	0
Total Free Ridership Score					**2%**

CFL Persistence

The survey results do not provide precise or robust estimates of persistence, however they do provide some useful information. The figures collected through the survey indicate that 11 percent of CFLs are failing or burning out, and that about half of these, or 6 percent, are being replaced with incandescent bulbs. CFL persistence may be a high priority for future study, perhaps involving site visits.

Showerhead Free Ridership Results

Showerhead free ridership results are summarized in Table 1-7 below. Not surprisingly, what really stands out in the results shown below is the reported influence of the offer of free showerheads. It makes sense that the offer of free showerheads is a powerful factor in customer decisions, but there are some arguably inconsistent results presented in Chapter 4 surrounding timing of awareness and previous water-saving installations. While there are no indications that showerhead free ridership is terribly significant, it could remain a research issue going forward to sort out some inconsistencies found here.

Table 1-7: Efficient Showerhead Free Ridership Results

Would have installed showerheads anyway?	Installed later?	Would have installed fewer showerheads?	How influential was the incentive?	Frequency	Score
no	n/a	n/a	Very influential	10	0
no	n/a	n/a	Somewhat influential	2	0
yes	Don't Know	no	Very influential	2	0
yes	More than 1 year later	yes	Very influential	3	0
yes	Within 1 year	no	Very influential	2	0
yes	Within 1 year	no	Not at all influential	1	1
yes	Within 1 year	yes	Very influential	3	0
Total Free Ridership Score					**4%**

Faucet Aerator Free Ridership Results

Faucet aerator free ridership results are shown in Table 1-8 below. Similar to the other free measures, the program offer of free installation was a powerful force in the decision to install. The final free ridership estimate is very low, at 8 percent.

Table 1-8: Faucet Aerator Free Ridership Results

Would have installed faucet aerators anyway?	Installed later?	Would have installed fewer faucet aerators?	How influential was the incentive?	Frequency	Score
no	n/a	n/a	Very influential	18	0
no	n/a	n/a	Very influential	1	0
yes	More than 1 year later	yes	Very influential	1	0
yes	Within 1 year	no	Very influential	1	0
yes	Within 1 year	no	Not at all influential	2	1
yes	Within 1 year	yes	Very influential	1	0
Total Free Ridership Score					**8%**

1.3.2 Spillover Results

The investigation of participant spillover yielded some notable results for CFLs, but not for other measures. Among the 40 CFL participants surveyed, 3 reported CFL adoptions that qualify as spillover under the requirements set forth in Chapter 4. These CFL spillover installations have an average size of 37 bulbs, which is 22 percent of the typical program installation size (164). Thus, CFL spillover can be estimated at 2 percent of program CFL savings.

Three additional non-CFL adoptions were reported by participants to be non-rebated and "very influenced" by their program experience. However, none of these adoptions could be confidently deemed program-qualifying and thus other program spillover is estimated to be zero percent.

2
Energy Trust Staff Response Memo

The evaluation results indicate that the current design and implementation of the multifamily building owner portion of the Home Energy Savings Program (now the Home Energy Solutions Program) is working well from the perspective of the target audience, the building owner. Overall satisfaction in the program is quite high and most of the building owners have had little or no history in retrofitting their buildings with energy or water saving technologies. Low free rider rates continue to justify the current measure offerings as well as the embedded assumption that the program promotes early replacement of most measures.

The failure rate of CFLs reported by building owners is troubling. The Program Management Contractor (PMC) plans to research the original extent of this problem and identify remedies.

3

Introduction

This Evaluation of the program year 2005/2006 Multifamily Home Energy Savings Program Assessment includes both process and net-to-gross assessments. This report seeks to evaluate the success of the program delivery methods in meeting customer needs and providing a high quality program experience. It also seeks to assess the program impact on energy efficiency measure adoption behavior – focusing on the impact of program services and financial incentives on high efficiency measure installation. This evaluation was commissioned by the Energy Trust of Oregon and completed by Itron, Inc.

The following Introduction section provides a description of the Multifamily Home Energy Savings Program, an overview of the evaluation objectives, an overview of data collection methods, as well as an outline of the remainder of the report.

An overview of the Multifamily Home Energy Savings programs is presented next.

3.1 Overview of the Programs

This section provides a brief overview of the Multifamily Home Energy Savings Program content and design.

The Energy Trust of Oregon offers cash incentives for energy saving measures in multifamily properties. The Energy Trust will also assist customers with the Oregon Business Energy Tax Credit application, which provides a tax credit for up to 35% of eligible project costs.

Each year the program provides approximately $1 million in cash incentives to multifamily property owners. The program serves those multifamily properties whose primary source of heating fuel is supplied by Portland General Electric, Pacific Power and NW Natural.

The program is made more appealing to property managers through promoting some of the non-energy benefits of participation. More specifically, the projects will not only reduce energy consumption, but will also:

- Help lower long-term maintenance costs
- Give greater comfort and affordability to tenants
- Raise the property's profile during resale

The intent of the program is to make installation affordable, leading not only to energy savings but also increased tenant retention and profitability for property managers.

The Energy Trust of Oregon provides assistance with the Oregon Business Energy Tax Credit. All application paperwork is process by ETO at no cost to the property manager. In addition referrals are provided to experienced trade allies and contractors to perform installation services.

Some measures are installed by the Energy Trust of Oregon (ETO) free of charge. In order to qualify for these free installations, participants must install a building weatherization shell measure or an HVAC measure. For qualifying customers, the following measures are offered for free:

- Up to 8 compact fluorescent lightbulbs
- High performance showerheads
- Faucet aerators for kitchen and bath

Other measures for which incentives are available include:

- Windows
- Attic, floor and wall and door insulation
- Duct insulation
- Electric and gas water heater
- Clothes washers
- Common area lighting
- Boiler Tune up and Vent Damper
- Boiler Pipe insulation
- Gas Furnace

- Other Gas heating systems such as high efficiency Boiler
- High efficiency heat pump (upgrade from standard efficiency or conversion from electric furnace or resistance heat)
- Other High Efficiency Electric HVAC systems such as individual unit heat pumps and Packaged Terminal Air Conditioning (PTAC)

In order to qualify for the windows measure, a participant must have a minimum amount of floor (R-11) and attic insulation (R-19). If these are not present, participants may have the insulation installed through the program and receive the associated rebate.

Program Accomplishments

A sample of program participants extending through the 18 month period ending in October of 2006 was obtained to support the data collection effort of this Study. The distribution of program measures and the associated energy savings over this period are shown below in Table 3-1.

Table 3-1: Program Accomplishments Program Years 2005 and 2006[2]

Measure	kWh Savings	Percent of Total kWh Savings	Therm Savings	Percent of Total Therm Savings
Ceiling Insulation	494,011	5%	18,450	31%
Wall Insulation	61,829	1%	2,775	5%
Floor Insulation	652,553	7%	12,401	21%
Insulated Door	60,783	1%	21	0%
Lighting	1,818,015	19%	-	-
Custom Lighting	30,929	0%	-	-
Showerhead	402,186	4%	1,358	2%
Electric Water Heater	3,643	0%	-	-
Faucet Restrictor	39,540	0%	-	-
Faucet Aerator	332,600	4%	925	2%
Windows	5,592,102	59%	22,950	38%
Gas Furnace	-	-	322	1%
Duct Sealing	-	-	961	2%
Total	9,488,191	100%	60,163	100%

[2] Participation shown here reflects 18 months of program activity ending October of 2006.

3.2 Study Objectives

This Study has a process component and net-to-gross component. The process component consists of an assessment of customer satisfaction with a variety of program characteristics, including program standards, customer service and energy savings.

The net-to-gross component seeks to determine which adoptions – both within and outside the program- occur as result of program influence. The net-to-gross estimation effort includes free ridership estimation for windows, insulation, CFL bulbs, efficient showerheads and faucet aerators. That is the estimation of the portion of participants that installed each of these measures that would have done so even in the absence of the program. In addition, we investigate the extent to which program participation has inspired customers to install additional high efficiency measures outside the program—that is, program participant "spillover".

3.3 Overview of Data Collection Strategy

As stated above, a sample of program participants extending through the 18 month period ending in October of 2006 was obtained to support the data collection effort of this Study. The number of available contacts was limited. There were 132 unique contact names eligible for this survey. These include building owners and managers that participated in the Mulitfamily Home Energy Savings Program over the 18 month period ending in October of 2006 that installed at least one of the five studied measures – CFL, Windows, Faucet Aerators, Showerheads or Insulation. A census of these customers yielded 79 completed telephone surveys with contacts representing 87 sites.

3.4 Report Contents

This section provides the structure of the evaluation report, as described below.

- The report includes an *Executive Summary*, concisely summarizing report findings and recommendations.
- This is followed by *Chapter 2 Introduction,* which lays the groundwork for the chapters that follow.
- Next, *Chapter 3 Program Process Assessment,* presents customer satisfaction and program perceptions.
- Finally, *Chapter 4 Participant Net-to-Gross Assessment* presents free ridership and spillover findings.
- Appendix A presents the survey instrument

4

Process Assessment

This chapter presents an assessment of customer satisfaction with the Program Year 2005/2006 Multifamily Home Energy Savings Program. This assessment characterizes customer feedback regarding the participation experience, program standards, program delivery and other important program characteristics.

The chapter begins with a discussion of customer satisfaction with various program elements. This is followed by an analysis of tenant (or occupant) satisfaction with energy savings. Next, the utilization and importance of trade ally lists is explored. The chapter closes with an examination of participant sources of program awareness, which is important feedback for refining program outreach efforts.

4.1 Participant Satisfaction

4.1.1 Satisfaction with Program Elements

Customers were asked to rate their satisfaction with various program elements on a scale of 1 to 5, where 5 is extremely satisfied and 1 is extremely unsatisfied. Specifically, participant respondents were asked to rate the following elements:

- The quality and completeness of information provided by the Energy Trust about the Multifamily Home Energy Savings Program.
- The helpfulness of the Energy Trust representative.
- Ease of applying for financial incentives from the Energy Trust
- Program standards and requirements.
- Satisfaction with any issue that needed resolution.
- Overall program experience.
- Overall program energy savings.

Participant satisfaction ratings are overwhelmingly positive, as summarized in Table 4-1 below. Satisfaction ratings for Program information, the ETO representative, overall

Program Experience and Energy Savings achieve a mean value of 4.5 or higher. Satisfaction with the application process and program standards have mean scores closer to 4. Among those that had issues that needed resolution, satisfaction scores with how those issues were resolved is very high, at 4.4. This is a very positive finding.

Table 4-1: Satisfaction with Program Delivery, Customer Service and Energy Savings

Satisfaction Rating	Information (%)	ETO Repre-sentative (%)	Application Process (%)	Program Standards (%)	Resolution of Issues (%)	Program Experience (%)	Energy Savings (%)
5, Extremely Satisfactory	65	73	41	35	41	58	46
4	24	20	35	44	27	33	23
3	4	4	16	10	10	8	3
2	3	0	5	4	1	1	0
1, Extremely Unsatisfactory	1	0	1	1	0	0	0
Don't Know	4	3	1	5	0	0	29
No Resolution Needed	-	-	-	-	22	-	-
Mean	4.5	4.7	4.1	4.1	4.4	4.5	4.6
N	79	79	79	79	79	79	79

Each time a customer provided a satisfaction rating lower than 5 the participant was invited to explain their dissatisfaction in more detail. There were 9 respondents (11%) that provided an explanation of dissatisfaction with at least one of the satisfaction elements shown above. Comments were generally in regards to the complexity of participation, paperwork and some mid-project changes in program standards[3]. A summary of participant explanations of dissatisfaction is shown in Table 4-2.

[3] There are two comments classified as "other" in the Exhibit 2-1. One of these comments is a complaint about the program inspector, and the other is a complaint that a single showerhead was not left behind for a tenant where it was not possible to directly install.

Table 4-2: Summary of Participant Explanations for Dissatisfaction with Program Elements

Explanation of Dissatisfaction	Comments
Too much / confusing paperwork	22%
Participation generally complicated	67%
Program standards changing caused confusion	22%
Other	22%
N	9

4.1.2 Satisfaction with Program Measures and Energy Savings

As shown in Table 4-3, tenants are very happy with the improvements resulting from Program participation. Interestingly, the most common comment regarding a specific benefit of program participation is increased comfort, not energy or bill savings. Comments about improved comfort include reduced noise, greater temperature stabilization and reduced condensation and mildew. A little under half of respondents reported positive tenant feedback on energy or bill savings. Another common citing was simply tenants' general satisfaction with the building upgrades.

Table 4-3: Tenant Satisfaction with Program Measures

Feedback provided by tenants/occupants regarding the upgrades completed through the Program	Percent
More comfortable/Less noise	67%
Generally happy/Satisfied with improvements.	56%
Saving energy/money	45%
Improved appearance	9%
Newly installed equipment has failed / broken	2%
No monetary savings on energy bills	3%
Dissatisfied/removing CFLs	2%
N	**64**

The survey probed customers directly regarding bill savings resulting from program measures. Table 4-4 below summarizes participant responses. Many respondents weren't able to answer the questions because they weren't privy to the bills or the installation had occurred too recently to tell. Approximately 42 percent of electricity-savers and nearly 70 percent of gas savers fall into this 'unknown' category.

The information provided by the remaining participants is very positive. Among those that had the information required to answer the questions, the overwhelming majority (93%) report noticing electricity savings in their bill. Perceived gas savings is a bit lower, at about 60 percent. Note that the sample of gas savers is fairly small, at 16.

Table 4-4: Perceived Energy Savings from Program Measures

Have you or your tenants seen savings on your monthly bill as a result of your participation?	Electric bill?	Gas bill?
Yes	54%	19%
No	4%	13%
Too soon to tell	4%	19%
Don't Know	38%	50%
N	**72**	**16**

Participants were asked how the savings measured up to their expectations in order to gauge satisfaction with bill savings resulting from program measures, Table 4-5 below shows how the perceived bill savings compared with participant expectations. Results are favorable for electric bill savings, and neutral for gas savings. About 80 percent of respondents that felt they had enough information to answer the question stated the savings met (54%) or exceeded (25%) expectations. There were only 3 respondents asked to compare gas savings to expectations, and all 3 stated that the savings were comparable to expectations.

Table 4-5: Bill Savings Relative to Expectations

Is the electric/gas bill savings higher, lower or about the same as expected?	Electric bill?	Gas bill?
Higher	18%	0%
Lower	15%	0%
About the same as expected	38%	100%
Don't Know	28%	0%
N	**39**	**3**

4.2 Trade Ally Lists

The Multifamily HES Program provides a list of qualified trade allies to participating customers. This list is intended to facilitate the installation process. Survey respondents indicate that 25 percent of participants are using this list. As shown in Table 4-6 below, most of those that use the list find it extremely useful.

Table 4-6: Importance of Trade Ally Lists in Selecting Contractor

How important was this list in selecting a contractor?	Response
5, Extremely Important	55%
4	30%
3	15%
2	0%
1, Extremely Unimportant	0%
N	**20**

4.3 Sources of Program Awareness

Participants were asked to report the ways they became aware of the Multifamily HES Program. The responses are shown in Table 4-7 below. The responses have a broad range and varied distribution, which is a testament to strong customer outreach. Not surprisingly, Contractors and other trade allies are a significant source of program awareness. These market actors are in a good position to sell program measures. Trade allies come into contact with customers that may be interested in having some improvements done already, making them good candidates for program participation.

Table 4-7: Sources of Program Awareness

Sources of Program Awareness	Percent
Contractor/Trade ally	25%
Word of Mouth from Friend or Co-worker	13%
Magazine or Trade Journal	12%
Energy Trust of Oregon Mailing or Flyer	9%
Utility Newsletter/Bill insert	7%
Customer Service Representative	6%
Participation in Previous Years	4%
Homeowner or Renter Association	4%
Newspaper, Television, Radio	3%
Manufacturer Information/Suggestion	3%
Trade Show / Event	3%
City of Portland	3%
Website	1%
Other	4%
N	**67**

5

Net to Gross Assessment

This section presents the results of the Multifamily Home Energy Saving (HES) Program net-to-gross assessment. The goal of the net-to-gross assessment is to measure all energy saving attributable to the program. This is referred to as "net" program savings. The ratio of the net program savings to gross program savings is the "net-to-gross" ratio, and it represents the portion of gross savings attributable to the program.

There are two main adjustments to gross savings that are required in order to arrive at net savings. The first is to subtract from gross savings the actions of participants that were unaffected by the program. That is, those participants that would have taken the same energy saving action, at the same time, without the program as they did through the program. This is referred to as "free ridership."

The second adjustment is to add to gross impacts the energy savings from high efficiency actions taken outside the program that are attributable to the program. Participants may be inspired to adopt high efficiency measures outside the program, as a result, at least in part, of their experience with the Multifamily Program[4]. These savings are referred as "spillover."

A thorough understanding of customer behavior and the factors that influence the decision to purchase energy-saving measures is essential for accurate net-to-gross analysis. The analysis must draw conclusions regarding what energy saving measure adoptions would and would not have occurred in the hypothetical circumstance that the programs did not exist. This chapter presents a comprehensive characterization of the decision-making process and the contributions of program and non-program forces to the final purchase decision.

Note that the multifamily sector often faces the problem of "split incentives". This problem occurs when the individuals that would benefit from energy efficient retrofit measures are not the individuals that make investment decisions for the property. This split incentive phenomenon makes the multifamily sector generally more difficult to reach with retrofit

[4] It is possible that nonparticipants may be affected by the Multifamily Program, but they are not part of this Study.

programs than the single-family or non-residential sectors. This also implies that the multifamily sector may have a potential for higher net-to-gross ratios than these other sectors.

This chapter begins with an exploration of issues relevant to a complete assessment of program net-to-gross ratios. This includes an examination of the role of program representatives in recruiting participants. It also includes a look at participants' previous program experience, and the role of the Business Energy Tax Credit (BETC) in customer decision-making. This broad exploration of issues is followed by a measure-by-measure analysis and estimation of program free ridership. Following the free ridership analyses, there is a discussion of participant spillover, and the chapter closes with a brief summary of the net-to-gross results.

5.1 Net-to-Gross Related Findings

This section summarizes Study findings relevant to the attribution of program measure adoptions to elements of program design and delivery. The findings presented here are intended as additional evidence in the consideration of net-to-gross estimation. Final estimation methods and results for program free ridership and spillover are presented in subsequent sections.

5.1.1 Role of Program Representatives in Recruiting Participants

The following analysis of the role of program representatives is relevant to both the process assessment and the net-to-gross assessment. The success of program representatives in recruiting participants is important feedback for program planning and design. The degree of influence the program has on decision-makers is also indicated by the role of representatives' recommendations. Table 5-1 below summarizes the extent to which recommendations from program representatives were a factor in participants' decision-making process.

Nearly 65 percent of participants received a recommendation from a program representative to install energy efficient measures. Not surprisingly, the rate of receiving recommendations is highest among the free measures (CFLs, showerheads and faucet aerators). The figures shown below underscore the importance of recommendations in recruiting participants. They also provide positive evidence of low free ridership rates, as those participants that receive recommendations are less likely to be independent instigators for these retrofit measures.

Table 5-1: Participation Prompted by Recommendations from Program Representatives

Did a HESP representative or Program contractor recommend you install <*measure*>?	Insulation	Windows	CFLs	Shower-heads	Faucet Aerators	Overall
Yes	49%	55%	74%	74%	83%	64%
No	36%	35%	20%	22%	17%	28%
Don't know	15%	9%	7%	4%	0%	8%
N	**34**	**74**	**40**	**22**	**23**	**79**

In addition to simply assessing the prevalence of program recommendations, participants were asked to report the influence of the recommendations on the decision to install retrofit measures. As shown in Table 5-2 below, the recommendations were highly influential, with nearly 80 percent reporting the recommendations were "very influential" and the remainder reporting the recommendations were "somewhat influential". Again, the recommendations had the greatest influence on the installation of the free measures.

Table 5-2: Influence of Program Representatives Recommendation on the Decision to Install Insulation

How influential was this recommendation in your decision to install <*measure*>? Would you say…	Insulation	Windows	CFLs	Shower-heads	Faucet Aerators	Overall
Very influential	79%	72%	85%	88%	80%	79%
Somewhat influential	21%	17%	15%	6%	10%	14%
Not at all influential	0%	10%	0%	6%	10%	6%
N	**16**	**40**	**30**	**16**	**19**	**51**

5.1.2 Participation in Other Incentive Programs

The survey queried customers on their history of participation in energy efficiency programs involving financial incentives. As shown in Table 5-3 below, about 44 percent of Multifamily participants have participated in other programs, though not surprisingly nearly half cited the BETC – a program strongly connected with the Multifamily HES Program. Other programs offered by Oregon State were also frequently cited, as were other utility programs. About one-third of respondents had participated in a program besides the ETO and BETC programs.

Table 5-3: Previous Participation in Other Programs

Which programs have you or your company participated in?	Frequency of Response
BETC	45%
Energy Trust of Oregon.	20%
Other Oregon State Program	16%
Appliance Program	13%
Residential Program.	11%
Portland General Electric (PGE) programs	6%
Pacific Power and Light programs	6%
Northwest Natural Gas Programs	6%
Other Utility Program	6%
County Program.	6%
Other	13%
N	31

5.1.3 Business Energy Tax Credit

Business Energy Tax credits are offered for the installation of windows and insulation, but not the other measures studied in this report (CFL, showerheads, faucet aerators.) We examine the role of the Business Energy Tax Credit as it relates to both allocating "credit" for energy efficient installation as well as characterizing the degree of BETC awareness and participation for program planning and design. The finding presented here indicate the BETC is an important part of participant installation decisions, but works much for effectively in conjunction with the Energy Trust Multifamily program, as most participants report the combination is the most important factor in their installation decisions.
A little over half of participants are familiar with the Oregon Business Energy Tax Credit (53%). As shown in Table 5-4 below, those that are familiar generally find the tax credit to be an important part of their energy efficiency investment decisions.

Table 5-4: Importance of Business Energy Tax Credit to Energy Efficiency Investment Decisions

How important are BETC tax credits in your decision making on energy efficiency improvements?	Responses
Very important	57%
Somewhat important	33%
Not at all important	5%
Don't know	5%
N	**42**

Next, we examine the extent of participation in the Business Energy Tax Credit program within eligible measures. As shown in Table 5-5 below, among those aware of the BETC and installed a qualifying measure about three-quarters report taking advantage of the Tax Credit. About 20 percent of insulation and 10 percent of windows participants report they did not take advantage of the credit, even though they were aware of it.

Table 5-5: Business Energy Tax Credit Participation

If aware of BETC: Did you take advantage of the Business Energy Tax Credit for the <*measure*> installed through the program?	Insulation	Windows
Yes	72%	79%
No	20%	10%
Don't Know	8%	10%
N	**20**	**39**

Insulation and windows participants were also asked to provide the relative influence of the Multifamily HES Program and the Business Energy Tax Credit on their decision to install windows and insulation measures. The results are presented in Table 5-6 below. Nearly 90 percent of those that installed insulation reported the combination of the two incentives was the most important factor. Among windows participants, 83 percent reported that the ETO program was at least as influential as the BETC or that the combination was most important. Ten percent of windows participants reported that the BETC had the most influence.

Table 5-6: Relative Influence of ETO and BETC on Installation Decision

When considering the influence of the BETC and the Energy Trust incentive on your decision to install <*measure*>? Would you say…	Insulation	Windows
Energy Trust incentive had the most influence	6%	17%
BETC and the Energy Trust had equal importance	6%	27%
The combination of the BETC and the Energy Trust incentive had the most influence	89%	40%
BETC had the most influence	0%	10%
Neither had influence	0%	7%
N	**15**	**30**

5.2 Free Ridership Analyses

The free ridership analysis is organized by measure. The first subsection that follows is dedicated to insulation, the second to windows, the third to CFLs, the fourth to showerheads and, the last to faucet aerators. While the analyses are similar across measures, there are also important nuances and differences that are discussed in each section. The insulation free ridership section, shown first, provides the greatest detail and longest explanations. Subsequent sections are abbreviated where appropriate in an effort not to be repetitive.

5.2.1 Insulation Free Ridership

This section investigates various indicators of the degree of free ridership among insulation participants in the Multifamily Home Energy Savings Program. First there is an examination of participant reported reasons for installing insulation. This is followed with an investigation of the timing of program awareness relative to the decision to install insulation. Next we explore participants' history of similar, previous installations. Finally, a detailed explanation of the final free ridership estimation methods and results is presented.

Participant Reasons for Installing Insulation

Cash incentives are offered for the installation of floor, wall and ceiling/attic insulation. In addition, a minimum amount of insulation is required in order to qualify for the windows incentives. As noted previously, the Program offers free CFLs, efficient showerheads and faucet aerators to qualifying customers. To qualify for these free installations, participants must install a building shell weatherization measure or HVAC measure. Thus, a variety of incentives are created for installing insulation.

Respondents were asked to report a primary reason for installing insulation, as well as any other, secondary reasons. Table 5-7 below summarizes respondents' reasons for installing insulation. The primary reasons are shown in the middle column of the table, and the secondary reasons are shown on the right. A significant portion (38%) of participants cited the program rebates and requirements as their primary reason for installing insulation. That is, they installed insulation primarily because it was required in order to qualify for the windows rebates, or the free measures (CFL, showerhead and aerator installations). Another 15% cited the tax credit as the primary reason. These responses are indicative of a low free ridership rate and an effective incentive structure.

Table 5-7: Program Participants Reasons for Installing Insulation

Reasons for Installing Insulation	Primary	Secondary
To qualify for ETO rebates	38%	3%
Save Energy	31%	26%
To qualify for tax credit	15%	6%
Improve building	10%	9%
Please tenants	5%	18%
N	**34**	**16**

Timing of Program Awareness

Participants were asked to report the timing of their program awareness relative to their decision to install insulation. Though it is not possible to deduce the free ridership rate from this information alone, it can provide a "lower bound" and a general indication of the degree of free ridership. Participants that become aware of the program only *after* making the decision to install insulation are more likely to be free riders than those for whom this order is reversed. It should also be noted that this question can be difficult for respondents to answer. As we'll see later, response distributions for this question are sometimes inconsistent with responses to other free ridership questions and should be interpreted with some caution.

Table 5-8 below shows that 15% of the insulation participants report becoming aware of the program before deciding to install insulation. This result actually lines up very well with the final estimated insulation free ridership of 19 percent.

Table 5-8: Timing of Program Awareness

Did you become aware of the cash incentive before or after you decided to install insulation?	Response
Before	62%
After	15%
At the same time	18%
Don't know	5%
N	**34**

Previous Similar Installations

Another factor to consider when analyzing free ridership among insulation participants is participant installation histories. More specifically, we consider participant histories of other

building envelope measures, and whether or not these measures were rebated. A customer that already has installed building envelope measures without the assistance of the program incentive can arguably be considered to have a higher probability of being a free rider, particularly if those installation were not rebated. Even if those installations were rebated, histories of similar previous installations indicate an awareness of the benefits of the measure prior to program participation. In addition, habitual program participation is often viewed as an indicator of a high likelihood of free ridership. On the other hand, we cannot definitively conclude that a history of *rebated* installations indicate a customer would have installed even without the rebate, because we cannot deduce their price sensitivities.

Table 5-9 below summarizes participants' previous building envelope measure installations. A remarkable 76 percent of respondents indicate they had zero previous building envelope installations. Of the remaining 24 percent, over half had installed over 2 years ago, indicating they are not likely habitual participants.

Table 5-9: Participant Histories of Previous Building Envelope Installations

Installed Insulation Previously?	Received a Rebate?	How Long Ago?	Response
Yes	Yes	More than 2 years ago	9%
Yes	No	Less than 12 months ago	3%
Yes	No	1 to 2 years ago	3%
Yes	No	More than 2 years ago	6%
Yes	Don't Know	1 to 2 years ago	3%
No	n/a	n/a	76%
		N	34

Free Ridership Rate Estimation

The calculation of insulation free ridership uses an algorithm based on responses to a series of 6 survey questions. These questions and the free ridership algorithm are presented below.

Insulation Free Ridership Survey Questions

INS3. Did you have any specific plans to install insulation before learning about the Home Energy Savings Program?

1. Yes
2. No

INS5. Would you have gone ahead with this planned installation of insulation if you had not participated in the Home Energy Savings Program?

1. Yes
2. No

INS7. Which of the following THREE statements best describes the actions you would have taken had the cash incentive NOT existed:

1. We would not have installed insulation
2. We would have installed insulation anyway, but at a later date
3. We would have installed insulation anyway, and at the same time

INS9. (Ask if respondent would have purchased insulation later.) If the cash incentive was not available, when would you have installed insulation?

1. Within a year from the time you installed through the program, or
2. More than a year later

INS13. (Ask if respondent would have installed without program and installed more than one type of insulation) Our records indicate that you installed insulation in your [Ceiling, Door, Floor, Wall] If the program did not exist would you have installed insulation in all of these areas, or just some of these areas?

1. I would have installed insulation in ALL of these areas
2. I would have installed insulation in some of these areas

INS15. We'd like to get a sense of what influenced you to purchase your insulation. How influential was the cash incentive in your decision to install insulation? Would you say the cash incentive was…

1. Very influential
2. Somewhat influential
3. Not at all influential

Insulation Free Ridership Algorithm

The free ridership survey battery shown above is integrated to produce a free ridership "score" for each participant respondents. These scores are an assessment of the probability that the customer would have purchased insulation in the absence of the program. The scoring algorithm is based on combining four free ridership determinants. Each determinant is an indicator of free ridership, and they are combined to produce a robust overall indicator of participant free ridership.

- The first determinant is the participant-reported likelihood of installing insulation in the absence of the program. It is important to note that this determinant is based on conjecture, as the questions used to gauge this likelihood are hypothetical.

- The second determinant is the reported timing of the adoption that would have taken place in the absence of the program. This determinant reflects the degree to which the program may have "accelerated" the adoption of insulation.

- The third is an assessment of the size of the installation that would have occurred in the absence of the program. This reflects the degree to which the program may have inspired larger or more comprehensive installations.

- The fourth and final determinant is the influence of the cash incentive on the decision to install insulation. This reflects the impact of the cash incentive on the decision to install insulation.

Participants receive a score of 0, 0.5 or 1 for each of the four determinants. These determinant values are multiplied to yield the final free ridership score for the individual. The procedure for calculating each determinant is described next.

Likelihood of installation. The first determinant—the likelihood of installing insulation in the absence of the program—is calculated using questions INS5 and INS7. Participants that report a high likelihood of installing insulation in the absence of the program (INS5=1 or INS7 =2 or INS7=3) are assigned a value of 1 for the first determinant. Those that state they would not have installed insulation without the program (INS5 not equal to 1 and INS7=1) are assigned a value[5] of 0.

Timing of installation. The second determinant of free ridership—the timing of the installation that would have occurred in the absence of the program—is calculated using INS7 and INS9. Those that, in the absence of the program, would have installed within one year of program installation (INS7 = 3 or INS9=1) are assigned a score of 1 for this determinant. Those that indicate installation would have taken place more than a year after the program installation are assigned a value of 0. Those that "don't know" when they would have installed insulation without the program are assigned a value6 of 0.5.

Size of installation. The third determinant – the size of the installation that would have occurred in the absence of the program—is calculated using question INS13. This question asks whether the program affected the number of locations insulation was installed. For

[5] A score of 0.5 is not a possible score for the first determinant.

[6] Respondents that indicate they would not have purchased insulation without the program are not asked INS9, and receive no score for the second determinant.

example, a participant may choose to install floor and ceiling instead of just ceiling insulation. The program is unlikely to have affected the square feet of insulation installed because partial installations of insulation are not plausible. However, it is possible that the program inspired participants to install insulation in more locations. If a respondent indicates they would have installed fewer types of insulation without the program, this determinant takes a value of 0.5. Other responses are assigned a value of 1.

Influence of the cash incentive. The fourth and last determinant – the degree of influence of the cash incentive- is calculated using question INS15. This question has the advantage of being straight-forward and not hypothetical. It simply asks how influential the incentive was in the decision to install insulation. Respondents are provided three categorical responses to choose from –very influential, somewhat influential or not at all influential. A response of very influential receives a score of 0, somewhat influential receives a score of 0.5, and not at all influential receives a score of 1. A response of "don't know" is also assigned a value of 1.

Insulation Free Ridership Results

As described above, free ridership scores are the product of the values of 4 separate determinants. The distribution of these determinants is shown in Table 5-10 below. Thirty six percent of surveyed participants report they would not have installed insulation without the program. Among those that would have installed insulation without the program, 32 percent would have done so more than 1 year after the program installation. The influence of the cash incentive was very strong. Nearly 70 percent of respondents report that the cash incentive was "very influential" in their decision to install insulation. The final estimated free ridership score for insulation is 19 percent, which is consistent with other findings presented in this section.

Table 5-10: Insulation Free RidershipResults

Would have installed insulation anyway?	Installed later?	Would have installed fewer types of insulation?	How influential was the incentive?	Frequency	Score
no	n/a	n/a	Very influential	12	0
no	n/a	n/a	Somewhat influential	2	0
yes	Don't Know	no	Very influential	2	0
yes	More than 1 year later	no	Very influential	7	0
yes	More than 1 year later	no	Somewhat influential	1	0
yes	At the same time	no	Very influential	3	0
yes	At the same time	no	Somewhat influential	3	0.5
yes	At the same time	no	Not at all influential	4	1
yes	At the same time	no	Don't Know	2	1
yes	Within 1 year	no	Very influential	3	0
Total Free Ridership Score					**19%**

5.2.2 Windows Free Ridership

This section investigates various indicators of the degree of free ridership among windows participants in the Multifamily Home Energy Savings Program. The section begins with an examination of participant reported reasons for installing windows. This is followed with an investigation into the timing of program awareness relative to the decision to install, and participants' history of similar, previous installations. The final section lays out the methods and results for calculating final windows free ridership estimates.

Participant Reasons for Installing Windows

Respondents were asked to report a primary reason for installing windows, as well as any other, secondary reasons. Table 5-11 below summarizes respondents' reasons for installing windows. The most common reason cited for installing windows is to save energy (35%) or because the windows were old (24%). Note that building owners that installed new windows primarily because the windows were old does not mean that the windows would have been replaced even without the program. It is often the case that old windows remain in place for a very long time. On the other hand, those who installed new windows because the old windows were broken or as part of a building remodel are likely free riders, but these account for just 2 percent of participants.

Other common reasons for windows installation include improving the building resale value (12%), providing increased comfort (12%), and improving building appearance (5%). Five percent of the respondents cited the program as the primary reason for their installation.

Table 5-11: Program Participants Reasons for Installing Windows

What was the primary reason you installed windows?	Primary Reason	Other Reasons
Save Energy	35%	27%
Windows old	24%	9%
Improve building/resale value	12%	19%
Increased Comfort	12%	32%
Better looking/Design	5%	24%
Financial incentives.	5%	11%
Windows broken	1%	3%
Remodeling building	1%	5%
Past participation	1%	0%
Reduce condensation	1%	11%
Improve security	0%	3%
N	**74**	**55**

To get a more comprehensive characterization of the reasons participants installed new windows the survey also asked participants to report the features of high efficiency windows they value most. The answers to this question are shown in Table 5-12 below. The most common responses include greater HVAC efficiency (46%), improved appearance (36%) and increased comfort and operability (28%).

Table 5-12: Most Valued Efficient Window Features

What are the features of high efficiency windows that you value most?	Response
Lower heating/cooling requirements	46%
Appearance	36%
Tenant Comfort/Noise Reduction	20%
Operability	8%
Low price/Good value	1%
Don't know	5%
N	74

Timing of Program Awareness

Windows participants were asked to report the timing of their program awareness relative to their decision to install windows. Table 5-13 shown below summarizes participant responses. As discussed in more detail above, it is not possible to deduce the free ridership rate from this information alone, but it can provide additional evidence of the degree of free ridership. Twenty-three percent of windows participants report making the decision to install windows prior to learning of the HES Program. As we'll see later, this is reasonably consistent with the estimated free ridership of 15 percent.

Table 5-13: Timing of Program Awareness

Did you become aware of the cash incentive before or after you decided to install windows?	Response
Before	70%
After	23%
At the same time	4%
Don't know	3%
N	**74**

Previous Similar Installations

Another factor contributing to a complete characterization of free ridership among insulation participants are participant installation histories. More specifically, we consider participant histories of other building envelope measures, and whether or not these measures were rebated.

Table 5-13 below summarizes participants' previous building envelope measure installations. Ninety-two percent of windows participants had not installed a building envelope measure in at least two years. Seventy-eight percent had never installed a building envelope measure prior to their windows installation. Only 5 percent of participants report installing a non-rebated building envelope measure sometime prior to their windows installation. These results are indicative of a very low free ridership rate.

Table 5-14: Participant Histories of Previous Building Envelope Installations

Installed Building Envelope Measure Previously?	Received a Rebate?	How Long Ago?	Response
No	n/a	n/a	78%
Yes	No	More than 2 years ago	7%
Yes	Yes	More than 2 years ago	7%
Yes	No	1 to 2 years ago	4%
Yes	Yes	Don't know	1%
Yes	No	Don't know	1%
Don't know	n/a	n/a	1%
		N	74

Windows Free Ridership Rate Estimation

The calculation of participant free ridership uses an algorithm based on responses to a series of 6 survey questions. These question and the free ridership algorithms follow.

Windows Free Ridership Survey Questions

WN7. Did you have specific plans to install high efficiency windows before learning about the Home Energy Savings Program?

1. Yes
2. No

WN9. Would you have gone ahead with this planned installation of high efficiency windows if you had not participated in the Home Energy Savings Program?

1. Yes
2. No

WN11. If the cash incentive and program did not exist, how likely is it that you would still have purchased new windows at all?

1. Very likely
2. Somewhat likely
3. Not at all likely

WIN13. If the cash incentive was not available, when would you have bought new windows…(READ)

1. Within a year from the time you installed through the program, or
2. More than a year later

WN17. How did the availability of Program information and the cash incentive affect the level of energy efficiency you selected for your windows? Would you say…

1. The program influenced you to select a higher level of energy efficiency than you would have otherwise, or
2. You selected the same energy efficiency as you would have if the program did not exist.

WN25. We'd like to get a sense of what influenced you to select program-qualifying windows as opposed to standard efficiency windows or Energy Star windows. How influential was the cash incentive in your selection of program-qualifying windows at &ADDRESS? Would you say the cash incentive was…

1. Very influential
2. Somewhat influential
3. Not at all influential

Free Ridership Algorithm

The free ridership scoring algorithm is based on combining four free ridership determinants. Each determinant is an indicator of free ridership, and they are combined to produce anoverall indicator of participant free ridership.

- The first determinant is the participant-reported likelihood of installing insulation in the absence of the program.

- The second determinant is the reported timing of the adoption that would have taken place in the absence of the program.
- The third is an assessment of the efficiency of the windows that would have been installed in the absence of the program. This reflects the degree to which the program may have inspired higher efficiency installations.
- The fourth and final determinant is the influence of the cash incentive on the decision to install insulation.

Participants receive a score of 0, 0.5 or 1 for each of the four determinants. These determinant values are multiplied to yield the final free ridership score for the individual. The procedure for calculating each determinant is described next.

Likelihood of installation. The first determinant—the likelihood of installing insulation in the absence of the program—is calculated using questions WN9 and WN7. Participants that report a high likelihood of installing windows in the absence of the program (WN9=1 or WN11=3) are assigned a value of 1 for the first determinant. Those that state that without the program it is "somewhat likely" they would have installed anyway are assigned a value of 0.5 (WN9 not equal to 1 and WN11=2). Those that would not have installed windows without the program (WN9 not equal to 1 and WN11=1) are assigned a value of 0.

Timing of installation. The second determinant of free ridership—the timing of the installation that would have occurred in the absence of the program—is calculated using WN13. Those that, in the absence of the program, would have installed within one year of program installation (WN13 = 1 or) are assigned a score of 1 for this determinant. Those that indicate installation would have taken place more than a year after the program installation are assigned a value of 0. Those that "don't know" when they would have installed windows without the program are assigned a value[7] of 0.5.

Efficiency of installation. The third determinant – the efficiency of the windows that would have been installed in the absence of the program—is calculated using question WN17. This question asks whether the program affected the efficiency level of the windows. If a respondent indicates they would have installed less efficient windows without the program, this determinant takes a value of 0.5. Other responses are assigned a value of 1.

Influence of the cash incentive. The fourth and last determinant – the degree of influence of the cash incentive- is calculated using question WN25. A response of very influential

[7] Respondents that indicate they would not have purchased insulation without the program are not asked INS9, and receive no score for the second determinant.

receives a score of 0, somewhat influential receives a score of 0.5, and not at all influential receives a score of 1.

Window Free Ridership Results

Free ridership scores are the product of the values of 4 separate determinants. The distribution of these determinants is shown in Table 5-15 below. Fifty-eight percent of surveyed participants report that in the absence of the program they were "somewhat" or "not at all" likely to have installed new windows. Another 19 percent claim they would have installed windows, but more than one year after they did so through the program, or that they would have installed less efficient windows. The influence of the cash incentive was strong, with 61 percent of respondents reporting that the cash incentive was "very influential" in their decision to install windows; eighteen percent reported the cash incentive was "not at all influential". The final estimated free ridership rate among windows participants is 15 percent, which lines up well with other windows results presented in this section.

Table 5-15: Window Free Ridership Results

What Would Have Been Purchased in the Absence of the Program?					
Likelihood of Purchasing New Windows	When?	Efficiency Relative to Program Windows	How Influential was the Cash Incentive	Frequency	Free Ridership Score
Not at all likely	N/A	N/A	Very influential	12	0
Not at all likely	N/A	N/A	Somewhat influential	1	0
Not at all likely	N/A	N/A	Not at all influential	1	0
Somewhat likely	At the same time	Less efficient	Very influential	2	0
Somewhat likely	At the same time	Same efficiency	Somewhat influential	1	0.25
Somewhat likely	Within a year	Less efficient	Very influential	2	0
Somewhat likely	Within a year	Less efficient	Somewhat influential	1	0.13
Somewhat likely	More than a year later	Less efficient	Very influential	10	0
Somewhat likely	More than a year later	Less efficient	Not at all influential	1	0
Somewhat likely	More than a year later	Same efficiency	Very influential	3	0
Somewhat likely	More than a year later	Same efficiency	Somewhat influential	2	0
Somewhat likely	More than a year later	Same efficiency	Not at all influential	1	0
Somewhat likely	More than a year later	Same efficiency	Don't know	1	0
Somewhat likely	More than a year later	Don't know	Somewhat influential	1	0
Somewhat likely	Don't know	Same efficiency	Very influential	1	0
Somewhat likely	Don't know	Same efficiency	Somewhat influential	1	0.25
Somewhat likely	Don't know	Same efficiency	Not at all influential	2	0.50
Very likely	At the same time	Less efficient	Very influential	2	0
Very likely	At the same time	Less efficient	Somewhat influential	1	0.25
Very likely	At the same time	Same efficiency	Very influential	2	0
Very likely	At the same time	Same efficiency	Somewhat influential	5	0.50
Very likely	At the same time	Same efficiency	Not at all influential	5	1
Very likely	At the same time	Refused	Not at all influential	1	1
Very likely	At the same time	Don't know	Very influential	1	0
Very likely	Within a year	Same efficiency	Very influential	1	0
Very likely	Within a year	Same efficiency	Somewhat influential	1	0.50
Very likely	More than a year later	Less efficient	Very influential	4	0
Very likely	More than a year later	Less efficient	Somewhat influential	1	0
Very likely	More than a year later	Same efficiency	Very influential	3	0
Very likely	More than a year later	Same efficiency	Not at all influential	2	0
Very likely	More than a year later	Don't know	Very influential	1	0
Very likely	Don't know	Don't know	Very influential	1	0
TOTAL Free Ridership Score for Windows					**15%**

5.2.3 CFL Free Ridership

This section investigates various indicators of the degree of free ridership among CFL participants in the Multifamily Home Energy Savings Program. The section has similar content and organization as the free-ridership sections above. This section, however, closes with an assessment of CFL persistence.

Participant Reasons for Installing CFL

As noted above, the HES Program offers free CFLs, showerheads and faucet aerators to qualifying customers. In order to qualify for these free installations participants must install a building shell weatherization measure or HVAC measure.

Table 5-16 below summarizes respondents' reasons for installing insulation. The most commonly cited reason for installation is the Multifamily HES Program (72%), including the incentive (57%) and fulfilling program requirements (15%). This is a very strong result for the Program, implying very low free ridership. Saving energy and money account for an additional 24 percent. Pleasing tenants was the least common reason, at just 4 percent.

Table 5-16: Program Participants Reasons for Installing CFLs

What was the primary reason you installed CFLs?	Primary Reason	Other Reasons
Because Program offered them for Free	57%	6%
Saves Energy	22%	63%
Saves on Energy bill	2%	25%
Program requirement	15%	6%
Please tenants	4%	13%
ETO recommendation	0%	6%
Other	0%	13%
N	**40**	**16**

Timing of Program Awareness

Participants were asked to report the timing of their program awareness relative to their decision to install insulation. Participant responses are summarized in Table 5-17 below. Twenty-eight percent of participants become aware of the program only *after* making the decision to install CFLs.

Table 5-17: Timing of Program Awareness

Did you become aware of the cash incentive before or after you decided to install CFLs??	Response
Before	46%
After	28%
At the same time	17%
Don't know	9%
N	**40**

Previous Similar Installations

Another factor contributing to the characterization of free ridership among CFL participants are participant installation histories. **Table 5-18** below presents participant histories of other high efficiency lighting measures, and whether or not these measures were rebated. Less than one-third of respondents had installed an efficient lighting measure within 2 years of their program participation. One-quarter of respondents indicate they had never installed efficient lighting prior to program participation.

Table 5-18: Participant Histories of Previous Efficient Lighting Installations

Installed Efficient Lighting Measure Previously?	Received a Rebate?	How Long Ago?	Response
Yes	Yes	More than 2 years ago	15%
Yes	No	Less than 12 months ago	10%
Yes	No	1 to 2 years ago	20%
Yes	No	More than 2 years ago	22%
Yes	No	Don't know	5%
Yes	Don't know	Between 1 and 2 years ago OR	2%
No	n/a	n/a	25%
		N	40

Free Ridership Rate Estimation

The calculation of participant free ridership uses an algorithm based on responses to a series of 5 survey questions. These question and the free ridership algorithms are presented below.

Free Ridership Survey Questions

CFL1. Before participating in the Home Energy Savings program, did you have specific plans to install CFLs at &ADDRESS?

1. Yes
2. No

CFL3. Would you have gone ahead with this planned installation of CFLs if you had not participated in the Home Energy Savings Program?

1. Yes
2. No

CFL5. If you had not received free CFLs through the Home Energy Savings program, which of the following three statements best describes the actions you would have taken:

1. You would not have installed CFLs at &ADDRESS
2. You would have installed fewer CFLs at &ADDRESS,
3. You would have installed the same number of CFL's

CFL9. If you had not participated in the Home Energy Savings program and received free CFL bulbs, when would you have bought CFLs for &ADDRESS:

1. Within a year from the time you installed through the program, or
2. More than a year later

CFL10. We'd like to get a sense of what influenced you to install CFLs. How influential was the offer of free CFLs in your decision to install them? Would you say the offer was…

1. Very influential
2. Somewhat influential
3. Not at all influential

Free Ridership Algorithm

Similar to the other algorithms presented in this section, the free ridership survey battery shown above is integrated to produce a free ridership "score" for each participant respondents. The score is based on combining four free ridership determinants and each determinant is an independent indicator of free ridership.

- The first determinant is the participant-reported likelihood of installing CFLs in the absence of the program.
- The second determinant is the reported timing of the CFL adoption that would have taken place in the absence of the program.
- The third is an assessment of the size of the installation that would have occurred in the absence of the program. This reflects the degree to which the program may have inspired a greater number of CFL installations.
- The fourth and final determinant is the influence of the cash incentive on the decision to install insulation.

These determinant values are multiplied to yield the final free ridership score for the individual. The procedure for calculating each determinant is described next.

Likelihood of installation. The first determinant—the likelihood of installing insulation in the absence of the program—is calculated using questions CFL3 and CFL5. Participants that report a high likelihood of installing insulation in the absence of the program (CFL3=1 or CFL5=2 or CFL5=3) are assigned a value of 1 for the first determinant. Those that state they would not have installed CFLs without the program (CFL3 not equal to 1 and CFL5=1) are assigned a value[8] of 0.

Timing of installation. The second determinant of free ridership—the timing of the installation that would have occurred in the absence of the program—is calculated using CFL9. Those that, in the absence of the program, would have installed within one year of program installation (CFL9=1) are assigned a score of 1 for this determinant. Those that indicate installation would have taken place more than a year after the program installation are assigned a value of 0.

Size of installation. The third determinant – the size of the installation that would have occurred in the absence of the program—is calculated using question CFL5. If a respondent indicates they would have installed fewer CFLs without the program, this determinant takes a value of 0.5. Other responses are assigned a value of 1.

Influence of the cash incentive. The fourth and last determinant – the degree of influence of the cash incentive- is calculated using question CFL10. Respondents that indicate the incentive was "very influential" receive a score of 0, those that report the incentive was "somewhat influential" receive a score of 0.5, and those that report the incentive was "not at all influential" receive a score of 1.

CFL Free Ridership Results

As described above, free ridership scores are the product of the values of 4 separate determinants. The distribution of these determinants is shown in Table 5-19 below. Seventy-two percent of surveyed participants report they would not have installed CFLs without the program. As might be expected, the influence of the offer of free CFLs was a very strong force in the decision to install them. Ninety-three percent of respondents report the offer of free CFLs was "very influential" in their decision to install them. The final estimated free ridership rate for CFL installations is 2 percent.

[8] A score of 0.5 is not a possible score for the first determinant.

Table 5-19: CFL Free Ridership Results

Would have installed CFLs anyway?	Installed later?	Would have installed fewer CFLs?	How influential was the incentive?	Frequency	Score
no	n/a	n/a	Don't know	1	0
no	n/a	n/a	Not at all influential	1	0
no	n/a	n/a	Very influential	31	0
yes	Within 1 year	no	Not at all influential	1	1
yes	Within 1 year	yes	Very influential	1	0
yes	More than 1 year later	no	Very influential	2	0
yes	More than 1 year later	yes	Very influential	1	0
yes	Within 1 year	no	Very influential	2	0
yes	Within 1 year	yes	Very influential	6	0
Total Free Ridership Score					**2%**

5.2.4 CFL Persistence

The issue of the persistence of the compact fluorescents that were installed through the program was explored in the participant survey. Respondents were asked to report CFL failures, removals and the degree to which CFLs were replaced with incandescent bulbs. AS shown in Table 5-20 below, 22 percent of respondents indicate that some of the CFLs had burnt out or failed since installation. However, 28 percent were unable to answer this question. Among those that could answer the question (72%) nearly one-third (31%) report that some of the CFLs had failed or burnt-out. When asked to report the extent of the failure/burn-outs, respondents indicate that an average of approximately 18 percent of the bulbs had failed or burned out.

Table 5-20: CFL Burn-out and Failures

Distribution of CFL Failures		
Have any CFLs Failed?	**Response**	**Mean Percent Failed**
Yes	22%	18%
No	50%	
Don't know	28%	
N	**40**	**8**

A similar distribution is reported for CFL removals. Participants were asked to report whether any of the CFLs installed through the program were removed for reasons other than burnout or failure. Results are presented in Table 5-21 below. Twenty-two percent of respondents report that CFLs were removed for reasons other than failure or burn-out. More

respondents were able to answer this question than were able to report on burn-outs or failures. Among those that were able to answer the question, 27 percent reported CFL removals. The average size of removals is similar to burn-outs, at approximately 18 percent.

Table 5-21: CFL Removals

Distribution of CFL Removals		
Have any CFLs been Removed?	**Response**	**Mean Percent Removed**
Yes	22%	18%
No	59%	
Don't know	20%	
N	**40**	**7**

When participant survey responses are combined, a distribution of CFL removals or failures can be deduced. This distribution is shown in Table 5-22 below. Nearly 40 percent of participants report either CFL removal or failure. Among those that could answer the question half report CFL removal or failure. The average size of the CFL removal/failure is approximately 22 percent.

Table 5-22: CFL Removals and Failures

Distribution of CFL Failures Plus Removals		
Have any CFLs been Removed or Failed?	**Removed or Failed**	**Mean Percent Removed or Failed**
Yes	38%	22%
No	38%	
Don't know	25%	
N	**40**	**14**

Table 5-23 below presents participant reports of replacements of CFLs with incandenscent bulbs. Nearly one-quarter of participants report CFLs were replaced with incandescent bulbs. If we disregard the "don't know" responses, 28 percent report incandescent replacements. Furthermore, when bulbs were replaced, they averaged approximately 20 percent of the installed bulbs.

Table 5-23: Replacement of CFLs with Incandescent Bulbs

Have you replaced any of the CFLs installed through the program with incandescent bulbs?	Response	Mean Percent Replaced
Yes	24%	20%
No	59%	
Don't know	17%	
N	**40**	**8**

Though the results presented here are not precise or reliable enough to be considered robust, they do yield some rough persistence estimates. The figures indicate that 11 percent of CFLs are failing or burning out[9], and that about half of these, or 6 percent, are being replaced with incandescent bulbs[10].

5.2.5 Efficient Showerhead Free Ridership

This section investigates various indicators of the degree of free ridership among showerhead participants in the Multifamily Home Energy Savings Program. The section has similar content and organization as the free-ridership sections above.

Participant Reasons for Installing Efficient Showerheads

Respondents were asked to report a primary reason for installing efficient showerheads, as well as any other, secondary reasons. Table 5-24 below summarizes respondents' reasons for installing efficient showerheads. A significant portion (56%) of participants cited the offer of free installation or fulfilling program requirements as their primary reason for installation. Saving energy and water account for another 26 percent, and finally old equipment or tenant requests account for the final 8 percent.

[9] This disregards "don't know" responses and is the product of the 50 percent failure/removals and the 22 percent mean size of the removal/failure.

[10] This disregards "don't know" responses and is the product of the 28 percent replacements and the 20 percent mean size of the replacements.

Table 5-24: Program Participants Reasons for Installing Efficient Showerheads

What was the primary reason you installed efficient showerheads?	Primary Reason	Other Reasons
Program offered them for Free	43%	10%
Save water	22%	40%
Program requirements	13%	0%
Save energy	9%	40%
Improve efficiency	4%	0%
Tenant requests	4%	0%
Current equipment really old, inoperable	4%	0%
Other	0%	10%
N	22	10

Timing of Program Awareness

Participants were asked to report the timing of their program awareness relative to their decision to install efficient showerheads. Responses to this query are summarized in Table 5-25 below. About 35% of the showerhead participants interviewed report that they made the decision to install showerheads before becoming aware of the program. This is a somewhat unexpected result given other free ridership analyses shown in this section. However, it is not unusual for respondents to provide some inconsistent results. In these cases it is best to rely on a preponderance of the evidence, as we do here.

Table 5-25: Timing of Program Awareness

Did you become aware of the cash incentive before or after you decided to install showerheads?	Response
Before	35%
After	35%
At the same time	22%
Don't know	9%
N	**22**

Previous Similar Installations

Another factor relevant to the assessment of free ridership among showerhead participants are their installation histories. **Table 5-26** below summarizes participants' previous water saving measure installations. The data show that 18 percent of participants report installing a non-rebated water saving measure within the past year. Another 14 percent of participants report installing a water saving measure within the past 2 years.

Table 5-26: Participant Histories of Previous Water Saving Measure Installations

Installed Water Saving Measure Previously?	Received a Rebate?	How Long Ago?	Response
Yes	Yes	1 to 2 years ago	5%
Yes	No	Less than 12 months ago	18%
Yes	No	1 to 2 years ago	14%
Yes	No	More than 2 years ago	5%
Yes	No	Don't know	14%
No	n/a	n/a	45%
		N	**22**

Efficient Showerhead Free Ridership Rate Estimation

The calculation of participant free ridership uses an algorithm based on responses to a series of 5 survey questions. These question and the free ridership algorithms are presented below.

Free Ridership Survey Questions

SH5. Did you have any specific plans to install efficient showerheads before learning about the Home Energy Savings Program?

1. Yes
2. No

SH7. Would you have gone ahead with this planned installation of efficient showerheads if you had not participated in the Home Energy Savings Program?

1. Yes
2. No

SH9. If the program did not exist and the showerheads were not installed for free, which of the following THREE statements best describes the actions you would have taken?

1. We would not have installed efficient showerheads
2. We would have installed fewer showerheads at <*address*>
3. We would have installed the same number of showerheads at <*address*>

SH11. If you had not participated in the Home Energy Savings program and received free showerheads, when would you have bought efficient showerheads for <*address*>?

1. Within a year from the time you installed through the program, or
2. More than a year later

SH15. We'd like to get a sense of what influenced you to install efficient showerhead. How influential was the offer of free efficient showerheads in your decision to install them? Would you say the offer was…

1. Very influential
2. Somewhat influential
3. Not at all influential

Free Ridership Algorithm

The free ridership survey battery shown above is integrated to produce a free ridership "score" for each participant respondents. The scores are based on combining four free ridership determinants and each determinant is an indicator of free ridership.

- The first determinant is the participant-reported likelihood of installing efficient showerheads in the absence of the program.
- The second determinant is the reported timing of the adoption that would have taken place in the absence of the program.
- The third is an assessment of the size of the installation that would have occurred in the absence of the program.
- The fourth and final determinant is the influence of the offer of free showerheads on the decision to install them.

Participants receive a score of 0, 0.5 or 1 for each of the four determinants. These determinant values are multiplied to yield the final free ridership score for the individual. The procedure for calculating each determinant is described next.

Likelihood of Installation. The first determinant—the likelihood of installing showerheads in the absence of the program—is calculated using questions SH7 and SH9. Participants that report a high likelihood of installing efficient showerheads in the absence of the program (SH7=1 or SH9 =2 or SH9=3) are assigned a value of 1 for the first determinant. Those that state they would not have installed efficient showerheads without the program (SH7 not equal to 1 and SH9=1) are assigned a value of 0[11].

Timing of installation. The second determinant of free ridership—the timing of the installation that would have occurred in the absence of the program—is calculated using SH11. Those that, in the absence of the program, would have installed within one year of program installation (SH11 =1) are assigned a score of 1 for this determinant. Those that

[11] A score of 0.5 is not a possible score for the first determinant.

indicate installation would have taken place more than a year after the program installation are assigned a value of 0. Those that "don't know" when they would have installed showerheads without the program are assigned a value of 0.5.

Size of installation. The third determinant – the size of the installation that would have occurred in the absence of the program—is calculated using question SH9. This question asks whether the program affected the number showerheads installed. If a respondent indicates they would have installed fewer showerheads without the program then this determinant takes a value of 0.5. All other responses are assigned a value of 1.

Influence of the cash incentive. The fourth and last determinant – the degree of influence of the cash incentive- is calculated using question SH15. A response of very influential receives a score of 0, somewhat influential receives a score of 0.5, and not at all influential receives a score of 1.

Showerhead Free Ridership Results

Free ridership scores based on the 4 separate determinants described above. The distribution of these determinants is shown in Table 5-27 below. Fifty-two percent of surveyed participants report they would not have installed efficient showerheads without the program. Among those that would have installed showerheads without the program, 27 percent would have done so more than 1 year after the program installation, and an additional 27 percent would have installed fewer showerheads without the incentive.

What really stands out in the results shown below is the reported influence of the offer of free showerheads. Eighty-seven percent of respondents reported the offer of free showerheads was very influential in their decision to install them. The influence of the free offer reduces the final free ridership estimate to 4 percent. It makes sense that the offer of free showerheads is a powerful factor in customer decisions, but there are some arguably inconsistent results presented above surrounding timing of awareness and previous installations. There are many plausible explanations for the data presented here, but there is no evidence from which to draw a solid conclusion. While there are no indications that showerhead free ridership is terribly significant, it is recommended that it remain a research issue going forward only due to the inconsistencies found in these data.

Table 5-27: Efficient Showerhead Free RidershipResults

Would have installed showerheads anyway?	Installed later?	Would have installed fewer showerheads?	How influential was the incentive?	Frequency	Score
no	n/a	n/a	Very influential	10	0
no	n/a	n/a	Somewhat influential	2	0
yes	Don't Know	no	Very influential	2	0
yes	More than 1 year later	yes	Very influential	3	0
yes	Within 1 year	no	Very influential	2	0
yes	Within 1 year	no	Not at all influential	1	1
yes	Within 1 year	yes	Very influential	3	0
Total Free Ridership Score					**4%**

5.2.6 Faucet Aerator Free Ridership

This section investigates various indicators of the degree of free ridership among faucet aerator participants in the Multifamily Home Energy Savings Program.

Participant Reasons for Installing Faucet Aerators

Respondents were asked to report a primary reason for installing efficient showerheads, as well as any other, secondary reasons. Table 5-28 below summarizes respondents' reasons for installing faucet aerators. Overall, the predominant reason participants are installing faucet aerators is the ETO program, which is indicative of a very low free ridership rate. Nearly 75 percent of participants cited the offer of free installation or fulfilling program requirements as their primary reason for installation. Another 4 percent cite ETO recommendations as the primary reason. Surprisingly, saving energy and water account for only 12 percent.

Table 5-28: Program Participants Reasons for Installing Faucet Aerators

What was the primary reason you installed faucet aerators?	Primary Reason	Other Reasons
Program offered them for Free	67%	10%
Save water	4%	60%
Save energy	4%	20%
Improve efficiency	4%	0%
Energy Trust of Oregon recommendation	4%	0%
Program requirements	8%	0%
Other	0%	10%
Don't know	8%	0%
N	23	10

Timing of Program Awareness

Participants were asked to report the timing of their program awareness relative to their decision to install efficient showerheads. About one-quarter of the faucet aeraator participants interviewed indicate they made the decision to install aerators prior to becoming aware of the program.

Table 5-29: Timing of Program Awareness

Did you become aware of the cash incentive before or after you decided to install faucet aerators?	Response
Before	42%
After	25%
At the same time	29%
Don't Know	4%
N	**23**

Previous Similar Installations

Another factor relevant to the assessment of free ridership among faucet aerator participants are installation histories. We consider participant histories of installing water saving measures, and whether or not these measures were rebated. Table 5-30 below summarizes participants' previous water saving measure installations. Thirty-two percent of participants report installing a water saving measure within the past two years.

Table 5-30: Participant Histories of Previous Water Saving Measure Installations

Installed Water Saving Measure Previously?	Received a Rebate?	How Long Ago?	Response
Yes	Yes	1 to 2 years ago	5%
Yes	No	Less than 12 months ago	18%
Yes	No	1 to 2 years ago	9%
Yes	No	More than 2 years ago	14%
Yes	No	Don't know	14%
No	n/a	n/a	41%
		N	**22**

Free Ridership Rate Estimation

The calculation of participant free ridership utilizes an algorithm based on responses to a series of survey questions. These question and the free ridership algorithm is presented below.

Free Ridership Survey Questions

AE5. Did you have any specific plans to install faucet aerators before learning about the Home Energy Savings Program?

1. Yes
2. No

AE7. Would you have gone ahead with this planned installation of faucet aerators if you had not participated in the Home Energy Savings Program?

1. Yes
2. No

AE9. If the program did not exist and the faucet aerators were not installed for free, which of the following THREE statements best describes the actions you would have taken?

1. We would not have installed faucet aerators
2. We would have installed fewer faucet aerators at <*address*>
3. We would have installed the same number of faucet aerators at <*address*>

AE11. If you had not participated in the Home Energy Savings program and received free showerheads, when would you have bought efficient showerheads for <*address*>?

1. Within a year from the time you installed through the program, or
2. More than a year later

AE15. We'd like to get a sense of what influenced you to install efficient showerhead. How influential was the offer of free efficient showerheads in your decision to install them? Would you say the offer was…

1. Very influential
2. Somewhat influential
3. Not at all influential

Free Ridership Algorithm

The free ridership survey battery shown above is integrated to produce a free ridership "score" for each participant respondent. The score is based on combining four free ridership determinants and each determinant is an independent indicator of free ridership.

- The first determinant is the participant-reported likelihood of installing faucet aerators in the absence of the program. .
- The second determinant is the reported timing of the adoption that would have taken place in the absence of the program.
- The third is an assessment of the size of the installation that would have occurred in the absence of the program.
- The fourth and final determinant is the influence of the offer of free faucet aerators on the decision to install them.

Participants receive a score of 0, 0.5 or 1 for each of the four determinants. These determinant values are multiplied to yield the final free ridership score for the individual. The procedure for calculating each determinant is described next.

Likelihood of installation. The first determinant—the likelihood of installing faucet aerators in the absence of the program—is calculated using questions AE7 and AE9. Participants that report a high likelihood of installing faucet aerators in the absence of the program (AE7=1 or AE9 =2 or AE9=3) are assigned a value of 1 for the first determinant. Those that state they would not have installed faucet aerators without the program (AE7 not equal to 1 and AE9=1) are assigned a value of 0[12].

Timing of installation. The second determinant of free ridership—the timing of the installation that would have occurred in the absence of the program—is calculated using AE11. Those that, in the absence of the program, would have installed within one year of program installation (AE11 =1) are assigned a score of 1 for this determinant. Those that indicate installation would have taken place more than a year after the program installation are assigned a value of 0. Those that "don't know" when they would have installed faucet aerators without the program are assigned a value of 0.5.

Size of installation. The third determinant – the size of the installation that would have occurred in the absence of the program—is calculated using question AE9. This question asks whether the program affected the number faucet aerators installed. If a respondent indicates they would have installed fewer aerators without the program, this determinant takes a value of 0.5, all other responses are assigned a value of 1.

Influence of the cash incentive. The fourth and last determinant – the degree of influence of the cash incentive- is calculated using question AE15. A response of "very influential"

[12] A score of 0.5 is not a possible score for the first determinant.

receives a score of 0, "somewhat influential" receives a score of 0.5, and not at all influential receives a score of 1. A response of "don't know" is also assigned a value of 1.

Faucet Aerator Free Ridership Results

As described above, free ridership scores are the product of the values of 4 separate determinants. Table 5-31 below shows the distribution of the determinants and the resulting final estimate of faucet aerator free ridership. Note that 79 percent of surveyed participants report they would not have installed faucet aerators without the program. Among those that would have installed faucet aerators without the program, 20 percent would have done so more than 1 year after the program installation, and an additional 20 percent would have installed fewer faucet aerators without the program.

Similar to the other free measures, the program offer of free installation was a powerful force in the decision to install. Ninety-two percent of respondents reported the offer of free faucet aerators was very influential in their installation decision. Thus, the final free ridership estimate is very low, at 8 percent.

Table 5-31: Faucet Aerator Free RidershipResults

Would have installed faucet aerators anyway?	Installed later?	Would have installed fewer faucet aerators?	How influential was the incentive?	Frequency	Score
no	n/a	n/a	Very influential	18	0
no	n/a	n/a	Very influential	1	0
yes	More than 1 year later	yes	Very influential	1	0
yes	Within 1 year	no	Very influential	1	0
yes	Within 1 year	no	Not at all influential	2	1
yes	Within 1 year	yes	Very influential	1	0
Total Free Ridership Score					**8%**

5.3 Participant Spillover

This section is dedicated to estimating participant "spillover." That is the assessment of participant high efficiency measure adoptions attributable to the program, but not installed under the program. There are three main requirements for a measure adoption to qualify as spillover.

- First, the adoption must occur outside of any energy efficiency program.
- Second, the measure adoption must be a result of program participation.
- Third, the measure must be program-qualifying.

5.3.1 Spillover Estimation Methods

Participant respondents were asked to report all measure adoptions occurring outside the program and to report whether or not rebates are associated with those measures. Note that CFL participants were asked specifically to report any additional CFL installations they might have made outside the program.

Quantity, type and efficiency data associated with each reported measure adoption were collected to determine whether the measure was program qualifying and to assess the energy savings associated with it.

In order to assess whether a measure adoption occurred as a result of the program respondents were asked to report the influence of their program experience on their decision to install non-rebated measures. For CFL spillover, the question is as follows:

CFL33. How influential was your experience with the CFLs that were installed through the program in your decision to purchase these additional CFL bulbs? Would you say…

1. Very influential
2. Somewhat influential
3. Not at all influential

For participants installing other measures, the question was posed as:

SP23. How influential was your experience with the Energy Trust and the Home Energy Savings program or information provided through the program in your decision to install <equipment>? Would you say…

1. Very influential
2. Somewhat influential
3. Not at all influential

5.3.2 Spillover Scoring

In order for an adoption to qualify as potential participant spillover it must fulfill the following criteria:

1. The respondent must report the measure was not rebated by any entity.
2. The respondent must report the program was "very influential" in the decision to install the equipment (SP23=1 or CFL33=1).
3. The measure must be deemed program-qualifying.

5.3.3 Spillover Results

The investigation of participant spillover yielded some notable results for CFLs, but not for other measures. Among the 40 CFL participants surveyed, 3 reported CFL adoptions that qualify as spillover under the requirements set forth above. This is a spillover occurance of 7.5 percent. These three CFL spillover installations have an average size of 37 bulbs, which is 22 percent of the typical program installation size (164). Thus, CFL spillover can be estimated at 2 percent of program CFL savings.

Three additional non-CFL adoptions were reported by participants to be non-rebated and "very influenced" by their program experience. However, none of these adoptions were deemed program-qualifying and thus other program spillover is estimated to be zero percent.

5.4 Summary of Net-to-Gross Results

Table 5-32 summarizes the net-to-gross analysis results for the Program Year 2005/2006 Multifamily Home Energy Savings Program. Despite virtually zero spillover, the program has very high estimated net-to-gross ratios, ranging from 81 percent for insulation to 100 percent for CFLs.

Table 5-32: Summary of Net-to-Gross Results by Program Measure

Program Measure	Free Ridership	Spillover	Final Net-to-Gross Ratio
Insulation	19%	0%	81%
Windows	15%	0%	85%
CFL	2%	2%	100%
Showerhead	4%	0%	96%
Faucet Aerator	8%	0%	92%

There are some issues to bear in mind when considering these results. First, despite a very high net-to-gross ratio, the survey reveals that CFLs may have some persistence issues. The estimates presented here show that 11 percent are either failing or are being removed by building occupants, and about half of those are replaced with incandescent bulbs. Persistence of CFL installations might be pursued in more detail in further studies, and the uncertainty here can be taken under advisement for program planning purposes.

Finally, the relationship between participants' desire for one program measure and requirements to install others could be explored more explicitly in future studies. The general indication of the findings shown here is that the program design successfully and attractively bundles measures together, which may play a role in the program's high net-to-gross ratios.