

Prospective Benefits Impact Evaluation of the New Construction Program

Final Report

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EXECUTIVE SUMMARY

BACKGROUND AND EVALUATION OBJECTIVES

The Impact Team conducted an analysis of prospective benefits stemming from the **New York Energy SmartSM** Program investments made through the Commercial New Construction Program (NCP). The objective of this analysis was to determine the net energy savings attributable to the program's prior years' expenditures that will be realized after the program is discontinued. Prospective energy savings are a projection of savings to be realized from program-promoted energy efficiency measures and design approaches (EEMDA) that are implemented after the program ends and that would not have occurred without the program investments made prior to termination.

Prospective benefits were evaluated for three groups of market actors:

- Currently participating architecture and engineering (A&E) firms;
- Currently participating building owners; and
- Non-participating building owners whose practices have been influenced by the NCP.

The prospective benefits projection is based on the near-term *hypothetical* situation that the program was terminated on December 31, 2007. The prospective benefit impact estimates are the energy and demand savings that would be expected to occur due to actions taken in 2008 and beyond, given prior program efforts and the state of the market in 2007. This new impact evaluation effort assesses and estimates near-term prospective benefits of the NCP.

All forecasting has some level of uncertainty. The measurement of near-term prospective benefits is rare in the energy efficiency evaluation field. There have been projects that estimate longer-term future market transformational impacts. Many of these are seen as having significant measurement challenges, often with large uncertainty ranges. The Impact Team has chosen to instead begin by estimating short-term projected impacts in order to systematically address some of the challenges seen in prior work elsewhere.

RESEARCH APPROACH

The prospective benefits analysis is based on an assessment of the percentage of current incremental annual program benefits that can be expected to persist after the program's termination. This approach means that rather than building post-program effects up from an assumption of zero, the Impact Team started with the 2007 incremental net GWh and MW savings, representing a reasonable expectation of future annual program energy savings if the program continued, and adjusted these savings by expected changes in the supply of and demand for program-supported measures after the program ends. This adjustment was made through use of Prospective Benefit Factors that were developed from surveys of participating A&E firms and building owners, and non-participating building owners. These surveys were conducted jointly with NYSERDA's Market Characterization and Assessment team.

Prospective Benefit Factors take on a value between 0 and 1 to reflect the percentage of current savings that is expected to persist after the program ends. For example, a Prospective Benefit (PB) Factor of 0.7 means that 70% of current annual program savings are expected to accrue as additional savings during the first year after the program ends. The PB factor is a net factor as it includes estimates of the level of program influence on the respondents' actions. So these additional savings obtained after the program ends are estimates of net savings.

FINDINGS

The Impact Team estimates short-term annual prospective benefits for the NCP to be approximately 57.2 GWh and 16.3 MW, representing 74% of 2007 incremental net savings. Table ES-1 presents these results, as well as the 2007 gross savings, the 2006 attribution assumptions (used to estimate 2007 net savings), and the attribution-weighted Prospective Benefits (PB) Factors. The table shows that program-influenced non-participants are expected to continue their program-influenced practices at a rate of 83% compared to 72% for participants.¹

Table ES-1. Summary of Prospective Benefits Results

	GWh	MW
Prospective Benefits	57.2a	16.3a
Prospective Benefits - Participants	47.1	13.4
Prospective Benefits - Non-Participants	10.1	2.9
2007 Incremental Gross Savings	71.6	20.4
2006 Free-ridership Rate		0.46
2006 Inside Spillover Rate		0.05
2006 Outside Spillover Rate		0.32
2006 Non-Participant Spillover Rate		0.17
2006 NTG Ratio		1.08
2007 Incremental Net Savings	77.3	22.0
2007 Participant Incremental Net Savings	65.1	18.5
2007 Non-Participant Incremental Net Savings	12.2	3.5
Participant PB Factor	0.72	0.72
Participating A&E PB Factor	0.74b	0.74b
Participating BO PB Factor	0.70c	0.70c
Non-Participant PB Factor	0.83d	0.83d

a Estimates are provided here as point estimates. Unless the Prospective Benefit Factors are assumed to be an index of the underlying construct, derivation of confidence intervals from the variances in this multi-question and factor composite becomes unmeasurable. Assuming the PB factors were additive and independent, *i.e.*, not subsets or otherwise correlated, and the 2007 net program savings are fixed, an approximation of the 90% confidence interval for the GWh PB estimate is 46.5 to 50.6 for participants and 9.7 to 10.4 for non-participants. The same assumptions produce a 90% confidence interval of 13.2 to 14.4 MW for participants and 2.8 to 3.0 MW for non-participants..

These final NCP PB Factors and estimates have been revised using incentive-weighted calculations for participating A&E firms and building owners. Preliminary results reported in the NYSERDA March 2008 Quarterly Report Program Evaluation and Status Report - Issued May 2008 were based on savings-weighted calculations. Those weights were found to have inaccuracies; the savings estimates were being updated at the same time as this report was being created.

b The sample *c.v.* for the unweighted A&E PB Factor is 0.27 and that for the attribution weights is 0.61.

c The sample *c.v.* for the unweighted BO PB Factor is 0.29 and that for the attribution weights is 0.76.

d The sample *c.v.* for the unweighted Non-Participant PB Factor is 0.23.

¹ Prospective benefit results are based on the following sample sizes: 60 participating A&E firms; 60 participating building owners; 62 non-participating building owners. Given the stratified sampling used, the A&E firm sample represents a large percentage of the program population.

This analysis represents a first attempt by the Impact Team to quantify energy and demand savings from measures that are attributable to an energy efficiency program but that are expected to be implemented after the program's hypothetical termination. The analysis was limited by certain time and data constraints, and several opportunities for improving the projection became apparent while conducting this pilot effort. These are summarized in the last section of this report.

SECTION 1:**INTRODUCTION**

The New York State Energy Research and Development Authority (NYSERDA) is a public benefit corporation established in 1975. It administers System Benefits Charge (SBC) funds and the **New York Energy SmartSM** Program under an agreement with the New York State Public Service Commission (PSC). NYSEDA also oversees and coordinates evaluation of the effort pursuant to PSC order. NYSEDA began operating the **New York Energy SmartSM** Programs in July 1998. The programs are funded by an electric distribution SBC paid by customers of Central Hudson Gas and Electric Corporation, Consolidated Edison Company of New York, Inc., New York State Electric & Gas Corporation, National Grid, Orange and Rockland Utilities, and Rochester Gas & Electric Corporation. The Commercial New Construction Program (NCP) is one of many **New York Energy SmartSM** programs.

NYSERDA contracted with a team under the direction of Megdal & Associates to conduct impact evaluations for the SBC efforts (the Impact Team). An action plan was developed after an interactive process based on a review and analyses relating to a wide range of issues and including a variety of stakeholders. Some of these activities consisted of workshops to explore issues, methods and examination of prior impact evaluations, a risk analysis of impact evaluation estimates of gross and net program savings, and consideration of how to divide the available resources among the various of types of impact evaluations that were desired (gross savings evaluation, net-to-gross studies, non-energy impact measurement, and cost-effectiveness assistance).

This particular project, Prospective Benefits Analysis of the NCP, arose from a discussion of the opportunities and challenges with net-to-gross measurement for long-standing programs that include market transformation efforts. Since these efforts are geared toward moving market players toward more efficient options the lines between free-riders and spillover tends to weaken over time. Given that the ultimate goal of market transformation is to develop a sustainable market for energy efficiency, one way to measure the success of the program is to estimate the program effects that would continue in the hypothetical absence of the program.

This project differs from other analyses of post program benefits due to its focus on the short-term impacts. The design of the analysis requires projecting the savings for the year following the hypothetical end of the NCP. This approach reduces the degree of uncertainty associated with the projections, and also provides some insight into the near-term market transformational effects of the program interventions. However, this analysis does not assess the longer-term impacts. It is important to note that technologies and strategies for reaching the market will likely continue to improve over time and that the program may well have a critical role to play in encouraging the early adoption of new technologies as they become available. In short, the projection of post program benefits as presented in this report is related to the specific practices and methods currently employed by the program, and do not include the possibility of additional benefits to be achieved through future efforts.

This report documents the methodology and findings of the NCP Prospective Benefits Analysis. A summary of a preliminary set of findings from this analysis was presented in the March 2008 Quarterly Report Program Evaluation and Status Report - Issued May 2008. This report provides the final results and more details of the analyses. The team that worked on the NCP Prospective Benefits Analysis consisted of staff from Megdal & Associates, Opinion Dynamics Corporation, and West Hill Energy and Computing, worked closely with NYSEDA staff to conduct the data collection, analysis, and reporting activities contained in this report.

1.1 PROGRAM DESCRIPTION²

The NCP, begun in fall 1999, was established to encourage energy-efficient design and building practices among architects and engineers and to urge them to inform building owners and leaseholders³ about the long-term advantages of building to higher energy standards. The program is designed to accelerate the incorporation of energy efficiency, renewable energy, and green building features in the design, construction, and operation of commercial, industrial, and institutional buildings. The goal of the program is to encourage permanent improvements in standard design practice among building designers (*i.e.*, architecture and engineering (A&E) firms) and owners.

The NCP provides opportunities to implement permanent energy efficiency and load management improvements in building envelopes and major systems (*e.g.*, HVAC, lighting, controls, fans and pumps, etc.) at the time of new construction or major renovation.⁴ Building owners can apply for the following three types of performance-based, direct capital cost incentives:

- Pre-Qualified Equipment Incentives (set-rate)
- Custom Measure Incentives (system-based)
- Whole Building Design Incentives (energy modeling)

The incentives are designed to defray a portion of the incremental capital cost to purchase and install more energy-efficient equipment and may cover up to 60% of the incremental costs of qualified measures, with the actual incentive amount based upon the anticipated energy performance of the building. In addition, technical assistance incentives are available to applicants and their design teams (*i.e.*, A&E firms), from NYSERDA's pre-selected providers, to evaluate energy efficiency, peak demand reduction, and green building opportunities in their new construction projects as well as monitor and benchmark the completed projects' actual energy performance.

1.2 PROGRAM PARTICIPATION TO DATE⁵

As of December 31, 2007, 884 projects are participating through the NCP.⁶ The annual energy savings and peak demand reduction associated with these participating projects are projected to exceed 203 GWh

² The program description is paraphrased from the Program Opportunity Notice (PON) 1155. More detailed information about the NCP can be found in the PON as well as the program website (http://www.nyserda.org/programs/New_Construction/default.asp).

³ An eligible applicant is defined as the owner of the building, a tenant/leaseholder with at least five years remaining on the lease, non-residential condominium owners occupying and holding title to space within the subject building, or non-residential cooperative shareholders having the right to occupy space within the subject building. The applicant must pay the System Benefits Charge to be eligible to participate in the NCP.

⁴ The NCP defines major renovations as one of the following three types of projects where a licensed professional architect or engineer has prepared and certified the building plans: 1) Change of use and reconstruction of an existing building or space within; 2) Construction work of a nature requiring that the building or space within be out of service for at least 30 consecutive days; or 3) Reconstruction of a vacant structure or space within. For the purposes of this report, the term new construction will include major renovation projects as are eligible for the NCP program.

⁵ Unless otherwise noted, information in this section was obtained from the NCP Quarterly Report, 4th Quarter 2007. This section cites program-reported data. The energy and demand savings figures are not adjusted for the realization rate or net-to-gross ratio.

⁶ The total number of participating projects includes projects that have been completed and received incentive awards from the NCP as well as projects that currently have encumbered incentive dollars assigned to them.

and 52 MW respectively.⁷ Participating projects are distributed across the various utility areas and building sectors present in New York, and program applicants represent a diverse mix of building owners and A&E firms active within the state.

1.3 ANALYSIS GOALS

The Impact Team conducted an analysis of prospective benefits from the **New York Energy SmartSM** Program investments through the NCP. The objective of this analysis was to determine net energy savings attributable to the program's prior years' expenditures that will be realized after the program is discontinued. These impact estimates are prospective, a projection of what would occur in the hypothetical case of an end to the program at this time.

The NCP objective is to create long-term changes in design practices by mainstreaming energy efficiency and green building concepts. The NCP is a mature and multi-faceted market transformation and resource acquisition program that has been working within the design and new construction community since 1999. The latest market evaluation report found significant program-induced spillover occurring at a rate of 85% of in-program savings.⁸ This level of program-induced market development made NCP a likely candidate for prospective benefits and an ideal pilot program for estimating prospective benefits.

Prospective energy savings are a projection of savings to be realized from program-promoted energy efficiency measures and design approaches that are implemented after the program ends, and that would not have occurred without the program investments made prior to termination.

Prospective benefits were evaluated for three groups of market actors:⁹

- Currently participating architecture and engineering (A&E) firms;
- Currently participating building owners; and
- Non-participating building owners whose practices have been influenced by the NCP.

The prospective benefits scenario chosen for this evaluation is based on the near-term *hypothetical* situation that the program was terminated on December 31, 2007. A more likely medium-term *hypothetical* situation would be to assume that the program will be terminated at the end of 2011 – and to estimate the impacts in the years following that. However, the impacts for 2008-2011 are not known yet, so the uncertainty in the prospective benefits estimates would be greatly increased through the additional uncertainty in the underlying starting point for these estimates. In order to reduce the uncertainties in these estimates, the Impact Team decided to instead use the more well-grounded but less likely hypothetical situation that the program ended at the end of 2007. Then the prospective benefit impact estimates are the energy and demand savings that would be expected to occur due to actions taken in 2008 and beyond, given prior program efforts and the state of the market in 2007.¹⁰

⁷ These NCP savings estimates have been updated from the last annual report as NCP program savings estimates have been refined. Source: NCP Completes 101708.xls.

⁸ NYSERDA's *New Construction Program (NCP) – Market Characterization, Market Assessment and Causality Evaluation*, Final Report, May 2006, Section 5, Table 5-9.

⁹ The most recent *New Construction Program Market Characterization, Assessment and Causality Report (May 2006)* estimated and reported impacts for these three groups of market actors. This constituted the base for the prospective benefits estimation.

¹⁰ The NYSERDA definition of prospective benefits for this evaluation is significantly constrained from one of projecting the impacts of all market transformational (MT) effects into a long-term future given the NCP cumulative efforts from SBC I through 2007. The current prospective benefits definition was specifically selected by NYSERDA as their first step in estimating future impacts, a definition that could produce the most reliable

All forecasting has some level of uncertainty. The measurement of near-term prospective benefits is rare in the energy efficiency evaluation field. There have been projects that estimate longer-term future market transformational impacts. Many of these are seen as having significant measurement challenges, often with large uncertainty ranges. The Impact Team has chosen to instead begin by estimating short-term projected impacts in order to systematically address some of the challenges seen in prior work elsewhere. This new impact evaluation effort assesses and estimates near-term prospective benefits of the NCP.

1.4 REPORT FORMAT

The remainder of this report is organized as follows:

- Section 2 discusses data sources and methodology used for the prospective benefits analysis.
- Section 3 presents the results of the analysis.
- Section 4 presents recommendations for possible improvements to future prospective benefits analyses.

estimates, conservative for market transformation impacts but estimates expected to be more accurate and precise (less potential bias and less uncertainty).

SECTION 2:**DATA SOURCES AND METHODOLOGY**

The prospective benefits analysis is based on an assessment of the percentage of current annual incremental program benefits that can be expected to persist after the program's termination. This approach means that rather than building post-program effects up from an assumption of zero, this study starts with the 2007 incremental net GWh and MW savings, which are assumed to be a reasonable expectation of future annual program energy savings if the program continued, and adjusted these savings by expected changes in the supply of and demand for program-supported measures after the program ends. This adjustment was made through use of Prospective Benefit Factors that were developed through surveys of participating A&E firms and building owners, and non-participating building owners. These surveys were conducted jointly with NYSERDA's Market Characterization and Assessment (MC&A) evaluation team.

Prospective Benefit Factors take on a value between 0 and 1 to reflect the percentage of current savings that is expected to persist after the program ends. For example, a Prospective Benefit Factor of 0.7 means that 70% of current annual program savings are projected to occur after the program ends. The evaluation also calculated and used Net of Free-Rider Weights for program participants and Spillover Weights for non-participants. These weights estimate the level of influence the NCP had on the respondents' future actions.

The data sources and the methodology used to develop prospective benefits are summarized in this section.

2.1 DATA SOURCES

Primary data to support the prospective benefits analysis was collected from building owners and A&E firms that had participated in the NCP as well as from non-participant building owners. The data collection efforts were conducted as part of the 2008 NCP MC&A evaluation and were administered as telephone surveys. Table 2-1 summarizes the primary data collection efforts conducted for the MC&A evaluation of the NCP.¹¹

¹¹ For more information about the primary data collection for the 2008 MC&A evaluation, see NYSERDA's *New Construction Program (NCP) – Market Characterization and Assessment*, Final Report, July 2008.

Table 2-1. Primary Data Collection for the NCP

Market Actor	Population Size	Total Survey Completes Achieved ¹	% of Original Survey Complete Goal Achieved
Participating building owners	186	60	100%
Non-participating building owners	8,038	62	103%
Participating A&E firms	160	60	100%
Non-participating A&E firms ²	1,929	60	100%

¹ The targeted sample sizes were determined by the MC&A team and the survey team (APPRISE) based upon the formulae for estimating confidence and precision levels for proportions. The largest variance for an analysis of proportion occurs when the proportion is 0.5; *i.e.*, one half of the respondents indicate they are in that group and one-half state that they are not in that group.

² Non-participating A&E firm data was not used in the Prospective Benefits Analysis.

In addition to the primary data collection, the prospective benefits analysis also relied on survey data collected from participating A&E firms and building owners for the 2006 NCP impact evaluation.¹² The 2008 MC&A surveys did not include the full set of questions NYSERDA generally uses to establish free-ridership.¹³ However, a few “proxy” questions were common to the 2008 surveys and the 2006 surveys – which was the last survey used to develop free-ridership rates for the NCP. These common questions became the basis of a discriminant analysis that was designed to use the 2006 free-ridership determinations for assigning free-ridership to the 2008 respondents. This analysis is more fully described below.

2.2 PROSPECTIVE BENEFIT CALCULATION

Prospective benefits of the NCP are calculated separately for participants and non-participants. Total prospective benefits equal the sum of participant and non-participant benefits:

$$\text{Total Prospective Benefits} = \text{Participant Prospective Benefits} + \text{Non-Participant Prospective Benefits}$$

Participant prospective benefits are determined by adjusting 2007 net savings attributable to program participants using the Participant Prospective Benefit (PB) Factor developed from this evaluation. Net 2007 savings attributable to program participants are estimated as 2007 gross savings adjusted by the 2006 estimates of free-ridership, inside spillover, and outside spillover.

$$\text{Participant Prospective Benefits} = 2007 \text{ Gross Savings} * (1 - 2006 \text{ Free-rider Rate} + 2006 \text{ Inside Spillover Rate} + 2006 \text{ Outside Spillover Rate}) * \text{Participant PB Factor}$$

Similarly, non-participant prospective benefits are determined by adjusting 2007 net savings attributable to non-participants using the Non-Participant Prospective Benefit Factor developed from this evaluation.

¹² See NYSERDA’s *New Construction Program (NCP) – Market Characterization, Market Assessment and Causality Evaluation*, Final Report, May 2006.

¹³ In the past, NYSERDA’s Market Characterization and Assessment evaluation team was also responsible for establishing causality. In the current evaluation cycle, causality (*i.e.*, free-ridership and spillover) is the responsibility of the Impact Evaluation team.

Net 2007 savings attributable to non-participants consist of non-participant spillover and are estimated as 2007 gross savings times the 2006 non-participant spillover rate.

$$\text{Non-Participant Prospective Benefits} = \text{2007 Gross Savings} * \text{2006 Non-Participant Spillover Rate} * \text{Non-Participant PB Factor}$$

It should be noted that the 2007 gross savings and the 2006 free-ridership and spillover rates were determined prior to and independent of this prospective benefits analysis. As such, this report does not address estimation of these values.¹⁴ The following two sections provide an overview of how the Participant and Non-Participant Prospective Benefit Factors were calculated. For more detail, see Appendix A.

2.3 PARTICIPANT PROSPECTIVE BENEFIT FACTOR

The Participant Prospective Benefit Factor represents the percentage of 2007 net savings realized by program participants that is likely to still be realized after the program ends. Participant prospective benefits come from participating A&E firms who continue to offer and promote energy efficiency measures and design approaches (EEMDA) currently promoted by the NCP, and from participating building owners who continue to demand these measures and approaches after the program ends. A&E firms thus represent the supply side and building owners represent the demand side of the commercial new construction market. Since both continued supply of and demand for the EEMDA promoted by the NCP are required to realize prospective benefits, the Participant Prospective Benefit Factor is the average of the Participating A&E Prospective Benefit Factor and the Participating Building Owner Prospective Benefit Factor.

$$\text{Participant PB Factor} = (\text{Participating A\&E PB Factor} + \text{Participating BO PB Factor}) / 2$$

Both the Participating A&E PB Factor and the Participating Building Owner PB Factor are first developed at the respondent level and then rolled up into the overall factors.

The projection of prospective benefits is only meaningful if it properly accounts for both free-riders and spillover. Free-ridership was addressed in two ways:

1. the prospective benefits were estimated by applying the PB factors to the *net* 2007 program savings, and
2. the PB factors were adjusted to account for the varying free-rider rates of each A&E firm and building owner, *i.e.*, if a firm or owner was identified as having a high probability of free-ridership, the associated contribution of that firm or owner to prospective benefits was discounted.

Respondent-level factors are weighted by (1) the incentives received by the respondent (as a proxy for program savings for which the respondent accounts) combined with the stratum weight as is consistent with the sample design and (2) the likelihood that their current program-supported actions are attributable to the program, *i.e.*, that they are not a free-rider.

¹⁴ The annual savings only from the 2007 program operations (not cumulative annual) are calculated from the **New York Energy SmartSM Program Evaluation and Status Report, March 2008**, Table 2-8 and NYSERDA's *New Construction Program (NCP) – Market Characterization, Market Assessment and Causality Evaluation*, Final Report, May 2006, Section 5, and savings tracking tables maintained by NYSERDA evaluation staff dated April 2008.

$$\text{Participating A\&E PB Factor} = \frac{\Sigma(\text{AEPB Factor} * \text{A\&E Incentive Weight} * \text{A\&E NFR Weight})}{\Sigma(\text{A\&E Incentive Weight} * \text{A\&E NFR Weight})}$$

$$\text{Participating BO PB Factor} = \frac{\Sigma(\text{BOPB Factor} * \text{BO Incentive Weight} * \text{BO NFR Weight})}{\Sigma(\text{BO Incentive Weight} * \text{BO NFR Weight})}$$

2.3.1 Prospective Benefit Factors for Participating A&E Firms and Building Owners

The analysis uses four different Prospective Benefit Factors for participating A&E firms (AEPB Factors) and five different PB Factors for participating building owners (BOPB Factors). These factors are summarized in Table 2-2 and explained in more detail in the subsections below.

Table 2-2. Overview of Prospective Benefit Factors for Participants

	Part. A&E Firms	Part. Building Owners
PB Factor 1	Likelihood of continuing to incorporate the same EEMDA used now if the NYSEDA New Construction Program ended.	
PB Factor 2	Likely percentage change in the share of projects that will use EEMDA after program termination, compared to now. (Estimated at the measure level.)	
PB Factor 3	Extent to which the firm has incorporated EEMDA as standard practice in new construction projects in New York. (Estimated at the measure level.)	
PB Factor 4	Estimated profitability of incorporating EEMDA compared to standard approaches after program end.	Willingness to accept change in market price for EEMDA after program ends. (Estimated at the measure level.)
PB Factor 5		Level of A&E firm promotion of EEMDA and building owner drive for implementing energy efficiency (need for A&E promotion).

Some of the PB Factors are first calculated for individual energy efficiency measures and design approaches (EEMDA) that the respondent has installed through the program in the past three years. These EEMDA-specific estimates are then averaged to obtain respondent-level PB Factors.

The overall PB Factor for each survey respondent is calculated by taking the average of the respondent’s individual factors:

$$\text{AEPB Factor} = (\text{AEPB1} + \text{AEPB2} + \text{AEPB3} + \text{AEPB4}) / 4$$

$$\text{BOPB Factor} = (\text{BOPB1} + \text{BOPB2} + \text{BOPB3} + \text{BOPB4} + \text{BOPB5}) / 5$$

The following subsections provide an overview of each of the PB Factors for participating A&E firms and building owners.¹⁵ When reviewing these factors, it is important to remember that no single factor is intended to measure all aspects that influence a respondent’s future actions. Rather, by design, each factor looks at likely future behavior from a certain perspective, while keeping all other aspects constant. However, by aggregating the individual factors, all of the different aspects are taken into account. In addition, some of the individual factors might be better predictors of likely future actions of participating A&E firms and building owners than other factors. Since the Impact Evaluation Team had no way of assigning relative weights to the individual factors, the overall factor was calculated as a straight average for each respondent group.

¹⁵ More detailed formulas are presented in Appendix A.

PB Factor 1: Participating A&E Firms and Building Owners

The first PB Factor for both participating A&E firms and participating building owners represents the likelihood that the respondent will continue to incorporate currently-used EEMDA if the NCP ended. The higher the likelihood of continuing current practices, the higher the likely prospective benefit.

Respondents were asked:

<p><i>A&E Firms:</i></p> <p><i>Q.H1: “Using a 5-point scale where 1 means “very unlikely” and 5 means “very likely,” how likely would you be to continue to incorporate the same energy efficiency measures and design approaches you use now if the NYSERDA New Construction Program ended?”</i></p>	<p><i>Building Owners:</i></p> <p><i>Q.H1: “Using a 5-point scale where 1 means “very unlikely” and 5 means “very likely,” how likely would you be to continue to incorporate the same energy efficiency measures and designs you used for this project in future projects if NYSERDA ended their New Construction Program?”</i></p>
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Respondents who gave a response of 1 (“very unlikely”) were assigned a PB Factor of 0, because if they do not plan to continue to incorporate the measures currently promoted by the program, no prospective benefits can be expected from these 2007 program participants. Conversely, respondents with a response of 5 (“very likely”) were assigned a PB Factor of 1, meaning that their prospective benefits are estimated to be the same as their 2007 benefits. Respondents with a response in-between are assumed to realize prospective benefits that are a share of their 2007 benefits:

- H1=1 → PB1=0
- H1=2 → PB1=0.25
- H1=3 → PB1=0.5
- H1=4 → PB1=0.75
- H1=5 → PB1=1
- H1=DK → PB1=0¹⁶

PB Factor 2: Participating A&E Firms and Building Owners

The second PB Factor for participating A&E firms and participating building owners represents the estimated change between self-reported current and future rates of EEMDA installation. For each EEMDA that the respondent has installed through the NCP in the past three years, the respondent was asked about the current percentage of construction projects that incorporate EEMDA and the likely future percentage of construction projects that will incorporate the EEMDA:

¹⁶ A conservative assumption of zero PB was used for responses of “Don’t Know”.

<p><i>A&E Firms:</i></p> <p><i>Q.E1c: “Approximately what percentage of your [# IN Q B1 + Q B3] new construction projects currently incorporate [EEMDA]?”</i></p> <p><i>Q.H2: “Earlier you said that [# IN Q E1c]% of your new construction projects currently incorporate [EEMDA]. What share of your projects do you think would incorporate [EEMDA] if the New Construction Program were no longer available?”</i></p>	<p><i>Building Owners:</i></p> <p><i>Q.E1b: “Approximately what percentage of your [# IN Q B1 + Q B3] new construction projects currently incorporate [EEMDA]?”</i></p> <p><i>Q. H2: “Earlier you said that [# IN Q E1b]% of your new construction projects completed in the past three years incorporated [EEMDA]. What share of your projects do you think would incorporate [EEMDA] if the New Construction Program were no longer available?”</i></p>
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This measure was first calculated at the EEMDA level. The Impact Team developed a separate factor for each EEMDA by dividing the likely future installation rates (Q.H2) by the current installation rates (Q.E1b for building owners and Q.E1c for A&E firms). Each EEMDA-level factor was capped at 1. The respondent-level factor was then calculated by taking the average of each respondent’s EEMDA-level factors.

PB Factor 3: Participating A&E Firms and Building Owners

The third PB Factor for participating A&E firms and participating building owners represents the extent to which the firm has incorporated the EEMDA as standard practice in new construction projects in New York. If a practice has become standard practice, the firm is likely to continue it even after the program ends.

For each EEMDA that the respondent has installed through the NCP in the past three years, the respondent was asked the following question:

<p><i>A&E Firms:</i></p> <p><i>Q.E1e: “Using a 10-point scale where 1 means “not at all” and 10 means “to a great extent,” to what extent has your organization incorporated [EEMDA] as standard practice in new construction projects in New York State?”</i></p>	<p><i>Building Owners:</i></p> <p><i>Q.E1d: “Using a 10-point scale where 1 means “not at all” and 10 means “to a great extent,” to what extent will your organization incorporate [EEMDA] as standard practice in future new construction projects in New York State?”</i></p>
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This factor was also first estimated at the EEMDA level. Respondents who gave a response of 1 (“not at all”) were assigned a PB Factor of 0, meaning that no prospective benefits for that EEMDA can be expected from these 2007 program participants. Conversely, respondents with a response of 10 (“to a great extent”) were assigned a PB Factor of 1, meaning that their prospective benefits are estimated to be the same as their 2007 benefits. Respondents with a response in-between are assumed to realize prospective benefits that are a share of their 2007 benefits:

E1e/d=1	→	PB3=0
E1e/d=2	→	PB3=0.11
E1e/d=3	→	PB3=0.22
...		
E1e/d=8	→	PB3=0.78
E1e/d=9	→	PB3=0.89
E1e/d=10	→	PB3=1
E1e/d=DK	→	PB3=Null ¹⁷

PB Factor 4: Participating A&E Firms

The fourth PB Factor for participating A&E firms represents the estimated profitability of incorporating EEMDA compared to standard approaches after the program ends. If an energy efficient practice is as profitable or more profitable as the standard practice, the firms are likely to continue it even after the program ends. Participating A&E firms were asked:

A&E Firms:

Q.H4: “If the New Construction Program ended, would incorporating energy efficiency measures and design approaches be more profitable, less profitable, or the same as standard efficiency approaches?”

Respondents who answered “more profitable” or “the same” were assigned a PB Factor of 1 because they have no financial reason to change their current energy efficiency practices. Respondents who answered “less profitable” were assigned a PB factor of 0 because continuing current energy efficiency practices would mean a loss in profit.

PB Factor 4: Participating Building Owners

The fourth PB Factor for participating building owners represents their willingness to pay for EEMDA after the program ends, compared to the likely future market price reported by participating A&E firms. For this factor, participating A&E firms were first asked:

¹⁷ EEMDA-level PB factors are averaged to get a respondent’s overall PB Factor. This allowed the Impact Team to set aside individual EEMDA that were uncertain so they would not affect that respondent’s overall factor. The Null setting is used throughout the PB evaluation, where the factor is first estimated at the EEMDA level, to reduce uncertainty in each respondent’s PB factor and increase the certainty in the overall PB estimates.

A&E Firms:

Q.H3: “What percentage change in price would you expect to see in the market for [EEMDA] after the program ended? For example, -25% is a price decrease of 25%, 0% is no change in price, and 100% is a doubling of the price?”

The most frequent response to this question was “0”, *i.e.*, no price change. As a result, building owners looking for energy efficiency services after the program ends are most likely to face the same prices as they currently face. Building owners were then asked, for each EEMDA they have installed through the NCP in the past three years:

Building Owners:

Q.H3: “What percentage change in market price would you accept for [EEMDA] after the program ended and still incorporate [EEMDA] in your designs? For example, -25% is a price decrease of 25%, 0% is no change in price, and 100% is a doubling of the price.”

Since most participating A&E firms do not anticipate an increase in the market price for the various EEMDA, building owners’ willingness to pay for EEMDA after the program (and available incentives) end, was compared to a “no price change” scenario. Building owners who responded that they would be willing to pay the same or more ($H3 \geq 0$) were assigned a PB factor of 1, meaning they would not change their current practices. Building owners who indicated that they would require a price reduction to make up for lost program support ($H3 < 0$) were assigned a PB factor of 0, meaning they would no longer incorporate EEMDA in their designs. This factor was first estimated at the measure level and then rolled up to the building owner-level.

PB Factor 5: Participating Building Owners

The fifth PB Factor for participating building owners represents the building owners’ need to have their A&E firm convince them to incorporate energy efficient equipment and designs, compared to the current level of promotion of energy efficiency by A&E firms. Participating A&E firms were first asked:

A&E Firms:

Q.C4: “Do you promote energy performance or operating expense considerations to your clients for inclusion in the design of new construction projects?”

IF “Yes”:

Q.C5: “For what share of your projects do you promote these considerations?”

The Impact Team took the incentive-weighted average of the A&E firm responses to Q.C5 as the supply-side level of promotion without program assistance of the program EEMDAs, after the program were to end. For the demand-side, the survey asked participating building owners about their need to have the A&E firms promote energy efficient equipment and designs to them:

Building Owners:

Q.F1: “Which of the following four statements best describes your relationship with the Architectural and Engineering design team on this project?”

- 1. The architectural and engineering design team had to sell the project’s more efficient equipment and design aspects to me.*
- 2. I was not closely involved in the project’s energy-efficiency decisions and accepted the design team’s recommendations without a great deal of sales effort.*
- 3. I was keenly interested in the energy-efficiency aspects of the project and easily accepted the higher-efficiency recommendations made by the design team.*
- 4. I was the driver in pursuing energy-efficient equipment and design on our new construction project.”*

Building owners who answered “4” (they incorporated the energy efficient equipment and design on their own) were assigned a PB Factor of 1, since they don’t need promotion by the A&E firm. Conversely, building owners who answered “1” (they required promotion by the A&E firm) were assigned a factor of 0 since they are the least likely to incorporate EEMDA without the program.¹⁸ Building owners who answered “2” or “3” fall in-between the first two groups in their need for promotion and were assigned a PB Factor in-between 0 and 1:

F1=1	→	PB5=0
F1=2	→	PB5=Average of A&E C5 * 0.5
F1=3	→	PB5=Average of A&E C5 * 1
F1=4	→	PB5=1

2.3.2 Incentive Weights for Participating A&E Firms and Building Owners

Respondents PB factors were weighted by the incentive they received as a proxy for the respondent’s 2007 program savings relative to other respondents with an adjustment to include the stratum weights.¹⁹ This combined incentive and stratum weight ensures that the estimated PB Factors of respondents with large 2007 savings count more towards the overall factors than the estimated PB Factors of respondents with smaller 2007 savings and that the PB factors represent the full program population (taking the sampling representation back to the population).

2.3.3 Net of Free-Rider Weights for Participating A&E Firms and Building Owners

To adjust for the relative contribution of varying levels of free-ridership, a respondent-level “Net of Free-Rider” (NFR) weight was created for each participating A&E firm and building owner. These weights represent the level of influence the NCP had on the respondent’s practices and are used to weight the respondent-level PB Factors prior to aggregating them to the market level.

The NFR Weight represents a respondent’s likelihood of not being a free-rider and takes on a value between 0 and 1. For example, a NFR Weight of 1 means that the respondent is not a free-rider, *i.e.*, he is 100% influenced by the program. Conversely, a NFR Weight of 0 means the respondent is a free-rider and is not influenced by the program at all. Multiplying the respondent’s incentive-weighted PB Factor by the NFR Weight discounts the prospective benefits attributable to a respondent who is a free-rider, removing efficiency savings that would have occurred without the program.

For example, consider the following two respondents:

Respondent A: PB Factor = 0.75; NFR Weight = 0.2

Respondent B: PB Factor = 0.5; NFR Weight = 1.0

¹⁸ It should be noted that this is a somewhat conservative assumption as some A&E firms would still promote EEMDA without the program. Therefore, some of these building owners would still incorporate EEMDA into their new projects.

¹⁹ Preliminary results reported in the NYSERDA March 2008 Quarterly Report Program Evaluation and Status Report - Issued May 2008 were based on savings-weighted calculations. Those weights were found to have inaccuracies; the savings estimates were being updated at the same time as this report was being created. Incentives are highly correlated with the corrected savings estimates and have been used as a proxy for savings weights for the revised PB estimates provided in this report. Future PB evaluations should use savings weights when these are available and accurate.

Respondent A is likely to continue 75% of his current program-promoted practices after the program ends. However, his NFR Weight also indicates that 80% of his practices ($1 - 0.2 = 0.8$) were not influenced by the NCP (and are therefore not included in 2007 net savings). In contrast, Respondent B is likely to continue 50% of her current program-promoted practices after the program ends but was fully influenced by the program. Using the NFR Weight to weight the PB Factor therefore discounts the PB Factors of respondents with a high level of free-ridership, those that would be expected to take the actions without the program’s influence. Estimating and using the NFR Weights ensures that the overall PB Factor estimates are only for program-induced actions (not just actions that would be taken in the future).

Since there was no direct measurement of free-riders for 2007 participants, the Impact Team developed a number of different approaches to estimate the impact of free-riders. The analysis uses two different NFR Factors for participating A&E firms (AENFR Factors) and three different NFR Factors for participating building owners (BONFR Factors) to develop the respondent-level NFR Weights. These factors are summarized in Table 2-2 and explained in more detail in the subsections below.

Table 2-2. Overview of NFR Weights for Participants

	Part. A&E Firms	Part. Building Owners
NFR Factor 1	Discriminant analysis: Classification analysis using common FR questions in 2008 and 2006 surveys and 2006 FR determination to predict 2007 FR. ¹	
NFR Factor 2	Extent to which NYSERDA is responsible for incorporating EEMDA as standard practice. (Estimated at the measure level.)	
NFR Factor 3		Importance of technical assistance (and program incentive) in decision to incorporate energy efficiency measures.

¹ Due to limitations to control survey length, the 2008 surveys did not include the full set of questions NYSERDA generally uses to establish free-ridership. However, a few “proxy” questions were common to the 2008 survey and the 2006 survey – which was the last survey used to develop free-ridership rates for the NCP. Based on these common questions, the 2006 free-ridership determinations were assigned to the 2008 respondents based upon a discriminate analysis.

As with the PB Factors, some of the NFR Factors are first calculated for individual EEMDA; these are then averaged to obtain to the respondent-level factors.

The overall NFR Weight for each survey respondent is calculated by taking the average of the respondent’s individual NFR Factors.

$$AENFR\ Weight = (AENFR1 + AENFR2) / 2$$

$$BONFR\ Weight = (BONFR1 + BONFR2 + BONFR3) / 3$$

NFR Factor 1: Participating A&E Firms and Building Owners

The first NFR factor was developed through discriminant analysis. The underlying theory is that although the free-ridership questions were not directly included in the 2008 survey, responses to similar “proxy” questions in the 2006 and 2008 surveys can be used to identify free-riders and predict which respondents are more or less likely to be free-riders.

Table 2-3 and Table 2-4 below list the common questions for the 2006 and 2008 surveys. These questions were asked separately for twelve different measure groups in 2006 and six measure groups in 2008.

Table 2-3. Common Questions for the Participating Building Owners Surveys

2006 Survey	2008 Survey
F1a) Please rate your current familiarity with [EEMDA] (1=not at all familiar and 4=extremely familiar)	F1a) Please rate your current familiarity with [EEMDA] (1=not at all familiar and 4=extremely familiar)
F1d) To the best of your knowledge approximately what percentage of your new construction projects currently incorporate {EEMDA}?	F1b) To the best of your knowledge approximately what percentage of your new construction projects currently incorporate {EEMDA}?
F1e) To what extent, if any, has the NYSERDA new construction program influenced your use of [EEMDA] as standard practices in new construction projects? (Scale 1-4)	F1f) To what extent is the NYSERDA new construction program responsible for your organization's plans to use [EEMDA] as standard practices in future new construction projects? (Scale 1-10)

Table 2-4. Common Questions for the Participating A&E Firm Surveys

2006 Survey	2008 Survey
F1a) Please rate your current familiarity with [EEMDA] (1=not at all familiar and 4=extremely familiar)	F1a) Please rate your current familiarity with [EEMDA] (1=not at all familiar and 4=extremely familiar)
F1d) To the best of your knowledge approximately what percentage of your new construction projects currently incorporate {EEMDA}?	F1c) To the best of your knowledge approximately what percentage of your new construction projects currently incorporate {EEMDA}?
F1e) To what extent, if any, has the NYSERDA new construction program influenced your use of [EEMDA] as standard practices in new construction projects? (Scale 1-4)	F1f) To what extent is the NYSERDA new construction program responsible for your organization's use of [EEMDA] as standard practices in new construction projects? (Scale 1-10)

Discriminant analysis allows the researcher to divide participants into groups based on specific characteristics, in this case the answers to common questions in the 2006 and 2008 surveys. Linear functions are developed to separate the groups to the extent possible. The responses to the common questions in the 2006 survey were used to construct the linear functions, and then these functions were applied to the responses to the 2008 survey to classify the 2007 participants into free-ridership groups.²⁰ This process resulted in identifying individual 2008 survey respondents as having low, medium or high free-rider factors.

The linear classification function is defined as follows:

$$L_i(y) = \bar{y}_i' S_{pl}^{-1} y - \frac{1}{2} \bar{y}_i' S_{pl}^{-1} \bar{y}_i$$

²⁰ Please refer to the following source for more detailed information about the theory behind the discriminant analysis: Rencher, A. *Methods of Multivariate Analysis*. John Wiley and Sons, New York, 1995. Chapters 8 and 9.

A distinct linear classification function was constructed for each of the free-ridership groups (three in all), and then the results (L_i) were calculated for each group on the basis of the 2006 responses. Participants from the 2008 survey were assigned to a group based on the maximum value of classification function, L_i , for each respondent.

Three statistical tests were performed to assess the validity of the results, Wilkes' lambda, Roy's root, and the maximum likelihood ratio. These tests measure whether the classification functions are effective in separating the observations into groups.

In addition, the probability of misclassification, *i.e.*, the misclassification rate, was estimated using two methods, re-substitution and cross-validation. In re-substitution, each observation in the original data set is assigned to a category using the classification functions and the number of incorrect classifications is used to assess the error rate. This method tends to understate the actual error rate. The cross-validation methods require estimating the classification functions using all observations except one, and then using these functions to classify the final observation. This process is repeated for every observation and the misclassification rates can be calculated from the results. These two values provide two separate estimates of the error rates, giving an overall sense of the likely range of classification error in the analysis.

The primary set of variables was developed from the responses to the F1e question series in the 2006 survey, which assessed the degree of NYSERDA influence on specific construction practices. The scale of valid responses ranged from 1 to 4 for twelve measures. The number of responses in each of the four categories was tallied, and then divided by the total number of measures with a valid response to determine the percentage of 1's, 2's, etc. In this manner, each survey respondent was characterized according to the relevant measures to their firm or building.

In addition, the mean value for the valid responses to question F1d was calculated and incorporated into the calculations. These five variables were used for both the A&E and building owner analyses. For the analysis of A&E firms, three additional variables were included: the mean of valid responses to F1a and F1d, and a binary indicator of low efficiency as defined by a combination of low values in F1a and F1d.

In the initial 2006 survey analysis conducted by Summit Blue, a free-ridership percentage was calculated for each respondent. The Impact Team used these values to assign the respondents to free-rider categories. These categories were defined as less than 25% likelihood of free-ridership (low), 25 to 75% (medium), and greater than 75% (high) for the A&E firms and less than 15%, 15 to 85% and greater than 85% for the building owner survey.²¹

Both analyses (A&E firms and building owners) produced results that were highly statistically significant, with p-values ranging from less than 0.001 to 0.02. In terms of classification error rates, the analysis of the A&E firms was more reliable with error rates of 15% (re-substitution) and 23% (cross-validation). The building owner analysis has error rates of 29% (re-substitution) and 49% (cross-validation), suggesting that the building owner results are more variable.

Once the classification functions were developed, they were applied to the results of the 2008 analysis, and each 2008 respondent was assigned to one of three free-rider categories according to the results of the classification analysis.

NFR Factor 2: Participating A&E Firms and Building Owners

The second NFR factor for participating A&E firms and participating building owners represents the extent to which NYSERDA is responsible for incorporating the EEMDA as standard practice in new

²¹ The discriminant analysis was conducted *post hoc* and the surveys for the A&E firms were more tractable for these purposes. For the building owner surveys, it was necessary to define a more extreme definition of "high" and "low" free-ridership to separate the groups effectively.

construction projects in New York. If NYSERDA was responsible for the EEMDA becoming a standard practice for the firm, then the firm is not a free-rider.

For each EEMDA that the respondent plans to incorporate as standard practice, the respondent was asked the following question:

<p><i>A&E Firms:</i></p> <p><i>Q.E1f: “Using a scale from 0 to 10 where 0 means “not at all” and 10 means “to a great extent,” to what extent is the NYSERDA New Construction Program responsible for your organization’s use of [EEMDA] as standard practice?”</i></p>	<p><i>Building Owners:</i></p> <p><i>Q.E1e: “Using a scale from 0 to 10 where 0 means “not at all” and 10 means “to a great extent,” to what extent is the NYSERDA New Construction Program responsible for your organization’s plans to use [EEMDA] as standard practice?”</i></p>
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This factor was first estimated at the EEMDA level. Respondents who gave a response of 0 (NYSERDA was not at all responsible for EEMDA becoming standard practice) were assigned a NFR Factor of 0, meaning that they are a free-rider and none of their 2007 or future program savings can be attributed to NYSERDA. Conversely, respondents with a response of 10 (NYSERDA was fully responsible for EEMDA becoming standard practice) were assigned a NFR Factor of 1, meaning that all of their 2007 and future program savings can be attributed to NYSERDA. Respondents with a response in-between are assumed to realize prospective benefits that are a share of their 2007 benefits:

E1f=0	→	AENFR2=0	E1e=0	→	BONFR2=0
E1f=1	→	AENFR2=0.1	E1e=1	→	BONFR2=0.1
E1f=2	→	AENFR2=0.2	E1e=2	→	BONFR2=0.2
...			...		
E1f=8	→	AENFR2=0.8	E1e=8	→	BONFR2=0.8
E1f=9	→	AENFR2=0.9	E1e=9	→	BONFR2=0.9
E1f=10	→	AENFR2=1	E1e=10	→	BONFR2=1
E1f=DK	→	AENFR2=Null	E1e=DK	→	BONFR2=Null

NFR Factor 3: Participating Building Owners

The third NFR factor for building owners reflects the importance of NYSERDA’s technical assistance in the owner’s decision to incorporate energy efficiency measures. If building owners consider NYSERDA’s assistance important in incorporating EEMDA in their project, they are likely not a free-rider.

Building owners were asked the following two questions:

Building Owners:

Q.C1: “How important were each of the following factors in your decision to incorporate energy efficiency measures and design into the [PROJECT NAME] project? Please rate importance on a 1-to-4 scale where 1 means “not at all important” and 4 means “extremely important.” How about . . . ?

1 Technical assistance services

2 Energy savings

3 Recommendation or promotion by the design team [IF NECESSARY: Your Architectural or Engineering firm]

4 Opportunity to build a green building

5 Competitive pressures

6 Rising energy prices

7 Any others? Specify: _____”

Q.C3: “Which of these factors was most important in your decision to incorporate energy efficiency measures and design into this project?”

Building owners who considered NYSERDA’s technical assistance services (C1=1) or the NYSERDA incentive (not prompted for, but some respondents mentioned this under 7, “other”) the most important factor were assigned an NFR Factor of 1, meaning the incorporated EEMDA can be fully attributed to NYSERDA. Building owners who did not consider technical assistance or the incentive the most important factor but still gave either one of those factors a high rating received an NFR Factor of 0.75 for a rating of 4 (extremely important) and an NFR Factor of 0.5 for a rating of 3 (important).

The list of factors that the respondents were prompted to rate in Question C1 did not include the NYSERDA incentive.²² Therefore, the approach did not assign NFR Factors of less than 0.5. Since a prompted and an unprompted response cannot be directly compared, the analysis cannot conclude that the incentive was not important because the respondent did not volunteer it under the “other” category. It is therefore only appropriate to conclude that the incentive was important if it was mentioned unprompted,

²² This question was used for the parallel MC&A effort and could therefore not be designed to fully meet the needs of the prospective benefits analysis.

but not the reverse. Building owners who did not receive an NFR factor of 1, 0.75 or 0.5 therefore did not receive a factor at all.

C3=1 OR 7 (=incentive)	→	BONFR3=1
C1.1 OR C1.7 = 4	→	BONFR3=0.75
C1.1 OR C1.7 = 3	→	BONFR3=0.5
Else	→	BONFR3=NULL

2.4 NON-PARTICIPANT PROSPECTIVE BENEFIT FACTOR

The Non-Participant Prospective Benefit Factor represents the percentage of 2007 net savings realized by program non-participants that is likely to still be realized after the program ends. These prospective benefits come from spillover from program-influenced non-participant building owners that is expected to continue after the program ends.²³

The Non-Participant Building Owner PB Factor is first developed at the respondent level and then rolled up into the overall factor. Respondent-level factors are weighted by (1) their relative value of new construction (as further explained below in Section 2.4.2) and (2) the likelihood that their current program-supported actions are attributable to the program, *i.e.*, that their actions can be considered spillover.

$$\text{Non-Participant BO PB Factor} = \frac{\Sigma(\text{NBOPB Factor} * \text{NBO Weight} * \text{NBOSO Weight})}{\Sigma(\text{NBO Weight} * \text{NBOSO Weight})}$$

2.4.1 Prospective Benefit Factors for Non-Participant Building Owners

The analysis uses five different Prospective Benefit Factors for non-participant building owners (NBOPB Factors). These five factors are the same as those developed for participating building owners (see Section 2.3.1 beginning on page 2-4 above).

Table 2-5 summarizes the Prospective Benefit Factors for non-participant building owners. For a full discussion of the rationale and interpretation of these factors, please refer to Section 2.3.1 or to Appendix A.

²³ The most recent *New Construction Program Market Characterization, Assessment and Causality Report (May 2006)* based non-participant spillover on building owners only. This constituted the basis for estimating prospective benefits for non-participants.

Table 2-5. Overview of Prospective Benefit Factors for Non-Participants

NPBO Factor	Factor Description	Questions Used	Factor Algorithm
1	Likelihood of continuing to incorporate the same EEMDA used now if the NYSERDA New Construction Program ended.	Q.H3: "Using a 5-point scale where 1 means "very unlikely" and 5 means "very likely," how likely would you be to continue to incorporate the same energy-efficiency measures and designs you use now in future projects if NYSERDA ended their New Construction Program?"	$H3=1 \rightarrow 0$ $H3=2 \rightarrow 0.25$ $H3=3 \rightarrow 0.5$ $H3=4 \rightarrow 0.75$ $H3=5 \rightarrow 1$ $H3=DK \rightarrow 0$
2	Likely percentage change in the share of projects that will use EEMDA after program termination, compared to now. (Estimated at the measure level.)	Q.E1b: "Approximately what percentage of your new construction projects currently incorporate [EEMDA]?" Q. H4: "Earlier you said that [# IN Q E1b]% of your new construction projects currently incorporate [EEDMA]. What share of your projects do you think will incorporate [EEMDA] over the next five years if the New Construction Program were no longer available?"	For each EEMDA: $AEPB2_n = H4_n / E1b_n$ If $AEPB2_n > 1$ then set to 1 If $H4_n = DK \rightarrow$ Null Then roll up to respondent level: $NBOPB2 = \sum NBOPB2_n / n$
3	Extent to which the firm will incorporate EEMDA as standard practice in new construction projects in New York. (Estimated at the measure level.)	Q.E1c: "Using a 10-point scale where 1 means "not at all" and 10 means "to a great extent," to what extent will your organization incorporate [EEMDA] as standard practice in future new construction projects in New York State?"	For each EEMDA: $E1c=1 \rightarrow 0$ $E1c=2 \rightarrow 0.11$ $E1c=3 \rightarrow 0.22$... $E1c=8 \rightarrow 0.78$ $E1c=9 \rightarrow 0.89$ $E1c=10 \rightarrow 1$ $E1c=DK \rightarrow$ Null Then roll up to respondent level: $NBOPB3 = \sum NBOPB3_n / n$
4	Willingness to accept change in market price for EEMDA after program ends. (Estimated at the measure level.)	A&E Firms: Q.H3: "What percentage change in price would you expect to see in the market for [EEMDA] after the program ended? For example, -25% is a price decrease of 25%, 0% is no change in price, and 100% is a doubling of the price?" Building Owners: Q.H5: "What percentage change in market price would you accept for [EEMDA] after the program ended and still incorporate [EEMDA] into your designs? For example, -25% is a price decrease of 25%, 0% is no change in price, and 100% is a doubling of the price?"	H3: The most frequent response is 0 \rightarrow Compare H5 against no change in price. For each EEMDA: $H5 \geq 0 \rightarrow 1$ $H5 < 0 \rightarrow 0$ $H5=DK \rightarrow$ NULL Then roll up to respondent level: $NBOPB4 = \sum NBOPB4_n / n$

<p>5</p>	<p>Level of A&E firm promotion of EEMDA and building owner drive for implementing energy efficiency (need for A&E promotion).</p>	<p><i>A&E Firms:</i> Q.C4: “Do you promote energy performance or operating expense considerations to your clients for inclusion in the design of new construction projects?” IF “Yes”: Q.C5: “For what share of your projects do you promote these considerations?”</p> <p><i>Building Owners:</i> Q.F1: “Which of the following four statements best describes your relationship with the Architectural and Engineering design team you typically work with on new construction projects?”</p> <ol style="list-style-type: none"> 1. The architectural and engineering design team has to sell the more efficient equipment and design aspects to me. 2. I am not closely involved in energy-efficiency decisions on projects and accept the design team’s recommendations without a great deal of sales effort. 3. I am keenly interested in the energy-efficiency aspects of a project and easily accept the higher-efficiency recommendations made by the design team. 4. I am the driver in pursuing energy-efficient equipment and design on our new construction projects.” 	<p>F1=1 → 0 F1=2 → Average of A&E C5 * 0.5 F1=3 → Average of A&E C5 * 1 F1=4 → 1</p>
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2.4.2 Construction Value Weights for Non-Participant Building Owners

Non-participant PB factors were weighted by the value of commercial new construction costs for each non-participant building owner in relationship to the others and the stratum they represented. This weight ensures that the estimated PB factors of respondents with large 2007 new construction projects count more towards the overall factors than the estimated PB factors of respondents with smaller 2007 new construction projects.

2.4.3 Spillover Weights for Non-Participant Building Owners

In addition to the Prospective Benefit Factors, the evaluation developed a respondent-level “Spillover” (SO) Weight for each non-participant building owner. These weights are conceptually equivalent to the NFR weights for participants and represent the level of influence the NCP had on the respondent’s practices. They are used to weight the respondent-level PB Factors prior to aggregating them to the market level.

The SO Weight represents a respondent’s likelihood of having been influenced by NYSERDA’s NCP and takes on a value between 0 and 1. For example, an SO Weight of 1 means that the respondent’s incorporation of EEMDA was 100% influenced by the program. Conversely, an SO Weight of 0 means the respondent was not influenced by the program at all. Multiplying the construction value-weighted respondent’s PB Factor by the SO Weight discounts the prospective benefits attributable to a respondent whose EEMDA were little or not at all influenced by NYSERDA.

For example, consider the following two respondents:

- Respondent A: PB Factor = 0.75; SO Weight = 0.1
- Respondent B: PB Factor = 0.5; SO Weight = 0.9

Respondent A is likely to continue 75% of his current program-promoted practices after the program ends. However, his SO Weight also indicates that his energy efficient practices were only 10% influenced by the NCP. In contrast, Respondent B is likely to continue 50% of her current program-promoted practices after the program ends but was almost fully influenced by the program. Using the SO Weight to weight the PB Factor therefore discounts the PB Factors of respondents with a low level of NYSERDA influence. Estimating and using the SO Weights ensures that the overall PB Factor estimates are only for program-induced actions (not just actions that would be taken in the future).

The analysis uses two different SO Factors for non-participant building owners (NBOSO Factors) to develop the respondent-level SO Weights. These factors are summarized in Table 2-6 and explained in more detail in the subsections below.

Table 2-6. Overview of Non-Participant Spillover Weights

	Non-Part. Building Owners
NBOSO Factor 1	Perception that NYSERDA has influenced design practices for new construction projects.
NBOSO Factor 2	Extent to which NYSERDA is responsible for organization planning to incorporate EEMDA as standard practice. (Estimated at the measure level.)

NBOSO Factor 1: Non-Participant Building Owners

The first Spillover Factor reflects the non-participant building owner’s perception that the NCP has influenced their new construction building or design practices. Respondents were asked the following question:

Building Owners:

Q.H1: “Do you believe that NYSERDA’s New Construction Program has influenced your organization’s building or design practices on new construction projects in New York State?”

Respondents were assigned a factor of 1 if they answered “yes” to this question, meaning their practices can be counted as spillover. They were assigned a factor of 0 if they said “no”, “don’t know”, or if they were not aware of the program.

NBOSO Factor 2: Non-Participant Building Owners

The second Spillover Factor reflects the extent to which the NCP influenced the building owner’s plans to incorporate EEMDA as a standard practice. This factor is equivalent to the second NFR Factor for participating building owners. If NYSERDA was responsible for the EEMDA becoming a standard practice for the firm, then the firm’s practices can be counted as spillover.

For each EEMDA the respondent plans to incorporate as standard practice, the respondent was asked the following question:

Building Owners:

Q.E1d: “Using a scale from 0 to 10 where 0 means “not at all” and 10 means “to a great extent,” to what extent is the NYSERDA New Construction Program responsible for your organization’s plans to use [EEMDA] as standard practice?”

This factor was first estimated at the EEMDA level. Respondents who gave a response of 0 (NYSERDA was not at all responsible for EEMDA becoming standard practice) were assigned an SO Factor of 0, meaning that they cannot be counted as program spillover and that none of their 2007 or future program savings can be attributed to NYSERDA. Conversely, respondents with a response of 10 (NYSERDA was fully responsible for EEMDA becoming standard practice) were assigned an SO Factor of 1, meaning that all of their 2007 and future program savings can be attributed to NYSERDA. Respondents with a response in-between are assumed to realize prospective benefits that are a share of their 2007 benefits:

E1d=0	→	NBOSO2=0
E1d=1	→	NBOSO2=0.1
E1d=2	→	NBOSO2=0.2
...		
E1d=8	→	NBOSO2=0.8
E1d=9	→	NBOSO2=0.9
E1d=10	→	NBOSO2=1
E1d=DK	→	NBOSO2=Null

SECTION 3: RESULTS

Based on the analytical approach described in the previous section, the Impact Team estimates short-term annual prospective benefits for the NCP to be approximately 57.2 GWh and 16.3 MW, representing 74% of 2007 incremental net savings. Table 3-1 presents these results, as well as the 2007 gross savings, the 2006 attribution assumptions, and the attribution-weighted Prospective Benefits (PB) Factors used to develop the prospective benefits estimates. The table shows that program-influenced non-participants are expected to continue their program-influenced practices at a rate of 83% compared to 72% for participants.²⁴

Table 3-1. Summary of Prospective Benefits Results

	GWh	MW
Prospective Benefits	57.2a	16.3a
Prospective Benefits - Participants	47.1	13.4
Prospective Benefits - Non-Participants	10.1	2.9
2007 Incremental Gross Savings	71.6	20.4
2006 Free-ridership Rate		0.46
2006 Inside Spillover Rate		0.05
2006 Outside Spillover Rate		0.32
2006 Non-Participant Spillover Rate		0.17
2006 NTG Ratio		1.08
2007 Incremental Net Savings	77.3	22.0
2007 Participant Incremental Net Savings	65.1	18.5
2007 Non-Participant Incremental Net Savings	12.2	3.5
Participant PB Factor	0.72	0.72
Participating A&E PB Factor	0.74b	0.74b
Participating BO PB Factor	0.70c	0.70c
Non-Participant PB Factor	0.83d	0.83d

a Estimates are provided here as point estimates. Unless the Prospective Benefit Factors are assumed to be an index of the underlying construct, derivation of confidence intervals from the variances in this multi-question and factor composite becomes unmeasurable. Assuming the PB factors were additive and independent, i.e., not subsets or otherwise correlated, and the 2007 net program savings are fixed, an approximation of the 90% confidence interval for the GWh PB estimate is 46.5 to 50.6 for participants and 9.7 to 10.4 for non-participants. The same assumptions produce a 90% confidence interval of 13.2 to 14.4 MW for participants and 2.8 to 3.0 MW for non-participants..

These final NCP PB Factors and estimates have been revised using incentive-weighted calculations for participating A&E firms and building owners. Preliminary results reported in the NYSERDA March 2008 Quarterly Report Program Evaluation and Status Report - Issued May 2008 were based on savings-weighted calculations. Those weights were found to have inaccuracies; the savings estimates were being updated at the same time as this report was being created.

b The sample *c.v.* for the unweighted A&E PB Factor is 0.27 and that for the attribution weights is 0.61.

c The sample *c.v.* for the unweighted BO PB Factor is 0.29 and that for the attribution weights is 0.76.

d The sample *c.v.* for the unweighted Non-Participant PB Factor is 0.23.

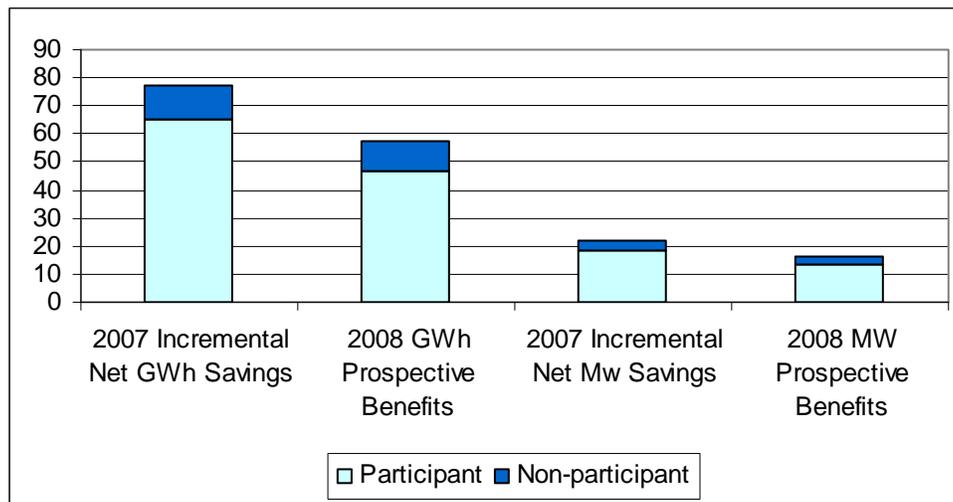
²⁴ Prospective benefit results are based on the following sample sizes: 60 participating A&E firms; 60 participating building owners; and 62 non-participating building owners. Given the stratified sampling used, the A&E firm sample represents a large percentage of the market.

The PB Factors measure the proportion of current year savings expected to be achieved in the following year due to the program’s influence. A PB Factor derived from participant responses reflects what they would do without program incentives and other current influences, and measures how much the current program has transformed their future actions.²⁵

The prospective benefit estimates derived from non-participant spillover accounts for non-participants acting from program influence but without any program incentives. Consequently, non-participants have less of a change in influence factors after program termination than the participants (*i.e.*, the loss of available incentives) and the proportion of prospective savings to current savings would be expected to be higher for this group.²⁶ Nevertheless, the overall incremental net savings for participants are much greater than for non-participant, so the participants are a more substantial source of post program benefits than non-participants

These are high rates of prospective benefits. The projection of prospective benefits is considerable and comes to a substantial percentage of the savings the program is currently claiming. There are no additional expenditures required to obtain these savings since these are the projected savings from the prior year expenditures. The size of these prospective benefits compared to the incremental net electricity and demand savings claimed by the NCP are shown in Figure 3-1.

Figure 3-1. 2008 NCP Prospective Benefits Compared to NCP 2007 Incremental Savings



Recall that the NCP was selected for this pilot prospective benefits impact evaluation due to its high spillover levels, indicating that its prospective benefits could be expected to be high enough to identify

²⁵ To the extent that current program participants are free-riders due to prior year programs, however, their future actions are not included as being induced by the current program year. The extent of program influence is incorporated through the NFR Weights discussed earlier.

²⁶ It should be noted that the Prospective Benefit Factors are measuring expected savings for the year after program termination relative to current savings. The responses from current participants and non-participants are used to derive these factors. Yet, these are not expected to be literal estimates of savings from these particular participants and non-participants.

and make this study worthwhile to undertake. The level of prospective benefits could be expected to depend upon the level of program-induced market transformation that is being achieved. Readers should be cautioned that few program designs and market transformation accomplishments to-date could be expected to produce this high level of prospective benefits.

These estimates are for the year immediately after the hypothetical 2007 program termination. However, benefits are likely to last beyond the first year of program termination. The rate of decay in these savings could be affected by numerous factors, such as the sustainability of program-induced market transformation and changes in the energy codes. There are very few studies measuring the sustainability of market transformation effects or decay for efficiency impacts. Significant research to estimate specific levels of decay for this program in the New York markets was beyond the scope of the current evaluation, but various decay scenarios can be examined if the prospective benefits are added to future benefit/cost calculations.

The significant level of prospective benefits would suggest the need for continued evaluation of the impacts from the market transformation elements of the **New York Energy SmartSM** programs. To the extent that these programs have market transformation goals, analysis of the investments should consider including estimates of the prospective benefits in order to fully account for program savings impacts and an evaluation of the goal of the investment.

SECTION 4:

RECOMMENDATIONS FOR IMPROVEMENTS TO PROSPECTIVE BENEFITS ANALYSIS

This analysis represents a first attempt by the Impact Team to quantify energy and demand savings from measures that are attributable to an energy efficiency program but that are implemented after the program's termination. The analysis was limited by certain time and data constraints, and several opportunities for improving the projection became apparent while conducting this pilot effort. These include the following:

- Develop prospective benefit estimates at the same time as impact estimates to increase certainty about the free-ridership status of participants and spillover status of non-participants. This would eliminate the need for the NFR and SO Weights used in this analysis, and would reduce the uncertainty of the prospective benefit estimates.
- Research/develop program-specific hypotheses of the decay of prospective benefits.
- Complete similar prospective benefit impact evaluations for other programs and encourage knowledge transfer about conducting these types of evaluations and how to improve them.

SECTION 5:**APPENDIX A: DETAILED PROSPECTIVE BENEFIT ALGORITHMS**

This appendix provides additional detail on the estimation of the prospective benefits and the development of the Prospective Benefit Factors, the Net of Free-Rider Weights, and the Spillover Weights.²⁷

5.1 SUMMARY OF PROSPECTIVE BENEFITS CALCULATION

Prospective Benefits = Participant Prospective Benefits + Non-Participant Prospective Benefits

Participant Prospective Benefits = 2007 Gross Savings * (1 – 2006 Free-rider Rate + 2006 Inside Spillover Rate + 2006 Outside Spillover Rate) * Participant PB Factor

Participant PB Factor = (Participating A&E PB Factor + Participating BO PB Factor) / 2

Participating A&E PB Factor = $\Sigma(\text{AEPB Factor} * \text{A\&E Incentive Weight} * \text{AENFR Weight}) / \Sigma(\text{A\&E Incentive Weight} * \text{AENFR Weight})$

AEPB Factor = $(\text{AEPB1} + \text{AEPB2} + \text{AEPB3} + \text{AEPB4}) / 4$

AENFR Weight = $(\text{AENFR1} + \text{AENFR2}) / 2$

Participating BO PB Factor = $\Sigma(\text{BOPB Factor} * \text{BO Incentive Weight} * \text{BONFR Weight}) / \Sigma(\text{BO Incentive Weight} * \text{BONFR Weight})$

BOPB Factor = $(\text{BOPB1} + \text{BOPB2} + \text{BOPB3} + \text{BOPB4} + \text{BOPB5}) / 5$

BONFR Weight = $(\text{BONFR1} + \text{BONFR2} + \text{BONFR3}) / 3$

Non-Participant Prospective Benefits = 2007 Gross Savings * 2006 Non-Participant Spillover Rate * Non-Participant PB Factor

Non-Participant BO PB Factor = $\Sigma(\text{NBOPB Factor} * \text{NBO New Construction Value Weight} * \text{NBOSO Weight}) / \Sigma(\text{NBO New Construction Value Weight} * \text{NBOSO Weight})$

NBOPB Factor = $(\text{NBOPB1} + \text{NBOPB2} + \text{NBOPB3} + \text{NBOPB4} + \text{NBOPB5}) / 5$

NBOSO Weight = $(\text{NBOSO1} + \text{NBOSO2}) / 2$

²⁷ The specific survey questions used for this research are detailed below with their scoring algorithms. Further description of the primary data collection for the 2008 MC&A evaluation and a complete set of surveys are available in the Appendices within NYSERDA's *New Construction Program (NCP) – Market Characterization and Assessment*, Final Report, July 2008.

5.2 PB FACTOR ALGORITHMS – PARTICIPATING A&E FIRMS

Factor	Description	Survey Question(s)	Algorithm
AEPB1	Likelihood of continuing to incorporate the same EEMDA used now if the NYSERDA NCP ended.	H1. Using a 5-point scale where 1 means “very unlikely” and 5 means “very likely,” how likely would you be to continue to incorporate the same energy efficiency measures and design approaches you use now if the NYSERDA New Construction Program ended?	H1=1 → 0 H1=2 → 0.25 H1=3 → 0.5 H1=4 → 0.75 H1=5 → 1 H1=DK → 0
AEPB2	Likely percentage change in the share of projects that will use EEMDA after program termination, compared to now.	E1c. Approximately what percentage of your [Q B1 + Q B3] new construction projects currently incorporate [EEMDA]? H2. Earlier you said that [E1c]% of your new construction projects currently incorporate [EEMDA]. What share of your projects do you think would incorporate [EEMDA] if the New Construction Program were no longer available?	By EEMDA* AEPB2_n=H2_n/E1c_n If AEPB2 _n >1 then set to 1 If H2 _n =DK → Null Roll up to respondent level: AEPB2=Σ AEPB2_n/n
AEPB3	Extent to which the firm has incorporated EEMDA as standard practice in new construction projects in New York.	E1e. Using a 10-point scale where 1 means “not at all” and 10 means “to a great extent,” to what extent has your organization incorporated [EEMDA] as standard practice in new construction projects in New York State?	By EEMDA* E1e=1 → 0 E1e=2 → 0.11 E1e=3 → 0.22 ... E1e=10 → 1 E1e=DK → Null Roll up to respondent level: AEPB3=Σ AEPB3_n/n
AEPB4	Estimated profitability of incorporating EEMDA compared to standard approaches after program end.	H4. If the New Construction Program ended, would incorporating energy efficiency measures and design approaches be more profitable, less profitable, or the same as standard efficiency approaches?	H4=1 (More profit.) → 1 H4=2 (Less profit.) → 0 H4=3 (Same) → 1 H4=DK → 0
<p>* For each EEMDA: If E1a=1, 2 OR E1c=0 OR E1d=0 set factor to NULL.</p> <p>E1a. Please rate your current familiarity with [EEMDA] on a 4-point scale where 1 means “not at all familiar” and 4 means “extremely familiar.”</p> <p>E1c. Approximately what percentage of your new construction projects currently incorporate [EEMDA]?</p> <p>E1d. Approximately what percentage of your organization’s installations of [EEMDA] in New York State in the past three years were conducted through NYSERDA’s New Construction Program?</p>			

5.3 PB FACTOR ALGORITHMS – PARTICIPATING BUILDING OWNERS

Factor	Description	Survey Question(s)	Algorithm
BOPB1	Likelihood of continuing to incorporate the same EEMDA used now if the NYSERDA NCP ended.	H1. Using a 5-point scale where 1 means “very unlikely” and 5 means “very likely,” how likely would you be to continue to incorporate the same energy efficiency measures and designs you used for this project in future projects if NYSERDA ended their New Construction Program?	H1=1 → 0 H1=2 → 0.25 H1=3 → 0.5 H1=4 → 0.75 H1=5 → 1 H1=DK → 0
BOPB2	Likely percentage change in the share of projects that will use EEMDA after program termination, compared to now.	E1b. Approximately what percentage of your [# IN Q B1 + Q B3] new construction projects currently incorporate [EEMDA]? H2. Earlier you said that [# IN Q E1b]% of your new construction projects completed in the past three years incorporated [EEMDA]. What share of your projects do you think would incorporate [EEMDA] if the New Construction Program were no longer available?	By EEMDA* BOPB2_n=H2_n/E1b_n If BOPB2 _n >1 then set to 1 If H2 _n =DK → Null Roll up to respondent level: BOPB2=Σ BOPB2_n/n
BOPB3	Extent to which the firm has incorporated EEMDA as standard practice in new construction projects in New York.	E1d. Using a 10-point scale where 1 means “not at all” and 10 means “to a great extent,” to what extent will your organization incorporate [EEMDA] as standard practice in future new construction projects in New York State?	By EEMDA* E1d=1 → 0 E1d=2 → 0.11 E1d=3 → 0.22 ... E1d=10 → 1 E1d=DK → Null Roll up to respondent level: BOPB3=Σ BOPB3_n/n
BOPB4	Willingness to accept change in market price for EEMDA after program ends. (Estimated at the measure level.)	<i>A&E Firms:</i> H3. What percentage change in price would you expect to see in the market for [EEMDA] after the program ended? For example, -25% is a price decrease of 25%, 0% is no change in price, and 100% is a doubling of the price? <i>Building Owners:</i> H3. What percentage change in market price would you accept for [EEMDA] after the program ended and still incorporate [EEMDA] in your designs? For example, -25% is a price decrease of 25%, 0% is no change in price, and 100% is a doubling of the price.	For A&E H3: The most frequent response is 0 → Compare BO H3 against no change in price. By EEMDA* H3 _{BO} ≥ 0 → 1 H3 _{BO} < 0 → 0 H3 _{BO} =DK → NULL Roll up to respondent level: BOPB4=ΣBOPB4_n/n
BOPB5	Level of A&E firm	<i>A&E Firms:</i>	C4 < 1 → C5_1=0 else

Factor	Description	Survey Question(s)	Algorithm
	promotion of EEMDA and building owner drive for implementing energy efficiency (need for A&E promotion).	<p>C4. Do you promote energy performance or operating expense considerations to your clients for inclusion in the design of new construction projects?</p> <p>IF “Yes”:</p> <p>C5. For what share of your projects do you promote these considerations?</p> <p><i>Building Owners:</i></p> <p>F1. Which of the following four statements best describes your relationship with the Architectural and Engineering design team on this project?</p> <ol style="list-style-type: none"> 1. The architectural and engineering design team had to sell the project’s more efficient equipment and design aspects to me. 2. I was not closely involved in the project’s energy-efficiency decisions and accepted the design team’s recommendations without a great deal of sales effort. 3. I was keenly interested in the energy-efficiency aspects of the project and easily accepted the higher-efficiency recommendations made by the design team. 4. I was the driver in pursuing energy-efficient equipment and design on our new construction project. 	<p>C5_1=C5</p> <p>AE-Promo = IncWeight average of C5_1 across Part. A&E.</p> <p>F1 = 4 → BOPB5=1</p> <p>F1 = 3 → BOPB5=AE-Promo * 1</p> <p>F1 = 2 → BOPB5=AE-Promo * 0.5</p> <p>F1 = 1 → BOPB5=AE-Promo * 0</p>
<p>* For each EEMDA: If E1a=1, 2 OR E1b=0 set factor to NULL.</p> <p>E1a. Please rate your current familiarity with [EEMDA] on a 4-point scale where 1 means “not at all familiar” and 4 means “extremely familiar.”</p> <p>E1b. Approximately what percentage of your [# IN Q B1 + Q B3] new construction projects currently incorporate [EEMDA]?</p>			

5.4 PB FACTOR ALGORITHMS – NON-PARTICIPANT BUILDING OWNERS

Factor	Description	Survey Question(s)	Algorithm
NBOPB1	Likelihood of continuing to incorporate the same EEMDA used now if the NYSERDA New Construction Program ended.	H3. Using a 5-point scale where 1 means “very unlikely” and 5 means “very likely,” how likely would you be to continue to incorporate the same energy-efficiency measures and designs you use now in future projects if NYSERDA ended their New Construction Program?	H3=1 → 0 H3=2 → 0.25 H3=3 → 0.5 H3=4 → 0.75 H3=5 → 1 H3=DK → 0
NBOPB2	Likely percentage change in the share of projects that will use EEMDA after program termination, compared to now.	E1b. Approximately what percentage of your new construction projects currently incorporate [EEMDA]? H4. Earlier you said that [# IN Q E1b]% of your new construction projects currently incorporate [EEDMA]. What share of your projects do you think will incorporate [EEMDA] over the next five years if the New Construction Program were no longer available?	<u>By EEMDA*</u> NBOPB2_n=H4_n/E1b_n If AEPB2 _n >1 then set to 1 If H4 _n =DK → Null Roll up to respondent level: NBOPB2=Σ NBOPB2_n/n
NBOPB3	Extent to which the firm will incorporate EEMDA as standard practice in new construction projects in New York.	E1c. Using a 10-point scale where 1 means “not at all” and 10 means “to a great extent,” to what extent will your organization incorporate [EEMDA] as standard practice in future new construction projects in New York State?	<u>By EEMDA*</u> E1c=1 → 0 E1c=2 → 0.11 E1c=3 → 0.22 ... E1c=8 → 0.78 E1c=9 → 0.89 E1c=10 → 1 E1c=DK → Null Roll up to respondent level: NBOPB3=Σ NBOPB3_n/n
NBOPB4	Willingness to accept change in market price for EEMDA after program ends.	<i>A&E Firms:</i> H3. What percentage change in price would you expect to see in the market for [EEMDA] after the program ended? For example, -25% is a price decrease of 25%, 0% is no change in price, and 100% is a doubling of the price? <i>Building Owners:</i> Q.H5: “What percentage change in market price would you accept for [EEMDA] after the program ended and still incorporate [EEMDA] into your designs? For example, -25% is a price decrease of 25%, 0% is no change in price, and 100% is a doubling of the price?”	For A&E H3: The most frequent response is 0 → Compare NBO H5 against no change in price. <u>By EEMDA*</u> H5 ≥ 0 → 1 H50 < 0 → 0 H5=DK → NULL Roll up to respondent level: NBOPB4=ΣNBOPB4_n/n

Factor	Description	Survey Question(s)	Algorithm
NBOPB5	Level of A&E firm promotion of EEMDA and building owner drive for implementing energy efficiency (need for A&E promotion).	<p><i>A&E Firms:</i></p> <p>C4. Do you promote energy performance or operating expense considerations to your clients for inclusion in the design of new construction projects?</p> <p>IF “Yes”:</p> <p>C5. For what share of your projects do you promote these considerations?</p> <p><i>Building Owners:</i></p> <p>F1. Which of the following four statements best describes your relationship with the Architectural and Engineering design team you typically work with on new construction projects?</p> <p>1. The architectural and engineering design team has to sell the more efficient equipment and design aspects to me.</p> <p>2. I am not closely involved in energy-efficiency decisions on projects and accept the design team’s recommendations without a great deal of sales effort.</p> <p>3. I am keenly interested in the energy-efficiency aspects of a project and easily accept the higher-efficiency recommendations made by the design team.</p> <p>4. I am the driver in pursuing energy-efficient equipment and design on our new construction projects.</p>	<p>$C4 < 1 \rightarrow C5_1=0$ else $C5_1=C5$</p> <p>AE-Promo = IncWeight average of C5_1 across Part. A&E.</p> <p>$F1 = 4 \rightarrow BOPB5=1$</p> <p>$F1 = 3 \rightarrow BOPB5=AE-Promo * 1$</p> <p>$F1 = 2 \rightarrow BOPB5=AE-Promo * 0.5$</p> <p>$F1 = 1 \rightarrow BOPB5=AE-Promo * 0$</p>
<p>* For each EEMDA: If E1a=1, 2 OR E1b=0 set factor to NULL.</p> <p>E1a. Please rate your current familiarity with [EEMDA] on a 4-point scale where 1 means “not at all familiar” and 4 means “extremely familiar.”</p> <p>E1b. Approximately what percentage of your new construction projects currently incorporate [EEMDA]?</p>			

5.5 NFR FACTOR ALGORITHMS – PARTICIPATING A&E FIRMS

Factor	Description	Survey Question(s)	Algorithm
AENFR1	Discriminant analysis: Establish correlation between common FR questions in 2008 and 2006 surveys and 2006 FR determination.	n/a	See Section 2.3.3
AENFR2	Extent to which NYSERDA is responsible for incorporating EEMDA as standard practice.	E1f. Using a scale from 0 to 10 where 0 means “not at all” and 10 means “to a great extent,” to what extent is the NYSERDA New Construction Program responsible for your organization’s use of [EEMDA] as standard practice?	<p><u>By EEMDA*</u></p> <p>E1f=0 → 0 E1f=1 → 0.1 E1f=2 → 0.2 ... E1f=9 → 0.89 E1f=10 → 1 E1f=DK → Null</p> <p>Roll up to respondent level: AENFR2=Σ AENFR2_n/n If all E1a_n=1, 2 OR (E1a_n=3,4 AND E1f_n=DK) → AENFR2 = NULL</p>
<p>* For each EEMDA: If E1a=1, 2 OR E1c=0 OR E1d=0 set factor to NULL.</p> <p>E1a. Please rate your current familiarity with [EEMDA] on a 4-point scale where 1 means “not at all familiar” and 4 means “extremely familiar.”</p> <p>E1c. Approximately what percentage of your new construction projects currently incorporate [EEMDA]?</p> <p>E1d. Approximately what percentage of your organization’s installations of [EEMDA] in New York State in the past three years were conducted through NYSERDA’s New Construction Program?</p>			

5.6 NFR FACTOR ALGORITHMS – PARTICIPATING BUILDING OWNERS

Factor	Description	Survey Question(s)	Algorithm
BONFR1	Discriminant analysis: Establish correlation between common FR questions in 2008 and 2006 surveys and 2006 FR determination.	n/a	See Section 2.3.3
BONFR2	Extent to which NYSERDA is responsible for incorporating EEMDA as standard practice.	E1e. Using a scale from 0 to 10 where 0 means “not at all” and 10 means “to a great extent,” to what extent is the NYSERDA New Construction Program responsible for your organization’s plans to use [EEMDA] as standard practice?	<p><u>By EEMDA*</u></p> <p>E1e=1 → 0 E1e=2 → 0.1 E1e=3 → 0.2 ... E1e=9 → 0.9 E1e=10 → 1 E1e=DK → Null</p> <p>Roll up to respondent level: BONFR2=Σ BONFR2_n/n If all E1a_n=1, 2 OR (E1a_n=3,4 AND E1e_n=DK) → BONFR2 = NULL</p>

<p>BONFR3</p>	<p>Importance of technical assistance (and program incentive) in decision to incorporate energy efficiency measures.</p>	<p>Q.C1: “How important were each of the following factors in your decision to incorporate energy efficiency measures and design into the [PROJECT NAME] project? Please rate importance on a 1-to-4 scale where 1 means “not at all important” and 4 means “extremely important.” How about . . .?</p> <p>1 Technical assistance services 2 Energy savings 3 Recommendation or promotion by the design team [IF NECESSARY: Your Architectural or Engineering firm] 4 Opportunity to build a green building 5 Competitive pressures 6 Rising energy prices 7 Any others? Specify: _____”</p> <p>Q.C3: “Which of these factors was most important in your decision to incorporate energy efficiency measures and design into this project?”</p>	<p>C3=1 OR 7 (=incentive) → 1 C1.1 OR C1.7 = 4 → 0.75 C1.1 OR C1.7 = 3 → 0.5 Else → NULL</p>
<p>* For each EEMDA: If E1a=1, 2 OR E1b=0 set factor to NULL.</p> <p>E1a. Please rate your current familiarity with [EEMDA] on a 4-point scale where 1 means “not at all familiar” and 4 means “extremely familiar.”</p> <p>E1b. Approximately what percentage of your [# IN Q B1 + Q B3] new construction projects currently incorporate [EEMDA]?</p>			

5.7 SO FACTOR ALGORITHMS – NON-PARTICIPANT BUILDING OWNERS

Factor	Description	Survey Question(s)	Algorithm
NBOSO1	Perception that NYSERDA has influenced design practices for new construction projects.	H1. Do you believe that NYSERDA’s New Construction Program has influenced your organization’s building or design practices on new construction projects in New York State?	H1(no) =1 → 0 H1 (yes) =2 → 1 H1 (DK) =3 → 0 H1=Blank (Not aware of program) → 0
NBOSO2	Extent to which NYSERDA is responsible for organization planning to incorporate EEMDA as standard practice.	E1d. Using a scale from 0 to 10 where 0 means “not at all” and 10 means “to a great extent,” to what extent is the NYSERDA New Construction Program responsible for your organization’s plans to use [EEMDA] as standard practice?	By EEMDA* E1d=0 → 0 E1d=1 → 0.1 E1d=2 → 0.2 ... E1d=9 → 0.9 E1d=10 → 1 E1d=DK → Null Roll up to respondent level: NBOSO2=Σ NBOSO2_n/n If all E1a _n =1, 2 OR (E1a _n =3,4 AND E1d _n =DK) → NBOSO2 = NULL
<p>* For each EEMDA: If E1a=1, 2 OR E1b=0 set factor to NULL.</p> <p>E1a. Please rate your current familiarity with [EEMDA] on a 4-point scale where 1 means “not at all familiar” and 4 means “extremely familiar.”</p> <p>E1b. Approximately what percentage of your new construction projects currently incorporate [EEMDA]?</p>			