New Jersey's Clean Energy Program Energy Impact Evaluation

SmartStart Program Impact Evaluation

DRAFT

July 29, 2009

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1. Executive Summary

1.1 Overview

KEMA has been contracted by the New Jersey Board of Public Utilities' Office of Clean Energy (OCE) to perform an evaluation of energy impacts of New Jersey's Clean Energy Program's (NJCEP) energy efficiency and renewable programs. The results of this impact evaluation will assist OCE in determining the net and gross energy impacts of the programs. The results will also help the OCE update and modify the *Protocols to Measure Resource Savings* (Protocols)[1].

KEMA submitted the *New Jersey's Clean Energy Program Energy Impact Evaluation Final Work Plan* (Final Work Plan)[2] to OCE on October 8, 2007. The Final Work Plan as specified in the RFP mirrors the information provided in the bid proposal modified to reflect adjustments discussed at the kick-off meeting and subsequent discussions with OCE, the BPU Program Coordinator, the market managers and the utilities. The Final Work Plan presents individual research plans for the following six program areas.

1. Residential Electric and Gas HVAC Programs (Cool Advantage and Warm Advantage)
2. Residential New Construction Programs
3. ENERGY STAR Products Program
4. Commercial and Industrial Programs (SmartStart)[3]
5. Combined Heat and Power Program
6. Customer On-site Renewable Energy Program (CORE)[4]

[1] *New Jersey's Clean Energy Program, Protocols to Measure Resource Savings,* Revisions to September 2004 Protocols, December 2007.

[2] *New Jersey's Clean Energy Program Energy Impact Evaluation Final Work Plan.* Prepared by KEMA for New Jersey Board of Public Utilities, Office of Clean Energy. October 8, 2007.

[3] The SmartStart work plan was updated and approved by OCE in May 2008.
New Jersey's Clean Energy Program Energy Impact Evaluation Updated SmartStart Work Plan. Prepared by KEMA for New Jersey Board of Public Utilities, Office of Clean Energy. May 2, 2008.

[4] The comprehensive CORE work plan was updated and approved by OCE in November 2008.
New Jersey's Clean Energy Program Energy Impact Evaluation CORE Work Plan. Prepared by KEMA for New Jersey Board of Public Utilities, Office of Clean Energy. November 14, 2008.

This report presents the results of KEMA's retrospective assessment of energy savings reported by SmartStart for measures installed in program year 2006. KEMA's review of the *Protocols to Measure Resource Savings* for measures supported by SmartStart was provided in a separate document[5].

1.2 Overview of Approach

The NJCEP energy impact evaluation has two broad objectives:

1. To revise the savings calculation Protocols so that going forward the calculations using these Protocols provide (more) accurate statements of savings accomplishments.

2. To provide a retrospective assessment of program accomplishment, as part of a due diligence review of past utility program effectiveness on behalf of ratepayers.

The second of these objectives, KEMA's retrospective assessment (review of reported savings) is the topic of this report. The first objective, KEMA's prospective assessment (review of savings protocols) was the topic of a separate report submitted on July 10, 2009[6].

KEMA uses the statistical procedure of ratio estimation to develop estimates of evaluation verified gross and net impacts. There are two basic steps to the process.

- **Verify energy savings in a sample of participating customers.** For a sample of 63 customers that installed energy efficient equipment during the 2006 program year, KEMA estimated actual energy savings under current conditions. A telephone interview was delivered to another sample of 299 customers and used to collect information on measure installation and program attribution.

- **Expand sample results to the population of customers.** The sample results obtained in Step 1 were expanded to the population by calculating the ratios of verified-to-tracked savings (gross savings adjustment factor) and attributable-to-verified savings (attribution factor) for the sample.

The adjustment factors estimated from the data collection and analysis tasks include:

[5] *New Jersey's Clean Energy Program Energy Impact Evaluation SmartStart Program Protocol Review.* Prepared by KEMA for New Jersey Board of Public Utilities, Office of Clean Energy. July 10, 2009.
[6] Ibid.

- **Gross savings adjustment factor:** This factor adjusts tracking gross savings for installation and changes based on the engineering review. Applying the gross savings adjustment factor to tracking gross savings produces the estimate of verified gross savings.
- **Attribution factors:** This factor adjusts verified gross savings for program attribution. That is, the fraction of verified gross savings that occurred because of the Program.
- **Realization rate:** This factor combines the gross savings adjustment factor and the attribution factor. (It is the ratio of net savings to tracking gross savings.) That is, the fraction of tracking gross savings that occurred because of the Program.

The gross savings adjustment factor is computed as the product of the installation rate[7] and the engineering adjustment factor. The engineering adjustment factor was determined through a review of the program's tracking gross savings estimate for a sample of measures installed in 2006. Measures were reviewed to verify that the program's tracking gross savings estimates were a reasonable estimation of the energy savings that could be achieved with that measure. For custom measures, every aspect of the project and calculation was reviewed. For prescriptive measures, only the proper application of the prescriptive algorithm(s) and input values was reviewed. One on-site visit was conducted for a large custom project to verify installation and reported energy savings.

A telephone survey was delivered to a sample of participants to collect information for estimation of program attribution. Respondents verified whether or not the project was installed and answered questions about the influence of the program on the quantity, efficiency, and timing of the project installed. The attribution factor can range between zero and one. Zero indicates the Program had no effect on the quantity, efficiency, and timing of the project installed; and one indicates the project would not have been installed without the assistance of the Program.

[7] Installation rate is based on the results of telephone survey.

1.3 Impact Evaluation Results Summary

This section presents KEMA's retrospective assessment of energy savings reported by the SmartStart Program. Adjustment factors are provided for each energy unit (kW, kWh, and therms) and sector (Retrofit, New Construction, and Schools)[8].

1.3.1 Adjustment Factors

Overall, the Program achieved realization rates of 49 percent, 39 percent, and 13 percent for kWh, kW, and therms respectively. Based on the data provided for our evaluation, the total net savings achieved during the 2006 program year were 24,059,607 kWh; 4,531 kW; and 178,986 therms[9].

Figure 1-1 shows the gross savings adjustment factors for the SmartStart Program by sector and overall (Total). Overall gross savings adjustment factors were 105 percent, 86 percent, and 66 percent for kWh, kW, and therms, respectively. These are good results for kWh and kW. The difference between the two electric energy savings results is due to a consistent misapplication of the prescriptive savings formulas for kW savings[10]. The kWh formulas for these measures were applied correctly.

The low therms value was due to the Program's overestimation of therm savings for one large project[11]. This project accounted for 75 percent of program reported natural gas savings in 2006. Large projects can have a significant effect on the results because of the large fraction of energy savings they represent in the numerator and denominator of the adjustment factor equation (evaluation verified gross energy savings and program tracked gross energy savings in the case of the gross savings adjustment factor).

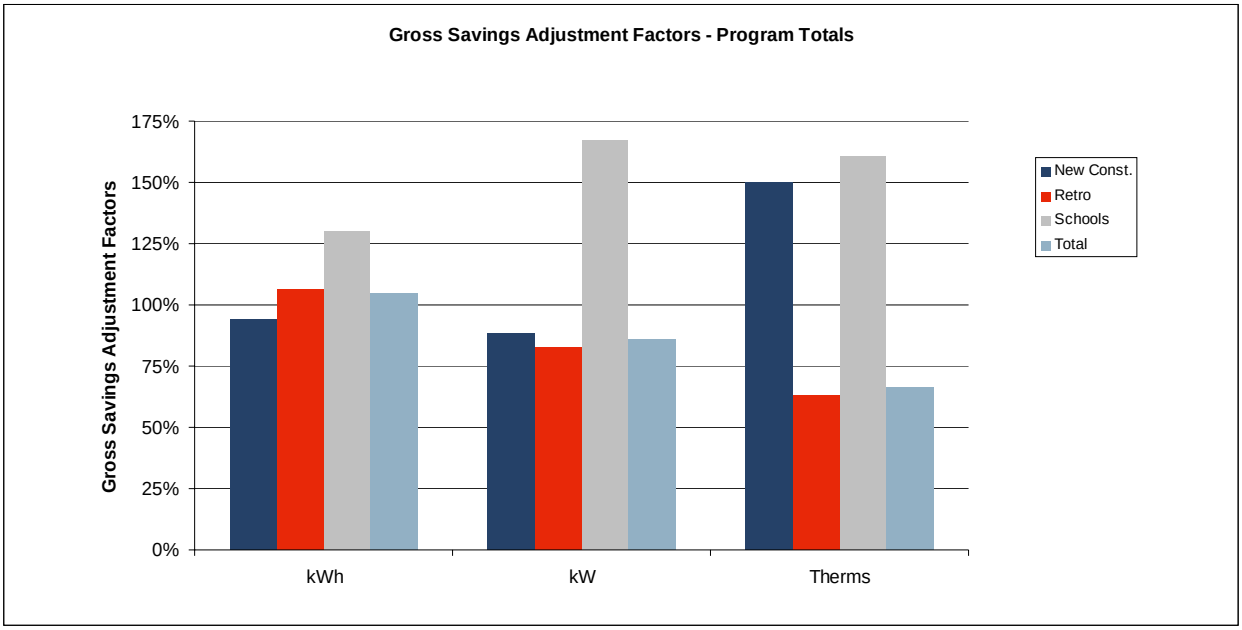
[8] Due to small sample sizes the sub-population estimates should be viewed with caution. Measures of statistical precision (e.g.: sample size, relative error, and 90% confidence interval) are provided in the report.

[9] These energy savings totals are based on the program tracking data KEMA was provided by each of the seven electric and natural gas utilities.

[10] Lighting and unitary HVAC measures.

[11] This project's engineering reviewing incorporated an on-site visit. The review also resulted in additional untracked savings of 40,284 kWh.

Figure 1-1: Gross Savings Adjustment Factors by Sector



The high gross savings adjustment factors for Schools are a result of underestimated savings for two large schools projects. The dramatically high results for Schools is included in the overall results, however the impact of a project on the adjustment factors for the overall program (total bars in the charts) is determined by the size of the project relative to all projects in the population. This is why the overall results tend to mirror the Retrofit sector that accounts for the vast majority of SmartStart tracking gross energy savings.

Figure 1-2 shows attribution adjustment factors for the SmartStart Program by sector and overall. Overall attribution rates were 47 percent, 45 percent, and 19 percent for kWh, kW, and therms. Some level of free ridership should be expected for most programs; however the overall attribution results for SmartStart are low relative to other large scale nonresidential programs. It is important to note that this is the first time net energy savings have been addressed by NJCEP. These estimates would be expected to improve with program designs with the clear objective of minimizing free ridership.[12]

The therms adjustment factor for Schools is zero. This result is based on only three sample points. The Schools sector had low participation relative to the other sectors and therefore received a small allocation of sample. That is, Schools accounted for a very small fraction of

[12] More detail discussion on attribution results is provided in Section 4.2.3APPENDIX B:.

program savings relative to Retrofit and New Construction so KEMA reviewed a small number of Schools projects compared to the other sectors.

Figure 1-2: Attribution Factors by Sector

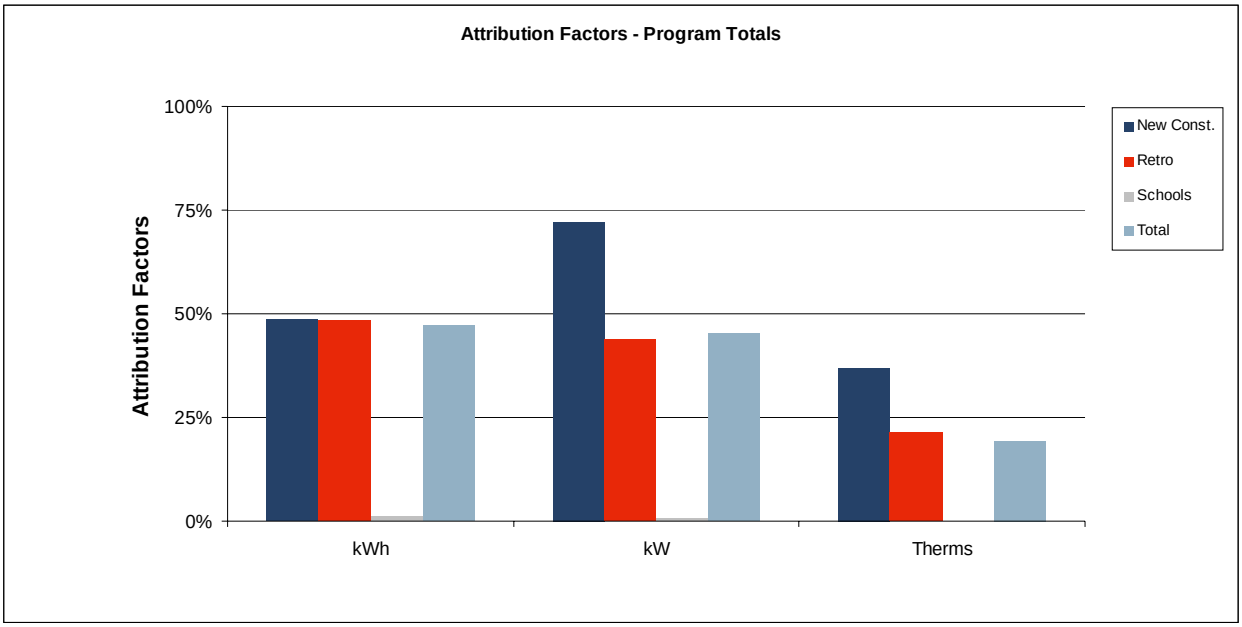
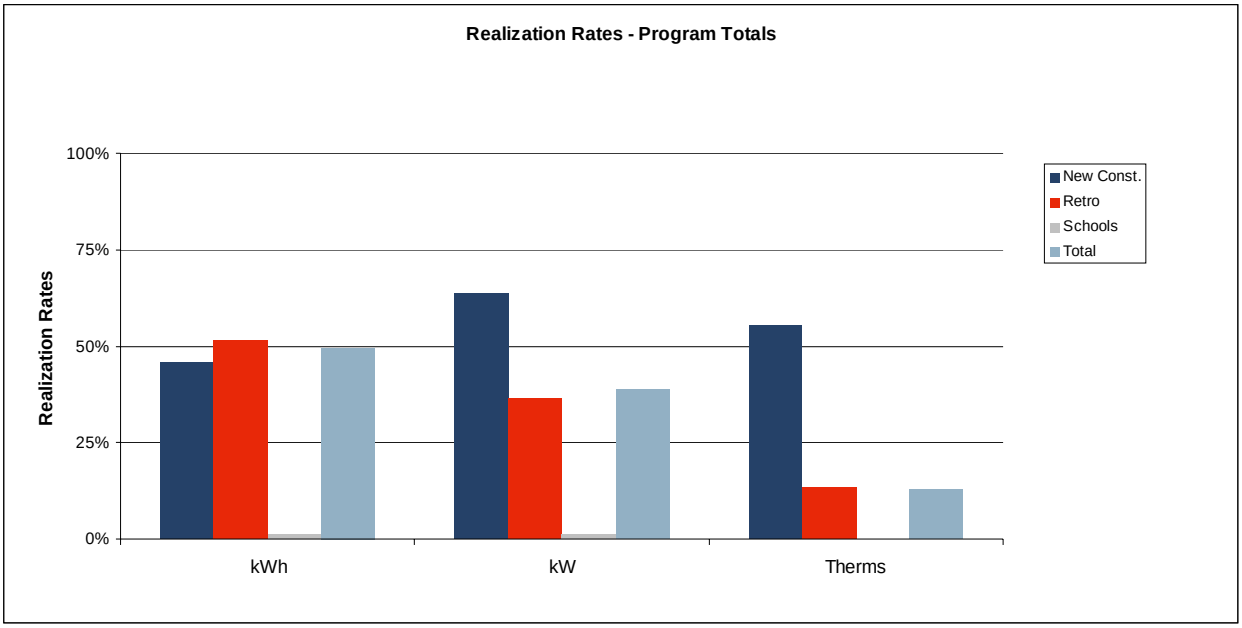


Figure 1-3 shows Realization Rates for the SmartStart Program. The Realization Rate is the combined effect of the gross savings adjustment factor and the attribution factor.

Figure 1-3: Realization Rates by Sector



1.3.2 Sampling

The sample frame was created by compiling the individual program tracking databases provided to KEMA by the seven participating electric and natural gas utilities. The samples were designed to produce the best possible statewide estimates of gross and net energy savings for kWh, kW and therms for the program overall. The sample was stratified by:

- Energy unit (kWh, kW and therms),
- Sector (New Construction, Retrofit, Schools),
- Measure type (prescriptive and custom projects), and
- Measure size (incentive amount).

As shown in Figure 1-1 and Figure 1-2, the 2006 program was dominated by Retrofit and Prescriptive measures.

Figure 1-4: Sample Frame by Sector

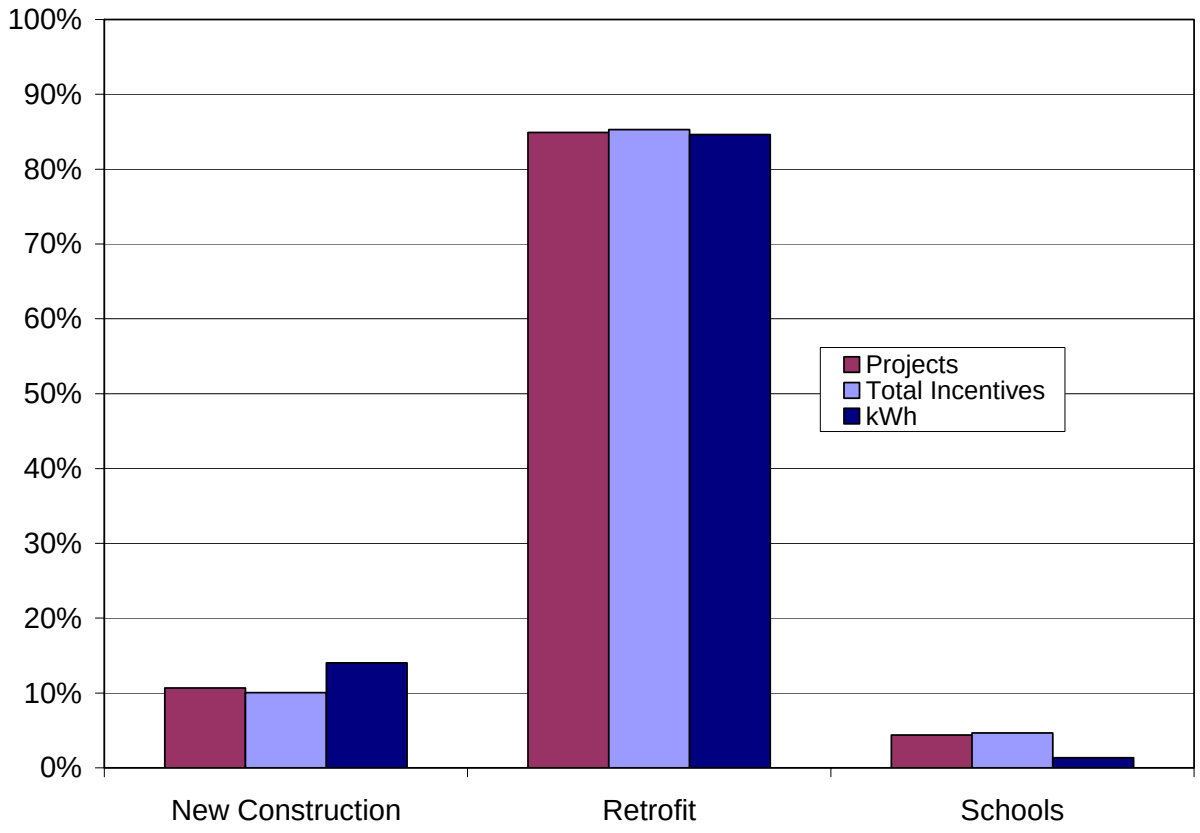


Figure 1-5: Sample Frame by Measure Type

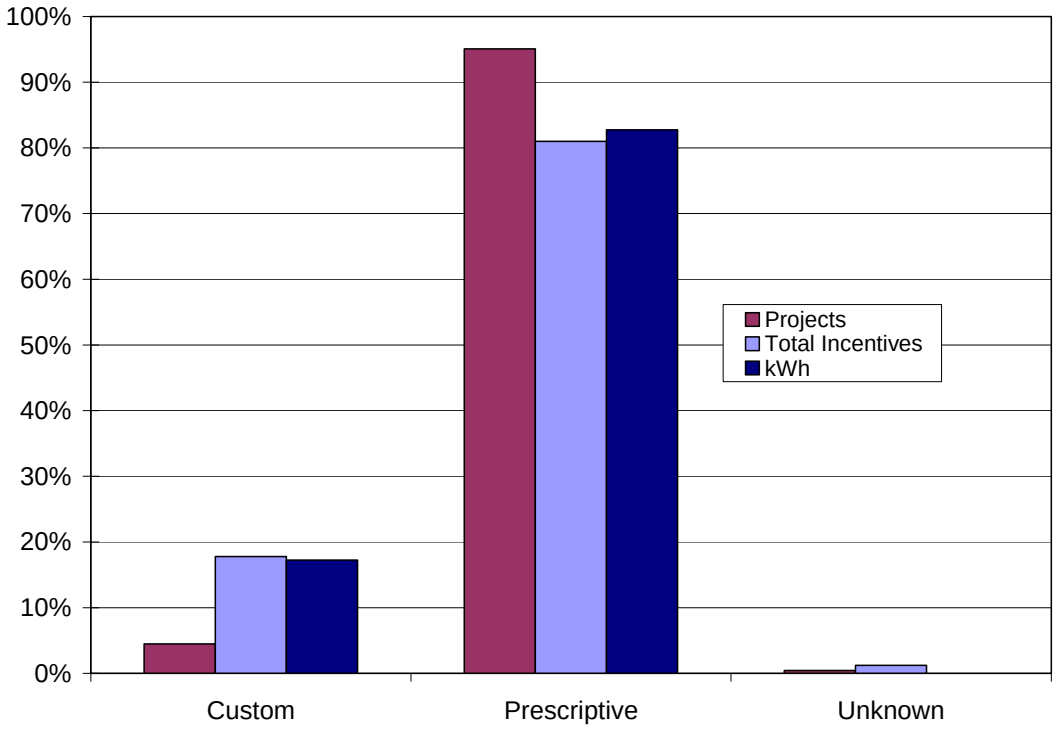


Table 1-1 and Table 1-2 show the fractions of sample frame energy savings included in the engineering review sample and the CATI sample (installation and attribution). Twelve percent and 26 percent of kWh energy savings reported by the Program are included in the engineering and CATI samples, respectively. Consistent with the distribution of sample frame measures, Retrofit and Prescriptive projects comprise the majority of the samples. Natural gas measures account for a small percentage of the sample because the 2006 program was dominated by electric measures. Only 121 measures of a total of 1,565 measures installed in 2006 had natural gas energy savings.

Table 1-1: Fraction of Sample Frame Energy Savings in the Engineering Sample

	kWh				kW				Therms			
		Reported Energy Savings				Reported Energy Savings				Reported Energy Savings		
Sector	n	Sample	Sample Frame	% of Sample Frame	n	Sample	Sample Frame	% of Sample Frame	n	Sample	Sample Frame	% of Sample Frame
Retrofit	38	3,776,163	41,189,535	9%	38	788	10,160	8%	4	1,273,634	1,335,803	95%
NC	9	2,091,869	6,828,544	31%	8	186	1,228	15%	2	705	37,839	2%
Schools	4	37,110	656,219	6%	4	29	253	11%	2	6,877	23,428	29%
Total	51	5,905,142	48,674,298	12%	50	1,002	11,641	9%	8	1,281,216	1,397,070	92%

Table 1-2: Fraction of Sample Frame Energy Savings in the CATI Sample

	kWh				kW				Therms			
		Reported Energy Savings				Reported Energy Savings				Reported Energy Savings		
Sector	n	Sample	Sample Frame	% of Sample Frame	n	Sample	Sample Frame	% of Sample Frame	n	Sample	Sample Frame	% of Sample Frame
Retrofit	185	10,498,503	41,189,535	25%	179	3,039	10,160	30%	20	260,168	1,342,261	19%
NC	21	2,092,795	6,828,544	31%	18	375	1,228	31%	4	6,748	37,839	18%
Schools	8	101,858	656,219	16%	9	46	253	18%	3	6,767	23,428	29%
Total	214	12,693,156	48,674,298	26%	206	3,461	11,641	30%	27	273,683	1,403,528	19%

The size of a project, in terms of energy savings, determines the influence the project will have on the estimates of gross and net energy savings. Therefore KEMA sampled large projects with certainty. That is, we attempted to include all participants that installed largest projects (incentive greater than $100,000). Furthermore, we performed a census on 21 of the 31 sampling stratum.[13] One limiting factor to the precision of estimates with finite populations is the inability of researchers to force respondents to participate in the research study, if program participants that installed large projects refuse or are unable to participate in the study the precision of the estimates decrease because a large fraction of energy savings is not included in the sample.

1.3.3 Engineering Review

As mentioned above a detailed engineering review of reported energy savings was performed for measure in the engineering sample. Table 1-3 shows the number of measures for which the verified gross installed (VGI) savings were different from the program-reported savings, and the degree of this difference. The VGI savings were greater than the program-reported savings for the majority of kWh and therm reviews. For kW, however, the opposite is true.

VGI was less than reported savings for a 26 of 34 kW measures reviewed. Sixteen of the 26 were adjusted between 20-30 percent. This large number of adjustment is the consistent calculation error in program-reported estimates. The calculation failed to apply Coincidence Factor (CF) for prescriptive lighting and unitary HVAC measures.

[13] Refer to Section 4.2 for more detailed sample information.

Table 1-3: Numbers of Measures Adjusted

Percent Change (by number of measures)	kWh			kW			Therms		
	V>R	V<R	Total	V>R	V<R	Total	V>R	V<R	Total
10% to 20%	2	0	2	0	5	5	0	0	0
20% to 30%	2	2	4	0	16	16	0	0	0
30% to 50%	0	1	1	0	4	4	0	0	0
50% to 100%	7	0	7	1	1	2	2	1	3
100% or Greater	0	0	0	2	0	2	1	0	1
Verified shows savings (+ or -) where reported = 0	4	1	5	5	0	5	0	0	0
Total Measures Adjusted	15	4	19	8	26	34	3	1	4
Notes: V = Verified; R=Reported									

Roughly half of all measures reviewed were adjusted, with kW adjustments being the most common. Most adjustments, both positive and negative, were due to calculation errors and misapplication of prescriptive savings formulas. The source of discrepancies between tracking and evaluation verified gross saving is unknown for some custom projects due to the lack of program documentation.

1.4 Recommendations

This section contains KEMA's recommendations to the Program based on the results of the impact evaluation. These recommendations are based on a retrospective assessment of program year 2006 accomplishments. KEMA understands that since 2006 the management of the SmartStart Program has been transferred from the utilities to the third-party Market Managers. Evaluation of the current programs was beyond the scope of this evaluation; however lessons learned from the program year 2006 may be useful to increase program effectiveness and energy savings impacts going-forward.

RECOMMENDATION #1

KEMA recommends the Program consider using attribution factors based on evaluation research to determine net energy impacts rather than the existing assumption that attribution is 100 percent. In light of the transition of the Program from the seven electric and natural gas utilities to the statewide Market Managers in April 2007, we do not recommend the use of the adjustment factors developed for this retrospective look at program year 2006 accomplishments.

For the purposes of program planning it would be appropriate for the Program to develop estimates of attribution based on current Program procedures and comparisons with attribution results for similar comprehensive statewide business programs.

RECOMMENDATION #2

KEMA recommends NJCEP conduct an impact evaluation covering the first three years (April 2007 through December 2009) of program performance under the Market Manager model. The results of this future evaluation should be used to assess the net achievements of the current program and be used for program planning to mitigate the effects of free ridership. An impact evaluation covering the first three years of program performance would also provide OCE and the Program with baseline data to measure improvements in gross and net energy impacts.

RECOMMENDATION #3

If OCE decides to include program attribution in its assessment of net energy impacts of the Program, KEMA recommends the Program consider incorporating strategies into the program design to mitigate the effects of free ridership. Potential strategies the Program could consider include:

1.) Increase promotion of the next generation of high efficiency equipment;

2.) Decrease promotion of market accepted high efficiency equipment;

3.) Limit repeat program participation (by the same customer) for the same technology; and

4.) Pre-screen customers for potential free ridership.

KEMA acknowledges that some of these strategies are likely part of the Market Manager's current program design.

RECOMMENDATION #4

Consistent and complete program tracking data is a fundamental requirement for a statewide energy efficiency program such as SmartStart. Program tracking data can be used for program operations, program planning, and reporting and verification of accomplishments. KEMA understands that OCE has implemented a statewide tracking database and process for archiving hard-copy project documentation subsequent to the time period covered by this evaluation (program year 2006).

KEMA recommends the Program consider implementing electronic database and hard-copy (custom projects) quality assurance procedures to ensure the newly created database is being used to its full potential. Simple data entry errors can have significant effects on the claimed

energy savings, particularly for large projects. For example, one missing zero at the end of an energy savings database entry could be the difference between 1,000,000 kWh and 100,000 kWh of energy savings attributable to the Program.

RECOMMENDATION #5

KEMA recommends the Program consider reviewing the prescriptive savings calculation spreadsheets to ensure the Protocol calculation methods are being used correctly. These calculations could also be incorporated into the statewide tracking database to further reduce the potential for errors.

2. Introduction

KEMA has been contracted by the New Jersey Board of Public Utilities' Office of Clean Energy (OCE) to perform an evaluation of energy impacts of New Jersey's Clean Energy Program's (NJCEP) energy efficiency and renewable programs. The results of this impact evaluation will assist OCE in determining the net and gross energy impacts of the programs. The results will also help the OCE update and modify the *Protocols to Measure Resource Savings* (Protocols)[14].

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1. Residential Electric and Gas HVAC Programs (Cool Advantage and Warm Advantage)
2. Residential New Construction Programs
3. ENERGY STAR Products Program
4. Commercial and Industrial Programs (SmartStart)[16]
5. Combined Heat and Power Program
6. Customer On-site Renewable Energy Program (CORE)[17]

This report presents the results of KEMA's retrospective assessment of energy savings reported by SmartStart for measures installed in program year 2006. KEMA's review of the *Protocols to*

[14] *New Jersey's Clean Energy Program, Protocols to Measure Resource Savings,* Revisions to September 2004 Protocols, December 2007.

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New Jersey's Clean Energy Program Energy Impact Evaluation CORE Work Plan. Prepared by KEMA for New Jersey Board of Public Utilities, Office of Clean Energy. November 14, 2008.

Measure Resource Savings for measures supported by SmartStart was provided in a separate document[18].

2.1 Program Overview

The NJCEP New Construction, Schools, and Retrofit programs have been marketed under the umbrella of the SmartStart Buildings Program. This program offers design support, technical assistance, financial incentives, and additional services for qualifying measures and equipment. There is also a Combined Heat and Power (CHP) component of this program that was evaluated separately[19].

Table 2-1 provides a summary of SmartStart Programs' overall budget, program expenditure and tracked savings for 2001-2006. This evaluation was limited to the 2006 program year.

[18] *New Jersey's Clean Energy Program Energy Impact Evaluation SmartStart Program Protocol Review.* Prepared by KEMA for New Jersey Board of Public Utilities, Office of Clean Energy. July 10, 2009.
[19] *New Jersey's Clean Energy Program Energy Impact Evaluation Combined Heat & Power (CHP) Program Impact Evaluation.* Prepared by KEMA for New Jersey Board of Public Utilities, Office of Clean Energy. June 10, 2009.

Table 2-1: SmartStart Program Summary from 2001-2006[20]

Commercial & Industrial Programs						
	2001	2002	2003	2004	2005	2006
C&I New Construction						
Program Budget (in 000's of $)			$3,145	$3,317	$3,300	$3,811
Actual Expenditures (in 000's of $)			$3,832	$3,902	$3,730	$1,422
Participants			188	176	198	187
Tracked KW Savings			1,935	6,380	3,548	3,861
Tracked MWh Savings			11,760	31,538	13,851	17,351
Tracked Dtherms Savings			8,246	4,576	12,335	2,855
C&I Retrofit						
Program Budget (in 000's of $)			$24,089	$21,773	$20,900	$25,180
Actual Expenditures (in 000's of $)			$25,095	$22,686	$17,347	$16,973
Participants			3,818	3,563	1,923	1,798
Tracked KW Savings			34,659	33,751	28,478	21,539
Tracked MWh Savings			179,679	163,631	260,238	78,194
Tracked Dtherms Savings			70,277	40,439	175,613	171,062
C&I New School Construction & Retrofit						
Program Budget (in 000's of $)			$6,670	$5,109	$3,500	$3,872
Actual Expenditures (in 000's of $)			$1,628	$3,073	$3,360	$1,672
Participants			203	244	266	109
Tracked KW Savings			1,561	3,199	4,356	901
Tracked MWh Savings			5,908	8,975	13,583	2,832
Tracked Dtherms Savings			9,482	9,629	2,053	27,913
C&I Total						
Program Budget (in 000's of $)	$21,551	$28,353	$33,904	$30,199	$27,700	$32,863
Actual Expenditures (in 000's of $)	$12,346	$38,271	$30,555	$29,661	$24,437	$20,067
Participants	1,632	9,070	4,209	3,983	2,387	2,094
Tracked KW Savings	6,364	26,750	38,155	43,330	36,382	26,301
Tracked MWh Savings	30,943	144,635	197,347	204,144	287,672	98,377
Tracked Dtherms Savings	33,802	33,504	88,005	54,644	190,001	201,830

2.2 Overview of Approach

The NJCEP energy impact evaluation has two broad objectives:

3. To revise the savings calculation Protocols so that going forward the calculations using these Protocols provide (more) accurate statements of savings accomplishments.

4. To provide a retrospective assessment of program accomplishment, as part of a due diligence review of past utility program effectiveness on behalf of ratepayers.

The second of these objectives, KEMA's retrospective assessment (review of reported savings) is the topic of this report. The first objective, KEMA's prospective assessment (review of savings protocols) was the topic of a separate report submitted on July 10, 2009[21].

[20] New Jersey Clean Energy Program. *New Jersey's Clean Energy Program Report submitted to the New Jersey Board of Public Utilities*. Reports from 2001-2006.

KEMA uses the statistical procedure of ratio estimation to develop estimates of evaluation verified gross and net impacts. There are two basic steps to the process.

- **Verify energy savings in a sample of participating customers.** For a sample of 63 customers that installed energy efficient equipment during the 2006 program year, KEMA estimated actual energy savings under current conditions. A telephone interview was delivered to another sample of 299 customers and used to collect information on measure installation and program attribution.

- **Expand sample results to the population of customers.** The sample results obtained in Step 1 were expanded to the population by calculating the ratios of verified-to-tracked savings (gross savings adjustment factor) and attributable-to-verified savings (attribution factor) for the sample.

The adjustment factors estimated from the data collection and analysis tasks include:

- **Gross savings adjustment factor:** This factor adjusts tracking gross savings for installation and changes based on the engineering review. Applying the gross savings adjustment factor to tracking gross savings produces the estimate of verified gross savings.

- **Attribution factors:** This factor adjusts verified gross savings for program attribution. That is, the fraction of verified gross savings that occurred because of the Program.

- **Realization rate:** This factor combines the gross savings adjustment factor and the attribution factor. (It is the ratio of net savings to tracking gross savings.) That is, the fraction of tracking gross savings that occurred because of the Program.

2.3 Organization of Report

This remainder of the report is organized as follows. Section 3 – *Energy Savings Results* presents the results of the impact evaluation and KEMA's recommendations for program improvements. The final section, Section 4 – *Approach,* presents detailed discussion of the impact evaluation approach. This section includes adjustment factor definitions and the detailed sampling plan.

[21] Ibid.

Six appendices accompany this report.

- *Appendix A: Attribution Analysis Methodology.* Provides a detailed explanation of the program attribution methodology used in this impact evaluation.
- *Appendix B: Responses to Attribution Questions.* Present the results of the survey questions that were used to estimate program attribution.
- *Appendix C: Ratio Expansion – Sample to Population Results.* Provides the ratio estimation computation KEMA employed to develop estimates of evaluation verified gross and net impacts.
- *Appendix D: Other Adjustment Factors.* Provides the installation rate and engineering verification factor. The combine effect of these factors is reported in the body of the report as the gross savings adjustment factors.
- *Appendix E: Additional CATI Survey Results.* Provides a summary of the process related survey question results; including customer satisfactions, rebound effects, and customer commitment to energy efficiency.
- *Appendix F: Telephone Survey Instrument.* Participant Survey Instrument.

Section APPENDIX B: – *Responses to Attribution Questions* presents the responses to the CATI survey attribution questions organized by energy unit and sector, and a detailed analysis of this data.

Section APPENDIX E: – Additional CATI Survey Results present various results from the CATI survey and an analysis of its implications for SmartStart.

3. Energy Savings Results

The primary objective of this evaluation was to calculate energy and demand savings attributable to the SmartStart Program for program year 2006. This section of the report provides a brief description of the impact evaluation's key indices, the results of the adjustment factor analysis, the application of adjustment factors to gross reported savings, recommended program improvements, and a discussion of the discrepancies between verified gross and tracked energy savings.

3.1 Descriptions of Key Indices

The impact analysis for a measure, group of measures, sector, or program area is used to determine three key adjustment factors to the program-reported gross savings:

- **Gross savings adjustment factor:** This factor combines the installation rate and the engineering verification factor. It corresponds to the ratio of the verified gross savings to the tracking estimate of savings.

- **Attribution factors:** This factor adjusts verified gross savings for program attribution. It is the estimated proportion of verified gross savings attributable to the SmartStart Program. It corresponds to the ratio of net savings to verified gross savings. The attribution factors presented in this report use the historical calculation methodology.

- **Realization rate:** This factor combines the gross savings adjustment factor and the attribution factor. It corresponds to the ratio of the net savings to the tracking estimate of savings.

The gross savings adjustment factor for each sector is determined by selecting a sample of completed measures from the sector and conducting an engineering review of the reported savings estimates for those measures. The sampling process is described in Section 4.2 - *Sample Design for SmartStart Evaluation*.

The attribution factor is developed based on a series of interview questions asked of each sampled participant. The questions ask the participant to indicate the influence that the program had on the quantity, efficiency, and timing of the measure installed.

The analysis provides the following information:

- Savings estimates reported by the program by sector and overall.

- Gross savings adjustment factors by sector and overall.
- Attribution adjustment factors by sector and overall.
- Realization Rates by sector and overall.
- Verified gross savings developed by applying the gross adjustment factors to the savings estimates from the tracking database.
- Verified net savings developed by applying the attribution adjustment factors to the verified gross savings.

3.2 Results

This section provides the results of the program year 2006 impact evaluation. The results are provided by the overall program and each sector for kWh, kW, and therms. The gross savings adjustment factors are presented first, followed by the attribution factor and the realization rate.

The details of the installation rate and engineering verification factors, the components of the gross savings adjustment factor, are provided in Appendix D. The installation rate adjusts the gross savings for non-installation and the engineering verification factor adjusts gross savings for changes based on the engineering review.

3.2.1 Results Tables

The adjustment factors are provided in the tables below with indicators of statistical precision including sample sizes, the 90 percent confidence interval, and relative error. The relative error (%) indicated for each confidence interval is the relative difference between the estimated percentage and the upper or lower confidence bound, not the absolute difference. The ± amount indicated for each confidence interval is the absolute difference in the estimated percentage. For example, the Retrofit kWh gross savings adjustments estimate in Table 3-1 is 105 percent, the 90 percent confidence interval is ± 6.4 percentage points (i.e., 105% ± 6.4% or 98.2% to 111.0%) and the relative precision (at 90 percent confidence) is 6.1 percent (6.4%/105%).[22] The

[22] The critical value for calculating the confidence interval ± for each adjustment factor is determined using Student's t distribution and n-1 for the degrees of freedom, where n is the sample size. The critical value for the Gross Savings Adjustment Factor and the Realization Rate is determined using the degrees of freedom based on the minimum sample size for the components of the adjustment factor. These two adjustment factors are products of other adjustment factors.

adjustment factors are calculated using a SAS® macro provided by SAS for ratio estimation by domains.

The procedure also returns the standard error of the estimate. The standard error is calculated using two methods. The first method recognizes the sample as drawn from a finite population: the measures installed within the analysis period (the 2006 program year) with associated energy impacts reported by the utilities. This calculation uses the Finite Population Correction (FPC) factor. This factor is a reduction to the calculated variance that accounts for the fact that a relatively large fraction of the population of interest has been observed directly and is not subject to uncertainty. It is appropriate to apply precision statistics, such as confidence intervals, based on the standard error calculated in this manner when quantifying the results of the program during the study period only.

The second calculation treats the population of interest as essentially infinite. Thus, the measures installed to date and the sample selected from them is regarded as random instances of a virtually infinite number of measures that could have been installed under the program. In this case, the FPC is not included. It is appropriate to apply standard errors calculated in this manner when applying the verification factors developed from this study to tracked savings from other years to estimate verified savings in those years.

In this report, the sampling frame includes all measures installed in the 2006 program year for which KEMA was able to obtain files. Energy impacts were collected from two sources: electronic versions of a tracking database from participating utilities and hard-copies of program paperwork, also from participating utilities. We use the FPC when applying the calculated adjustment factors to that period. We would not use the FPC when applying these adjustment factors to savings outside the analysis period; for example energy savings associated with measures installed in 2005.

3.3 Gross Savings Adjustment Factors by Sector

Table 3-1 and Figure 3-1 present the gross savings adjustment factors for the 2006 SmartStart program year. The gross savings adjustment factors combine the installation rates and the engineering verification factors to adjust the tracking estimate of gross savings. The gross savings adjustment factors for the program overall were 105 percent, 86 percent, and 66 percent for kWh, kW, and therms, respectively. These are good results for kWh and kW. The difference between the two electric energy savings results is due to a consistent misapplication

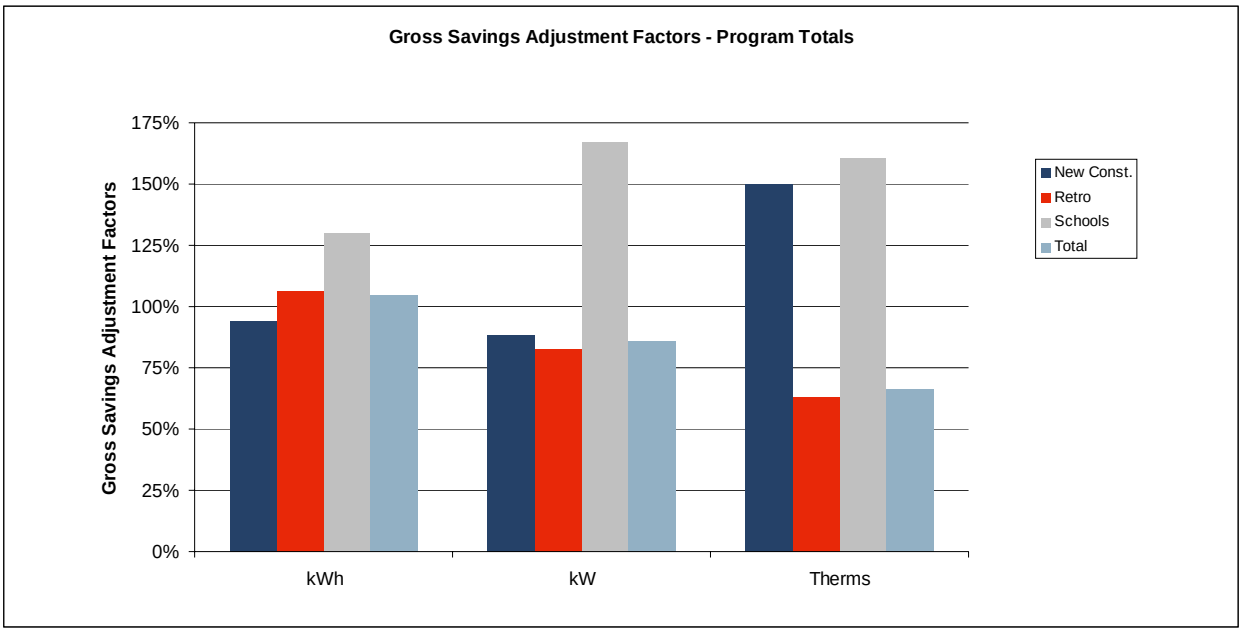
of the prescriptive savings formulas for kW savings[23]. The kWh formulas for these measures were applied correctly.

The low therms value was due to the Program's overestimation of therm savings for one large project[24]. This project accounted for 75 percent of program reported natural gas savings in 2006. Large projects can have a significant effect on the results because of the large fraction of energy savings they represent in the numerator and denominator of the adjustment factor equation (evaluation verified energy savings and program reported tracked gross energy savings in the case of the gross savings adjustment factor).

Table 3-1: Gross Savings Adjustment Factors by Sector

	kWh						kW						Therms					
		Gross Savings Adjustment Factor	90% Confidence Interval					Gross Savings Adjustment Factor	90% Confidence Interval					Gross Savings Adjustment Factor	90% Confidence Interval			
Segment	min n		Rel. Error (%)	+/-	Lower Bound	Upper Bound	min n		Rel. Error (%)	+/-	Lower Bound	Upper Bound	min n		Rel. Error (%)	+/-	Lower Bound	Upper Bound
New Const.	9	94%	10.4%	9.8%	84.3%	103.8%	8	88%	12.0%	10.6%	77.8%	98.9%	2	150%	173.0%	259.7%	0.0%	409.8%
Retrofit	38	106%	7.1%	7.6%	98.8%	114.0%	38	83%	5.4%	4.5%	78.2%	87.2%	4	63%	50.8%	32.1%	31.1%	95.2%
Schools	4	130%	39.2%	50.8%	78.9%	180.5%	4	167%	61.3%	102.6%	64.8%	270.0%	2	161%	3.6%	5.8%	154.9%	166.6%
SmartStart Overall	51	105%	6.1%	6.4%	98.2%	111.0%	50	86%	5.8%	5.0%	81.0%	90.9%	8	66%	45.7%	30.2%	35.9%	96.4%

Figure 3-1: Gross Savings Adjustment Factors by Sector



[23] All Lighting and unitary HVAC.

[24] This project's engineering reviewing incorporated an on-site visit. The review also resulted in additional untracked savings of 40,284 kWh.

The high gross savings adjustment factors for Schools are a result of underestimated savings for two large schools projects. The dramatically high results for Schools is included in the overall results, however the impact of a project on the adjustment factors for the overall program (total bars in the charts) is determined by the size of the project relative to all projects in the population. This is why the overall results tend to mirror the Retrofit sector that accounts for the vast majority of SmartStart tracking energy savings.

3.4 Attribution Factors by Sector

Table 3-2 and Figure 3-2 present the attribution factors for the 2006 SmartStart program year. The attribution factors for the program overall are 47 percent, 45 percent, and 19 percent for kWh, kW, and therms, respectively. Some level of free ridership should be expected for most programs; however the overall attribution results for SmartStart are low relative to other large scale nonresidential programs. It is important to note that this is the first time net energy savings have been addressed by NJCEP. These estimates would be expected to improve with program designs with the clear objective of minimizing free ridership.[25]

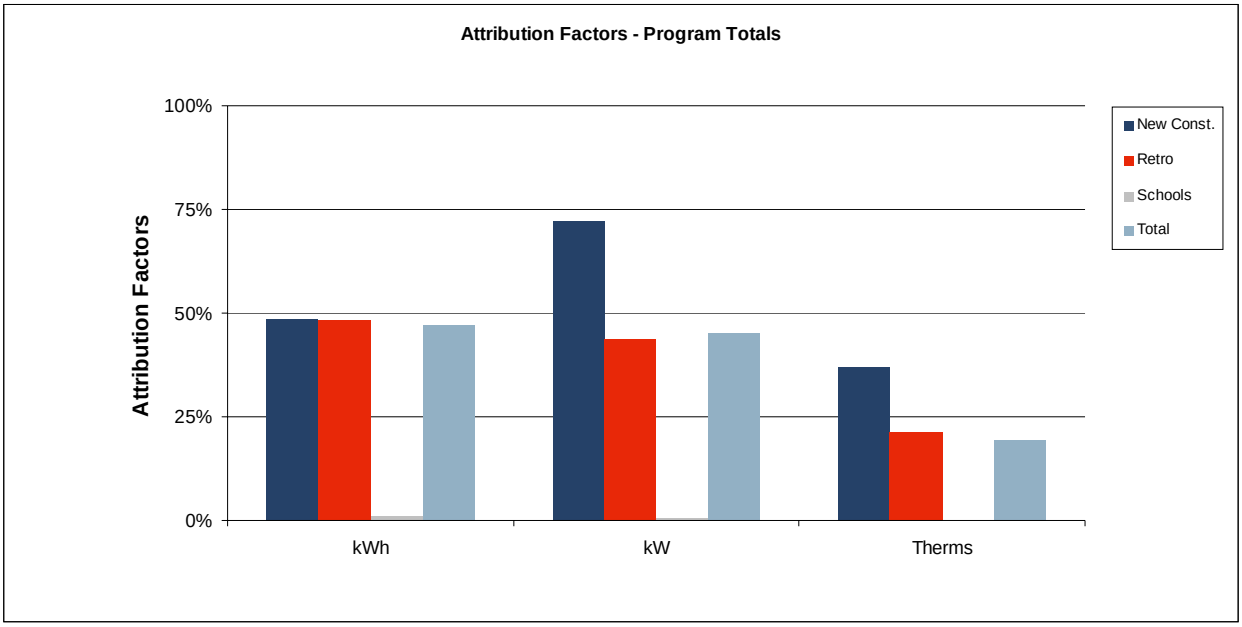
The therms adjustment factor for Schools is zero. This result is based on only three sample points. The Schools sector had low participation relative to the other sectors and therefore received a small allocation of sample. That is, Schools accounted for a very small fraction of program savings relative to Retrofit and New Construction so KEMA reviewed a small number of Schools projects compared to the other sectors.

Table 3-2: Attribution Adjustment Factors by Sector

	kWh						kW						Therms					
			90% Confidence Interval						90% Confidence Interval						90% Confidence Interval			
Segment	n	Attribution Adjustment Factor	Rel. Error (%)	+/-	Lower Bound	Upper Bound	n	Attribution Adjustment Factor	Rel. Error (%)	+/-	Lower Bound	Upper Bound	n	Attribution Adjustment Factor	Rel. Error (%)	+/-	Lower Bound	Upper Bound
New Const.	20	49%	81.2%	39.5%	9.1%	88.1%	17	72%	36.3%	26.1%	45.9%	98.1%	3	37%	173.1%	63.8%	0.0%	100.0%
Retrofit	145	48%	16.0%	7.7%	40.6%	56.0%	140	44%	29.4%	12.9%	30.9%	56.8%	18	21%	15.9%	3.4%	17.9%	24.8%
Schools	8	1%	194.9%	2.1%	0.0%	3.1%	9	1%	177.0%	1.2%	0.0%	1.9%	3	0%	<0.1%	<0.1%	0.0%	0.0%
SmartStart Overall	173	47%	19.1%	9.0%	38.2%	56.3%	166	45%	25.8%	11.7%	33.6%	57.0%	24	19%	22.6%	4.4%	15.0%	23.7%

[25] More detail discussion on attribution results is provided in Section 4.2.3APPENDIX B:.

Figure 3-2: Attribution Adjustment Factors by Sector



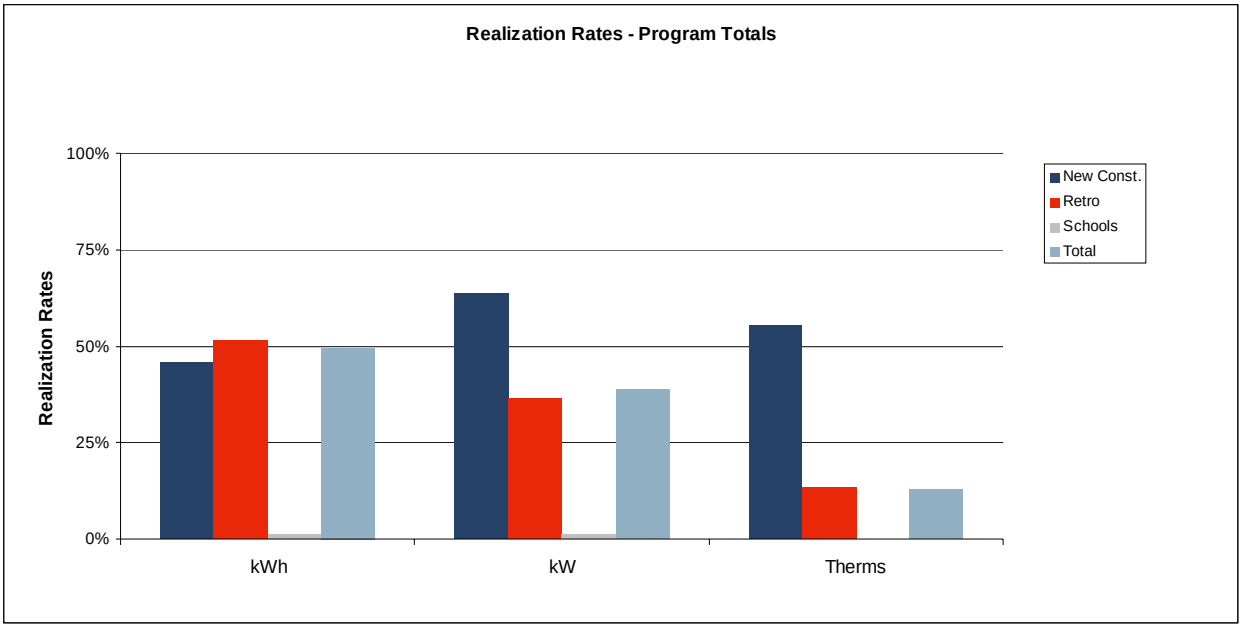
3.5 Realization Rates by Sector

Table 3-3 and Figure 3-3 present the realization rates for the 2006 SmartStart program year. The realization rates combine the gross savings adjustment factors and the attribution factors to adjust the tracking estimate of gross savings. The realization rates for the program overall are 49 percent, 39 percent, and 13 percent for kWh, kW, and therms, respectively. The standard errors for realization rate are very large for New Construction and Schools, due to the small sample of measures from these sectors.

Table 3-3: Realization Rates by Sector

	kWh						kW						Therms					
			90% Confidence Interval						90% Confidence Interval						90% Confidence Interval			
Segment	min n	Realization Rate	Rel. Error (%)	+/-	Lower Bound	Upper Bound	min n	Realization Rate	Rel. Error (%)	+/-	Lower Bound	Upper Bound	min n	Realization Rate	Rel. Error (%)	+/-	Lower Bound	Upper Bound
New Const.	9	46%	87.0%	39.8%	6.0%	85.5%	8	64%	40.6%	25.8%	37.8%	89.4%	2	55%	275.8%	152.5%	0.0%	207.8%
Retrofit	38	51%	17.8%	9.1%	42.2%	60.5%	38	36%	30.5%	11.0%	25.2%	47.3%	4	13%	54.5%	7.3%	6.1%	20.8%
Schools	4	1%	226.9%	3.1%	0.0%	4.5%	4	1%	214.8%	2.5%	0.0%	3.6%	2	0%	<0.1%	<0.1%	0.0%	0.0%
SmartStart Overall	51	49%	20.3%	10.0%	39.4%	59.5%	50	39%	26.8%	10.4%	28.5%	49.4%	8	13%	51.9%	6.6%	6.2%	19.5%

Figure 3-3: Realization Rates by Sector



3.6 Evaluation Verified Energy Impacts

Table 3-4 shows the program tracked, evaluation verified gross and net energy impacts for the 2006 SmartStart Program year based on the data provided to KEMA.

Table 3-4: Program Year 2006 Gross and Net Energy Impacts

	kWh			kW			Therms		
Sector	Gross Reported Savings	Verified Savings	Net Savings	Gross Reported Savings	Verified Savings	Net Savings	Gross Reported Savings	Verified Savings	Net Savings
New Construction	41,189,535	43,073,211	20,359,904	10,160	8,729	3,954	1,335,803	883,526	171,137
Retrofit	6,828,544	7,140,826	3,375,335	1,228	1,055	478	37,839	25,027	4,848
Schools	656,219	686,229	324,368	253	217	98	23,428	15,496	3,001
Total	48,674,298	50,900,267	24,059,607	11,641	10,001	4,531	1,397,070	924,049	178,986

3.7 Engineering Verification Findings

The engineering review determined the verified gross savings for each measure reviewed in the engineering sample.[26] For one of the measures, an engineer conducted an on-site inspection of the installed equipment. The engineer used information provided by the utilities in the measure

[26] All measures that are reviewed by an engineer on the evaluation team are considered part of the engineering sample.

paperwork and savings calculation spreadsheets, as well as the on-site inspection to determine whether the reported savings were reasonable.

The review had two main components:

1. *Evaluation of the calculation parameters.* The engineer reviewed the parameters used in the energy savings equations to determine whether they were reasonable. Where possible, parameters (i.e., motor power, operating hours) were verified through information gathered from manufacturer data. Other parameters were verified using secondary sources (i.e., standard light fixture wattages, cooling degree days, etc…). This step applied primarily to the custom measures and not the prescriptive measures.

2. *Evaluation of the calculation method.* The engineer reviewed the method used to calculate the energy savings. Most energy savings estimates can be calculated in a variety of ways and still produce reasonable, though not equal, energy savings values. The engineer reviewed the method used for each measure to ensure that it followed the general conventions of energy savings calculations and could produce a reasonably accurate result. For prescriptive measures, the engineer verified that the appropriate Protocol was correctly applied to the measure parameters.

For some measures, the engineering review process produced an energy savings estimate that differed from the estimate reported by the program. The following three tables show the count, energy savings and percent savings of the adjusted projects for the overall SmartStart Program[27]. The percentage in the tables is not the amount adjusted, but is the percent of tracking savings in the engineering review represented by projects which were adjusted.

Table 3-5: Discrepancy Count and Percent Savings, kWh Savings

Percent Change (by number of measures)	kWh								
	Count			Reported Savings			% Total Savings		
	V>R	V<R	Total	V>R	V<R	Total	V>R	V<R	Total
10% to 20%	2	0	2	60,170	0	60,170	1%	0%	1%
20% to 30%	2	2	4	437,459	1,633,490	2,070,949	7%	28%	35%
30% to 50%	0	1	1	0	7,284	7,284	0%	0%	0%
50% to 100%	7	0	7	93,621	0	93,621	2%	0%	2%
100% or Greater	0	0	0	0	0	0	0%	0%	0%
Verified shows savings (+ or -) where reported = 0	4	1	5	0	0	0	0%	0%	0%
Total	15	4	19	591,251	1,640,774	2,232,025	10%	28%	38%
Notes: V = Verified; R=Reported									

[27] For purposes of creating these tables, KEMA only included projects in which the program tracked and evaluation estimated energy savings differed by greater than 10 percent.

Table 3-6: Discrepancy Count and Percent Savings, kW Savings

Percent Change (by number of measures)	kW								
	Count			Reported Savings			% Total Savings		
	V>R	V<R	Total	V>R	V<R	Total	V>R	V<R	Total
10% to 20%	0	5	5	0	23	23	0%	2%	2%
20% to 30%	0	16	16	0	256	256	0%	26%	26%
30% to 50%	0	4	4	0	107	107	0%	11%	11%
50% to 100%	1	1	2	0	29	30	0%	3%	3%
100% or Greater	2	0	2	24	0	24	2%	0%	2%
Verified shows savings (+ or -) where reported = 0	5	0	5	0	0	0	0%	0%	0%
Total	8	26	34	24	416	440	2%	41%	44%
Notes: V = Verified; R=Reported									

Table 3-7: Discrepancy Count and Percent Savings, Therm Savings

Percent Change (by number of measures)	Therms								
	Count			Reported Savings			% Total Savings		
	V>R	V<R	Total	V>R	V<R	Total	V>R	V<R	Total
10% to 20%	0	0	0	0	0	0	0%	0%	0%
20% to 30%	0	0	0	0	0	0	0%	0%	0%
30% to 50%	0	0	0	0	0	0	0%	0%	0%
50% to 100%	2	1	3	6,877	1,048,760	1,055,637	1%	82%	82%
100% or Greater	1	0	1	18	0	18	0%	0%	0%
Verified shows savings (+ or -) where reported = 0	0	0	0	0	0	0	0%	0%	0%
Total	3	1	4	6,895	1,048,760	1,055,655	1%	82%	82%
Notes: V = Verified; R=Reported									

3.8 Recommendations

This section contains KEMA's recommendations to the Program based on the results of the impact evaluation. These recommendations are based on a retrospective assessment of program year 2006 accomplishments. KEMA understands that since 2006 the management of the SmartStart Program has been transferred from the utilities to the third-party Market Managers. Evaluation of the current programs was beyond the scope of this evaluation; however lessons learned from the program year 2006 may be useful to increase program effectiveness and energy savings impacts going-forward.

RECOMMENDATION #1

KEMA recommends the Program consider using attribution factors based on evaluation research to determine net energy impacts rather than the existing assumption that attribution is 100 percent. In light of the transition of the Program from the seven electric and natural gas utilities to the statewide Market Managers in April 2007, we do not recommend the use of the adjustment factors developed for this retrospective look at program year 2006 accomplishments.

For the purposes of program planning it would be appropriate for the Program to develop estimates of attribution based on current Program procedures and comparisons with attribution results for similar comprehensive statewide business programs.

RECOMMENDATION #2

KEMA recommends NJCEP conduct an impact evaluation covering the first three years (April 2007 through December 2009) of program performance under the Market Manager model. The results of this future evaluation should be used to assess the net achievements of the current program and be used for program planning to mitigate the effects of free ridership. An impact evaluation covering the first three years of program performance would also provide OCE and the Program with baseline data to measure improvements in gross and net energy impacts.

RECOMMENDATION #3

If OCE decides to include program attribution in its assessment of net energy impacts of the Program, KEMA recommends the Program consider incorporating strategies into the program design to mitigate the effects of free ridership. Potential strategies the Program could consider include:

1.) Increase promotion of the next generation of high efficiency equipment;

2.) Decrease promotion of market accepted high efficiency equipment;

3.) Limit repeat program participation (by the same customer) for the same technology; and

4.) Pre-screen customers for potential free ridership.

KEMA acknowledges that some of these strategies are likely part of the Market Manager's current program design.

RECOMMENDATION #4

Consistent and complete program tracking data is a fundamental requirement for a statewide energy efficiency program such as SmartStart. Program tracking data can be used for program operations, program planning, and reporting and verification of accomplishments. KEMA understands that OCE has implemented a statewide tracking database and process for archiving hard-copy project documentation subsequent to the time period covered by this evaluation (program year 2006).

KEMA recommends the Program consider implementing electronic database and hard-copy (custom projects) quality assurance procedures to ensure the newly created database is being used to its full potential. Simple data entry errors can have significant effects on the claimed energy savings, particularly for large projects. For example, one missing zero at the end of an energy savings database entry could be the difference between 1,000,000 kWh and 100,000 kWh of energy savings attributable to the Program.

RECOMMENDATION #5

KEMA recommends the Program consider reviewing the prescriptive savings calculation spreadsheets to ensure the Protocol calculation methods are being used correctly. These calculations could also be incorporated into the statewide tracking database to further reduce the potential for errors.

4. Approach

This section discusses the impact evaluation approach, including descriptions of the adjustment factors used in the analysis, the reporting format, and the sample design.

4.1 Approach and Definitions

4.1.1 Custom and Prescriptive Measures

Energy efficiency measures installed with the assistance of the Program and included in this evaluation were groups into the categories of custom and prescriptive measures. **Custom measures** allow customers to qualify for and receive an incentive for energy efficiency measures for which there is not a predefined prescriptive calculation approach in the Protocols. Custom measures are site and end-use specific, and require a detailed analysis to qualify for incentives. Measures generally fall into the custom measure category for one or more of the following reasons:

- The measure is a non-standard or unusual energy efficiency measure.
- The measure is highly site-specific, where energy savings vary dramatically between sites, even at a given product type and size.
- The measure is very large, warranting extra effort to provide an accurate energy savings estimate and appropriate incentive amount.
- The customer or contractor who fills out the application is unlikely to know the needed information to determine energy savings for a given measure.
- The customer applying for a certain type of measure would likely have many other "low-hanging-fruit" type energy savings opportunities that a custom measure may identify and encompass.

Prescriptive measures provide pre-determined incentives for various types of qualifying equipment. The savings for these measures are determined using the predefined prescriptive calculation approach in the Protocols.

4.1.2 Adjustment Factors Defined

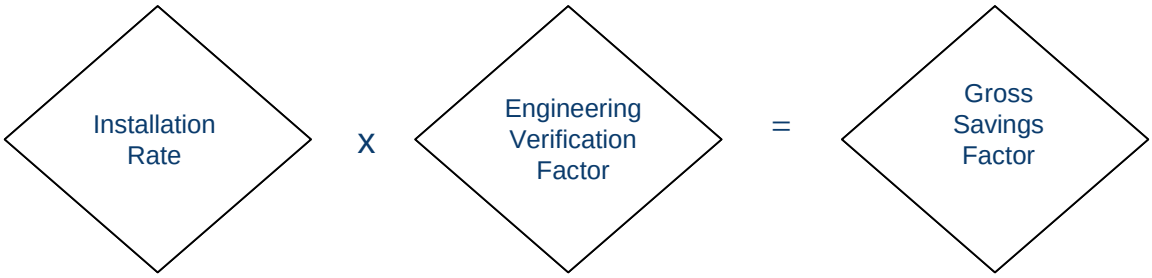
The adjustment factors estimated from the data collection and analysis are as follows:

- **Installation rate:** This factor corresponds to the fraction of measures that were installed. Each measure is assigned a binary factor that identifies whether it was installed or not installed. Adjustments to the number of units installed for a particular measure are included in the engineering verification factor, not in the installation rate.

- **Engineering verification factor:** This is the ratio of the verified gross savings to the tracking estimate of gross savings for installed measures. The engineering verification factor includes corrections to the numbers of units installed, changes in operating hours, changes in operating levels, etc.

- **Gross savings adjustment factor:** This factor combines the installation rate and the engineering verification factor. It corresponds to the ratio of the verified gross savings to the tracking estimate of savings. Figure 4-1 shows how the installation rate and engineering verification factor are combined to produce the gross savings adjustment factor.

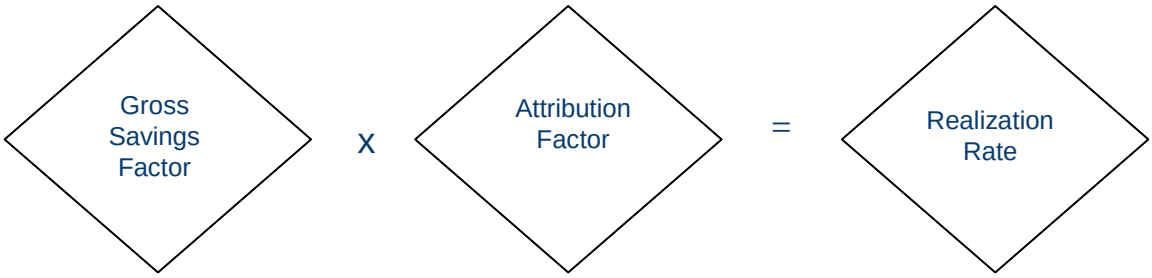
Figure 4-1: Gross Savings Adjustment Factor Calculation



- **Attribution factors:** This factor adjusts verified gross savings for program attribution. It is the estimated proportion of verified gross savings attributable to SmartStart. It corresponds to the ratio of net savings to verified gross savings. The attribution factor represents the program's influence on the timing, quantity, and efficiency of the measure installation. "Attributable to the Program" means that the installation of the energy efficient equipment and the resulting energy savings would not have occurred without the Program.

- **Realization rate:** This factor combines the gross savings adjustment factor and the attribution factor as shown in Figure 4-2. It corresponds to the ratio of the net savings to the tracking estimate of savings.

Figure 4-2: Realization Rate Calculation



4.2 Sample Design for SmartStart Evaluation

The purpose of this evaluation was to assess past energy savings due to the SmartStart program. There were two components to the evaluation's data collection: a telephone survey of 299 program participants and an engineering review of 63 installed measures which included one on-site inspection. These two components were sampled from the same frame, but the two samples were drawn independently.

The work plan called for a telephone survey of 200 participants, but KEMA increased the sample to 299 in order to cover the population more thoroughly and improve the precision of the energy savings adjustment factors. One limiting factor to the precision of estimates with finite populations is the inability of researchers to force respondents to participate in the research study, if program participants that installed large projects refuse or are unable to participate in the study the precision of the estimates decrease because a large fraction of energy savings is not included in the sample.

4.2.1 Stratification of Sample Frame

KEMA originally planned to determine energy impacts for all of the SmartStart Program years from 2001-2006. Unfortunately, program tracking data was not consistently collected across program years and participating utilities. After consultation, we limited our evaluation to a single year (2006). This is discussed at length in the revised work plan (dated May 1, 2008).

KEMA assembled a tracking database for 2006 from electronic and paper records received or retrieved in-person from the participating utilities. The program participant database included 1,590 unique measures receiving incentives. Of these, 25 had incomplete information (lack of contact information and some mistaken incentive amounts) and had to be excluded. The population of the sample frame was 1,565 unique incentives. This sample frame does not

represent all of the 2006 program year savings as reported in Table 2-1 it only contains the data provided to KEMA by the utilities.

In order to accurately and efficiently assess the contributions of the many different energy efficiency measures installed under the SmartStart program, we categorized the set of 1,565 measures rebated by the SmartStart program in the year 2006 into different strata. When a diverse population can be grouped into relatively homogeneous categories, stratifying the sample means that when we extrapolate from the survey sample back to the wider population, our estimates will be more precise, with less uncertainty, than estimates from a simple random sample.

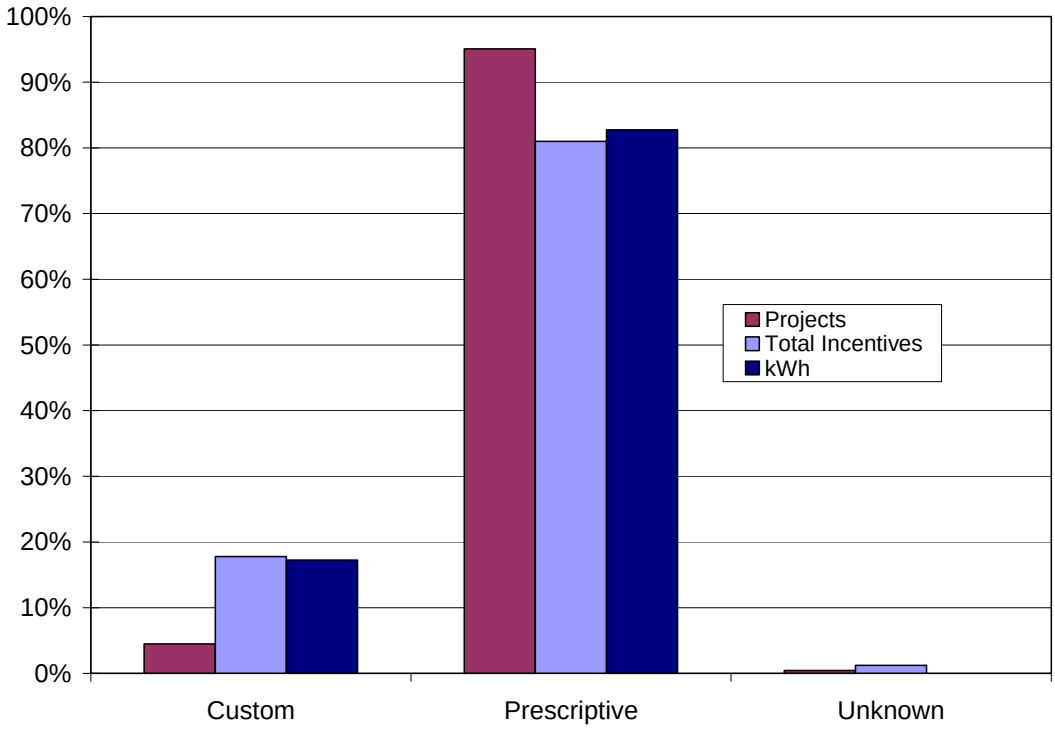
The population of 1,565 unique measures that were rebated in 2006 was stratified on four variables:

- Measure type (prescriptive and custom projects),
- Sector (New Construction, Retrofit, Schools),
- Measure size (incentive amount), and
- Energy unit (kWh, kW and therms).

a. Measure Type

SmartStart incentives were broadly grouped into two basic categories: Prescriptive and Custom Measures. Prescriptive incentives were issued according to a pre-determined list, per-unit as in per replacement lighting fixture, or per-square-foot of new space. Custom incentives were specific to the facility in question, usually determined by program personnel, based on a payback formula using information from site-visits, plan review and consultation. As can be seen in Figure 4-3, custom incentives accounted for less than 5 percent of the individual measures but nearly 20 percent of the incentive dollars paid out. The dollar value of the incentives closely tracked the estimated kWh saved, according to SmartStart's current methods. We also included an "unknown" measure type because there were seven unique incentives that were not clearly distinguished as custom or prescriptive in the tracking data, totaling over $115,000.

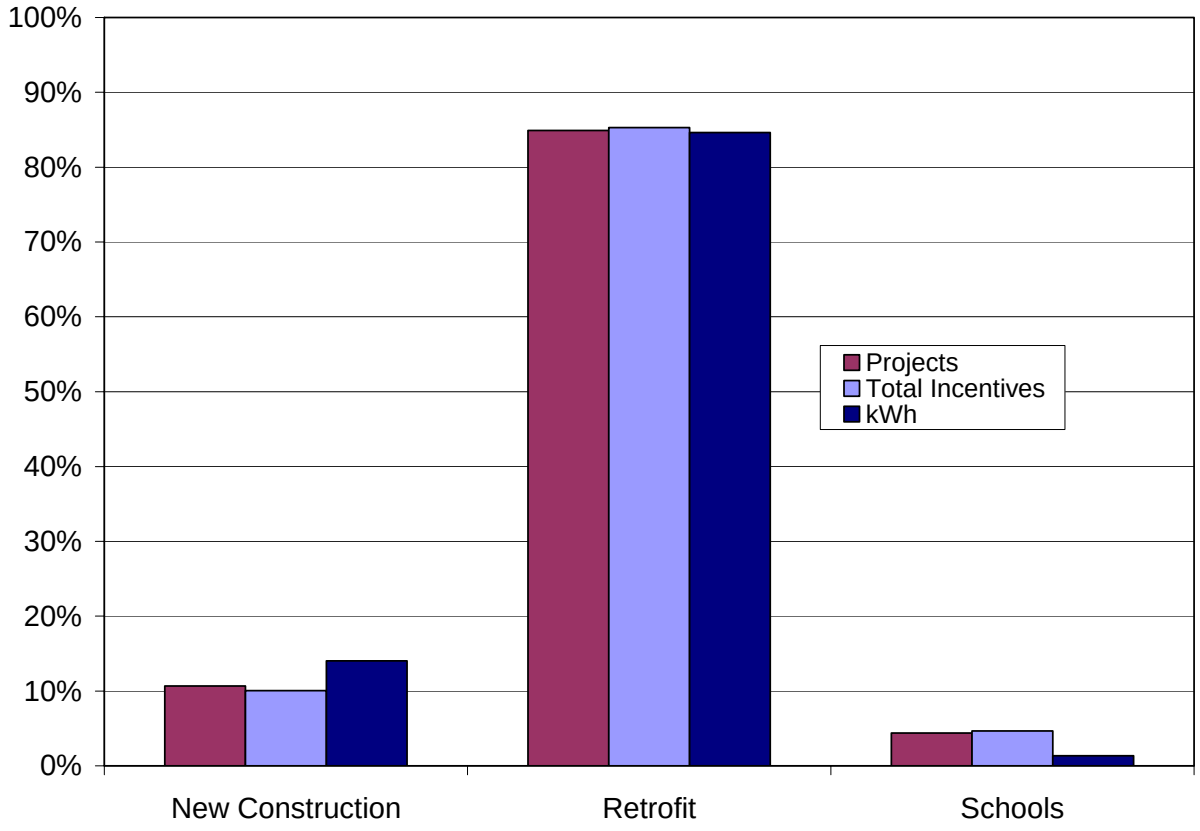
Figure 4-3: Measures by Measure Type



b. Sector

In 2006, SmartStart also grouped measures into categories as follows: New Construction, Retrofit, and Schools. Table 4-2 shows how the 1,565 measures and their savings were distributed among the three groupings. New construction accounted for 10 percent of the measures but 14 percent of the kWh savings. Schools buildings accounted for less than five percent of the measures and incentive payments and only 1.3 percent of the kWh savings.

Figure 4-4: Measures by Sector



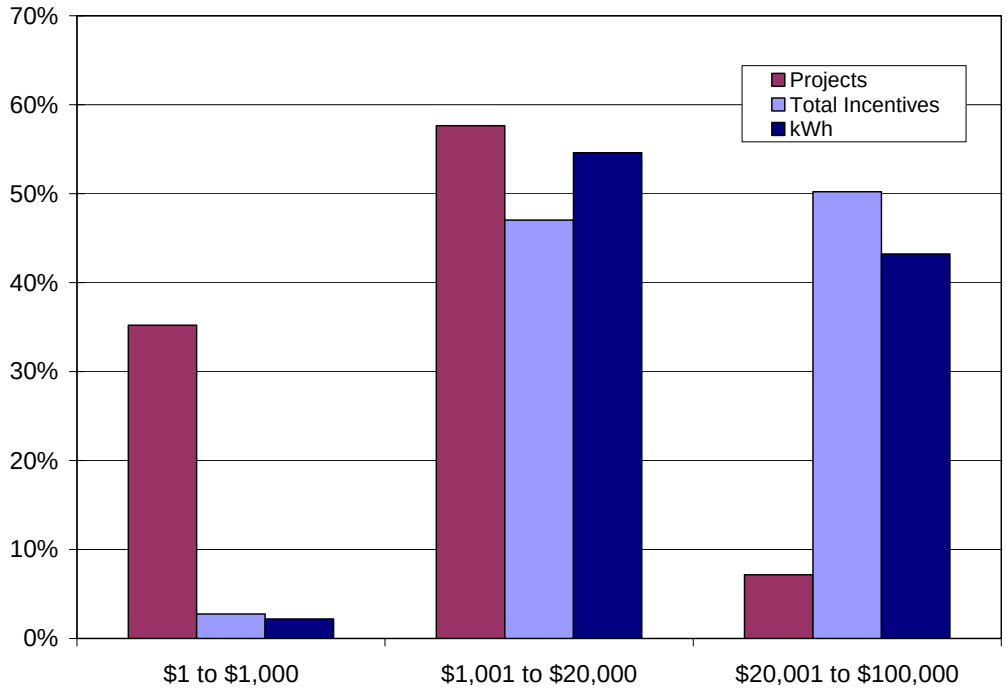
c. Measure Size

Because the measure size varies tremendously, it was important to stratify on this variable in order to ensure adequate coverage of the more common small measures and the more rare large ones. If left entirely to chance (simple random sample), the sample would likely be comprised of the more common small measures and omit the larger measures. There were many ways to capture the idea of measure size given that measures include different kinds and quantities of measures in different kinds of facilities.

KEMA used the size of the incentive payments as a proxy for measure size. It reduces the many size-related variables to dollar units. This allowed us to evaluate savings and costs for measures receiving a few hundred dollars in incentives to ones receiving up to $100,000. As can be seen in Figure 4-5, a third of measures received under $1,000 from the SmartStart program and accounted for less than 3 percent of the measure dollars and kWh savings. The largest measures – about 7 percent of the total – accounted for half of the incentive dollars, and

slightly less than half of the savings. It is important to stratify in proportion to either dollars or kWh savings to ensure the evaluate attempts to include the largest projects in the evaluation.

Figure 4-5: Measures by Size



d. Impact on Gas Usage

New Jersey's SmartStart program offers incentives for measures impacting gas and electric usage. As only about 7.5 percent of measures had an impact on gas usage, stratifying on this variable ensures the evaluation attempts to include the gas projects in the evaluation. Similar to measure size, if left entirely to chance (simple random sample), the sample would likely be comprised almost entirely of electric measures and omit the gas measures. Table 4-1 shows the relevant details of measures with no therm savings vs. those with any therm savings, and the subset of measures with both therm and kWh savings attributed to them.

Table 4-1: Measures With/Without Therm Savings

		Measures with No Therm Savings	Measures with Therm Savings	(of those) Measures with Both kWh and Therm Savings
Number of Projects	**Savings**	1,448	117	4
	Percent	92.5%	7.5%	0.3%
Total Incentives	**Dollars**	$8,747,513	$745,686	$107,872
	Percent	92.3%	7.9%	1.1%
kWh	**Savings**	48,577,985	96,312	96,312
	Percent	99.8%	0.2%	0.2%
kW	**Savings**	11,554	87	87
	Percent	99.3%	0.7%	0.7%
Therms	**Savings**	0	1,397,070	6,700
	Percent	0.0%	100.0%	0.5%

4.2.2 Distribution of Incentives Among Stratification Variables

The distribution of measures across the components of the sample stratification strata is shown in Table 4-2.

Table 4-2: Distribution of Projects

		Custom		Prescriptive		Unknown
Sector	**Incentive Amount**	**Therm Savings**	**No Therm Savings**	**Therm Savings**	**No Therm Savings**	**No Therm Savings**
New Construction	$1 to $1,000	0	1	24	52	0
	$1,001 to $20,000	1	4	11	62	0
	$20,001 to $100,000	1	2	0	9	0
	Total	**2**	**7**	**35**	**123**	**0**
Retrofit	$1 to $1,000	0	2	40	407	2
	$1,001 to $20,000	3	34	22	722	4
	$20,001 to $100,000	3	15	2	72	1
	Total	**6**	**51**	**64**	**1,201**	**7**
Schools	$1 to $1,000	0	0	1	22	0
	$1,001 to $20,000	1	0	5	33	0
	$20,001 to $100,000	3	0	0	4	0
	Total	**4**	**0**	**6**	**59**	**0**
All Sectors	**Total**	**12**	**58**	**105**	**1,383**	**7**

4.2.3 Stratification of Sample

Altogether, there were 1565 unique records with contact information and the require measure information (e.g. reported energy savings, measure description, quantity installed, etc.). If each of these went to a single unique entity, we would simply perform a stratified random sample for

each of the strata in Table 4-2. However, the 1565 unique measures reporting in the tracking databases were installed by 831 unique customers in the database. Of these, 617 received exactly one incentive, whereas the remaining 214 received on average 4.4 incentives in 2006. If we telephoned these customers according to a stratified random sample, we would likely choose some customers more than once, for more than one of their incentives. This is not a problem statistically, but raised concerns of customer burden and fatigue.

To reduce customer burden, we used a two-stage sampling procedure. First, we selected unique customers according to the strata above. Among these customers, we selected among their various measures randomly with a probability of choosing each one proportionate to the size of the incentives. This ensured that both groups (single measure participants and multiple measure participants) were sampled in part in proportion to the size of the incentive, and that our analysis was both efficient and effective for rare and common categories alike.

The final sampling plan and results are shown in Table 4-3: for each of the 31 strata, the first four columns describe the measures in that stratum, and the right-most three columns describe the sample design and achievement. For 21 of the 31 strata the target is “census” which means that we attempted to interview everyone in the stratum.

Table 4-3: Strata Targets

	Measure Type	Therm Savings?	Incentive Payment (Up To)	Stratum Number	Number of Projects	Survey Targets	Survey Achieved Complete Totals	Plan Review Complete Totals
New Construction	Custom	Therm Savings	$20,000	1	1	Census	0	-
			$100,000	2	1	Census	0	-
		No Therm Savings	$1,000	3	1	Census	0	-
			$20,000	4	4	Census	2	-
			$100,000	5	2	Census	2	-
	Prescrip-tive	Therm Savings	$1,000	6	24	1	1	1
			$20,000	7	11	4	3	1
		No Therm Savings	$1,000	8	52	1	1	1
			$20,000	9	62	Census	15	4
			$100,000	10	9	Census	2	4
Retrofit	Custom	Therm Savings	$20,000	11	3	Census	3	-
			$100,000	12	3	Census	2	2
		No Therm Savings	$1,000	13	2	Census	0	-
			$20,000	14	34	Census	6	-
			$100,000	15	15	Census	7	1
	Prescrip-tive	Therm Savings	$1,000	16	40	2	7	1
			$20,000	17	22	7	7	1
			$100,000	18	2	Census	1	-
		No Therm Savings	$1,000	19	407	9	12	1
			$20,000	20	722	200	187	25
			$100,000	21	72	Census	26	14
	Unknown	No Therm Savings	$1,000	22	2	Census	1	1
			$20,000	23	4	Census	2	-
			$100,000	24	1	Census	1	-
Schools	Custom	Therm Savings	$20,000	25	1	Census	0	1
			$100,000	26	3	Census	1	-
	Prescrip-tive	Therm Savings	$1,000	27	1	Census	0	1
			$20,000	28	5	Census	2	1
		No Therm Savings	$1,000	29	22	1	3	1
			$20,000	30	33	4	5	1
			$100,000	31	4	Census	0	1
Totals:					**1,565**	**300**	**299**	**63**

APPENDIX A: Attribution Analysis Methodology

This appendix provides a detailed explanation of the program attribution methodology used in this impact evaluation.

OVERVIEW OF APPROACH

The attribution analysis uses data collected from the engineering review, on-site visits, and participant surveys. These data are used to calculate the following adjustment factors:

Installation rate: This factor corresponds to the fraction of measures that were installed. Each measure is assigned a binary factor that identifies whether it was installed or not installed. Adjustments to the number of units installed for a particular measure are included in the engineering verification factor, not in the installation rate.

Engineering verification factor: This is the ratio of the verified gross savings to the tracking estimate of gross savings for installed measures. The engineering verification factor includes corrections to the numbers of units installed, changes in operating hours, changes in operating levels, etc.

Attribution factors: These factors are used to determine the proportion of the verified gross savings attributable to SmartStart. The attribution factors are determined from the participant's responses to a battery of survey questions designed to determine how influential SmartStart was in the decision to install a particular measure.

The three attribution factors that affect the final net savings are timing, efficiency, and quantity attribution. All three attribution factors are based on responses to the attribution questions in the impact evaluation survey. The following is a brief description of each factor:

Timing attribution, A_T: This measures the effect the program had on *when* the equipment was installed. The timing attribution is a linear function of the Acceleration Period, m_a, which corresponds to the number of months between when the equipment was actually installed and when it would have been installed in the absence of the program. For respondents who say they would have installed at the same time or earlier without the program, $m_a = 0$. For those who say they would have installed later, m_a is the number of months later they say they would have installed, up to a maximum of 48.

Efficiency attribution, A_E: These measures the effect the program had on the efficiency of the equipment installed. The efficiency attribution measures the proportion of savings

attributable to the program for increasing the efficiency of the equipment above what would have been installed otherwise.

Quantity attribution, A_Q: These measures the effect the program had on the quantity of the equipment installed. The quantity attribution measures the proportion of savings attributable to the program for increasing the quantity of equipment above what would have been installed otherwise.

The compliment of attribution is free-ridership. Attribution measures the portion of the savings that result because of the actions of the program. Free-ridership measures the portion of the savings that would have happened in the absence of the program. The free-ridership equivalents of the attribution factors are used to determine program net savings. They are:

Timing free-ridership, f_T: The timing free-ridership is also a linear function of the Acceleration Period, m_a, defined under Timing Attribution above.

Efficiency free-ridership, f_E: This is the fraction of verified gross installed (VGI) savings per unit that would have occurred without the program (free rider efficiency increment). This value is also equivalent to the factor E used in previous attribution analysis reports.

Quantity free-ridership, f_Q: This is the fraction of installed units that would have been installed without the program (free rider quantity factor). This value is also equivalent to the factor Q used in previous attribution analysis reports.

The free-ridership values are easily calculated from the attribution factors.

$$f_T = 1 - A_T$$

$$f_E = 1 – A_E$$

$$f_Q = 1 – A_Q$$

ATTRIBUTION ANALYSIS

The impact evaluation starts with the program-reported gross savings for a measure. This is the savings value reported by the program in the program tracking database. The verified gross savings are determined by multiplying the tracking savings by the installation rate and the engineering verification factor. The combined installation rate and engineering verification factor

has also been called the gross savings adjustment factor. These equations are illustrated in Figure A-1 and Figure A-2.

Figure A-1: Gross Savings Adjustment Factor Calculation

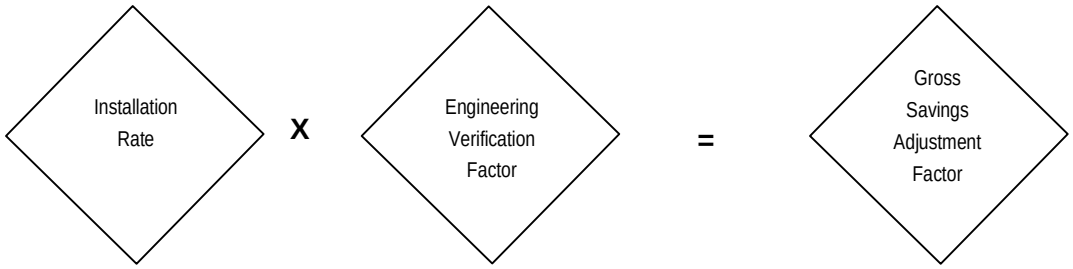
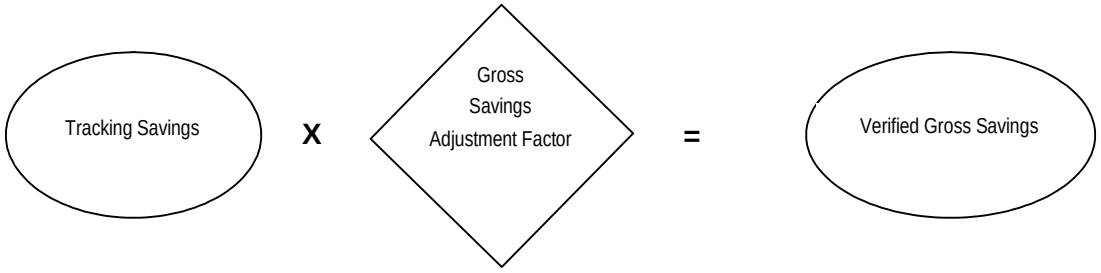
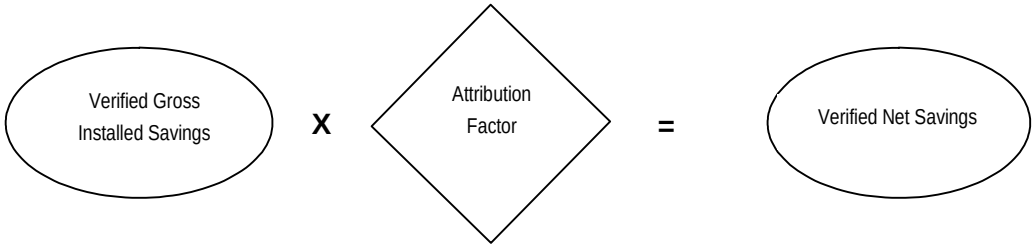


Figure A-2: Verified Gross Savings Calculation



As shown in Figure A-3, the verified net savings for each measure are equal to the VGI savings multiplied by the overall Attribution Factor, A.

Figure A-3: Verified Net Savings Calculation



The overall attribution factor is a function of the Simple Program Attribution (SPA) and the timing free-ridership. The SPA is the fraction of VGI savings that are attributable to the program and is a function of the efficiency free-ridership and the quantity free-ridership.

The fraction of VGI savings that would have occurred *without* the program is the product of the fraction of units that would have been installed without the program, f_Q, and the fractional unit savings that these units would have had without the program, f_E.

$f_{QE} = f_Q f_E$

For example, if two-thirds as many units would have been installed without the program (f_Q = 2/3), and the savings per unit would have been only half as much (f_E = 1/2), the portion of the savings that would have occurred without the program would be

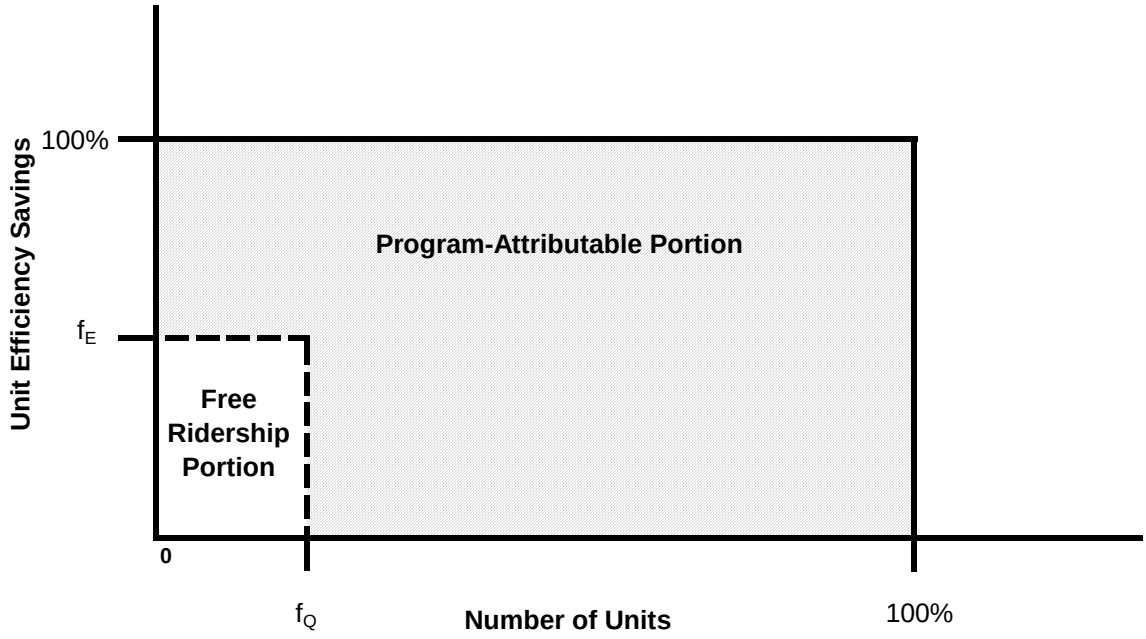
f_{QE} = (2/3) x (1/2) = 1/3.

The SPA is the complement of this free rider portion.

SPA = 1-f_{QE} = 1- f_Q f_E

The relationship is illustrated in Figure A-4.

Figure A-4: Graphical Derivation of the SPA Equation



The timing free-ridership is calculated from the acceleration period using

$f_T = 1 – m_a/48$.

The overall attribution factor is

$A = 1 – f_Q f_E f_T$

Thus, if the measure was accelerated by more than 48 months, the no-program timing factor f_T is 0 and the attribution is 1, regardless of f_Q and f_E. If the measure was not accelerated at all, f_T = 1, and the simple attribution is the final attribution, A = SPA.

The net savings can be calculated

First-year net savings = VGI Savings * $A_{historic}$

DETERMINING ATTRIBUTION PARAMETERS

The attribution factors defined in the previous section are determined from the participant responses gathered during the survey. This section provides an overview of the survey data and how it is used to determine each attribution factor. It also includes more detailed sections for each factor that show exactly how all survey responses are handled.

General procedure

This section provides an overview of the attribution factors and how they are determined.

Timing attribution, A_T: The timing attribution is determined directly from the acceleration period, m_a, which is in turn provided directly by the respondent. The timing attribution is equal to $A_T = m_a/48$ for values of m_a less than or equal to 48. There is no timing attribution effect for values of m_a greater than 48; in those instances we assume that the measure would never have been installed without the influence of the program.

Efficiency attribution, A_E: The efficiency attribution is based on the answers to questions DAT2a and DAT2b as shown in Table A-1. Respondents who indicate that they would have installed a lesser-efficient piece of equipment in the absence of the program are asked what efficiency they would have installed instead. An efficiency attribution value is assigned based on the response.

Table A-1: Efficiency Attribution Assignments

Efficiency That Would Have Been Installed without Focus		
Coarse Cut (DAT2a)	**Finer Cut (DAT2b)**	**Efficiency Attribution, E**
Same	*NA*	0%
Lesser	Standard efficiency or according to code	100%
	Slightly higher than standard efficiency	70%
	Between standard efficiency and the efficiency that was installed	50%
	Slightly lower than the high efficiency that was installed	30%
	Don't Know/Refused	Avg of above cases for sector
Greater	*NA*	0%
Don't Know/Refused	*NA*	Avg of all respondents for sector

Quantity attribution, A_Q: The quantity attribution is based on the percent increase in quantity caused by the program, which is in turn provided directly by the respondent. The quantity attribution is equal to A_Q = Inc / (Inc + 100%).

The next few sections deal with determining the timing, efficiency, and quantity attributions on a more detailed level.

Detailed assignments

This section gives a detailed accounting of how the attribution factors are determined from the survey responses.

Timing

The timing attribution, A_T, is determined from the first set of attribution survey questions. These questions are used to determine whether or not SmartStart accelerated implementation of a measure or caused it to be implemented before it would have been without the program. The two relevant questions are DAT1a and DAT1b.

DAT1a: "If SmartStart did not exist, how different would the timing of the installation have been? Would you say you would have installed [equipment type] at the same time, earlier, later, or never?"

DAT1b: "Approximately how many months later?" (DAT1b is only asked if DAT1a is "Later.")

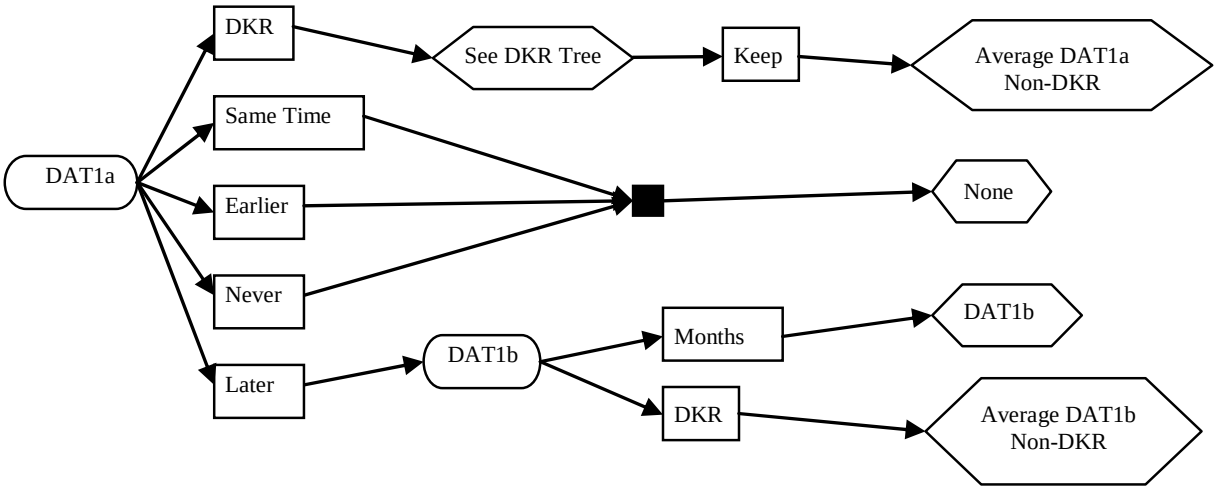
Note that these questions ask about the timing of installing equipment, not installation of efficient equipment in particular. For example, if the measure was replacement of a high-efficiency boiler, the question asks when the boiler would have been replaced without SmartStart. Engineers conducting the interviews are trained to ensure clarity for these

questions. Future refinements of the questionnaire will explore further improvements to the accuracy of the timing reports.

Determination of the Acceleration Period

Figure A-5 shows a decision tree for DAT1a and DAT1b. In the decision tree, "DKR" refers to "Don't Know" and "Refused."

Figure A-5: Decision Tree for the Acceleration Period



The measure is considered accelerated if the respondent indicates that the measure would have been installed less than 4 years later without the influence of SmartStart. The acceleration period is determined based on the answer to DAT1b. If the respondent is unable to answer DAT1b, the measure is assigned the average acceleration period across all accelerated measures in the same sector.

If the respondent answers DAT1a with Earlier or Same Time then there is no acceleration period. If the respondent answers DAT1a with Never and the Quantity and Efficiency sections apply to the measure then the survey skips to the next section and there is no acceleration period. If the respondent answers DAT1a with Don't Know or Refused but does provide answers to inform the Quantity and Efficiency Attributions then the measure is assigned the average Acceleration Attribution for all measures in the same sector.

Efficiency

Efficiency Attribution, A_E, gives the program credit for increasing the efficiency of a measure above what would have been installed in the absence of the program. The two relevant questions are DAT2a and DAT2b.

DAT2a: "If SmartStart did not exist, would you say you would have installed [equipment type] of the same efficiency, lesser efficiency, or greater efficiency?"

DAT2b: "If SmartStart did not exist, would you have installed [equipment type] that was "standard efficiency on the market at that time," "slightly higher than standard efficiency," "between standard efficiency and the efficiency that you installed," or "slightly lower than the high efficiency that was installed?" (DAT2b is only asked if DAT2a is "Lesser.")

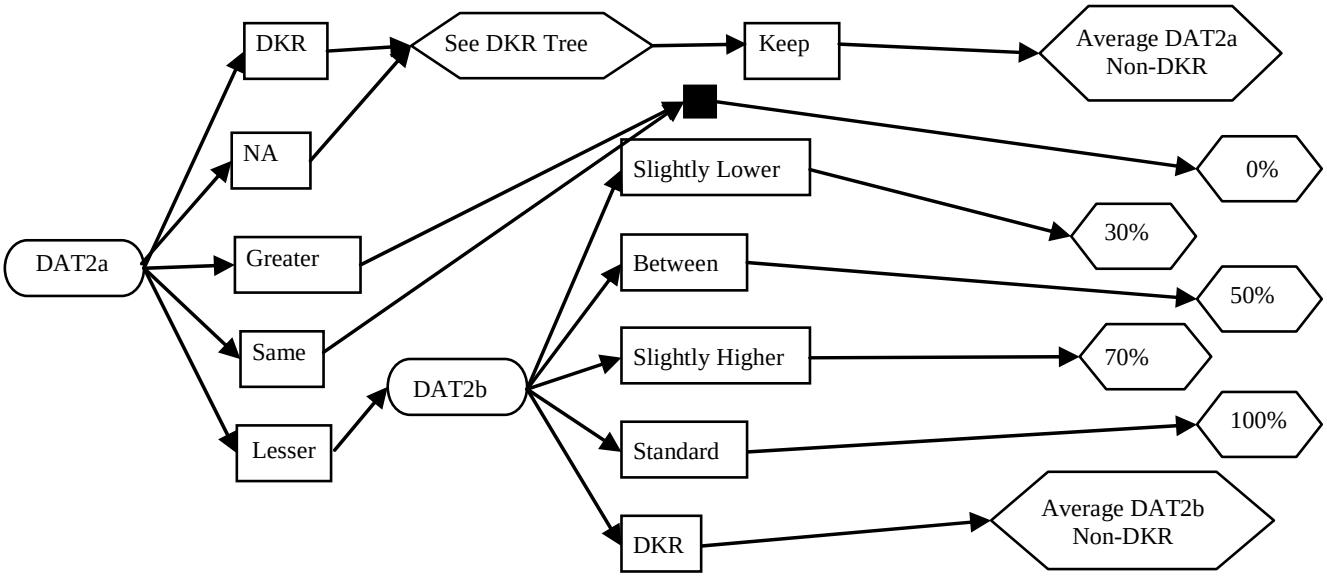
The program receives nonzero Efficiency Attribution if the respondent indicates that they would have installed a less efficient measure without the influence of SmartStart. The magnitude of the Efficiency Attribution is determined based on the answer to DAT2b, as shown in Table A-2. Figure A-6 shows the corresponding decision tree for DAT2a and DAT2b.

Table A-2: Efficiency Attribution Assignments

Efficiency That Would Have Been Installed without Focus		
Coarse Cut (DAT2a)	**Finer Cut (DAT2b)**	**Efficiency Attribution, E**
Same	*NA*	0%
Lesser	Standard efficiency or according to code	100%
	Slightly higher than standard efficiency	70%
	Between standard efficiency and the efficiency that was installed	50%
	Slightly lower than the high efficiency that was installed	30%
	Don't Know/Refused	Avg of above cases for sector
Greater	*NA*	0%
Don't Know/Refused	*NA*	Avg of all respondents for sector

If the respondent answers DAT2a with Greater or Same then the survey skips to the next section and there is zero Efficiency Attribution. If efficiency is not applicable to this measure but quantity is applicable and the measure would have been installed anyway then the survey skips to the next section and the Efficiency Attribution will not affect the Simple Program Attribution. If the respondent answers DAT2a with Don't Know or Refused but does provide answers to inform the Quantity Attribution and Acceleration Period then the measure is assigned the average Efficiency Attribution for all measures in the same sector.

Figure A-6: Decision Tree for Efficiency Attribution



Quantity

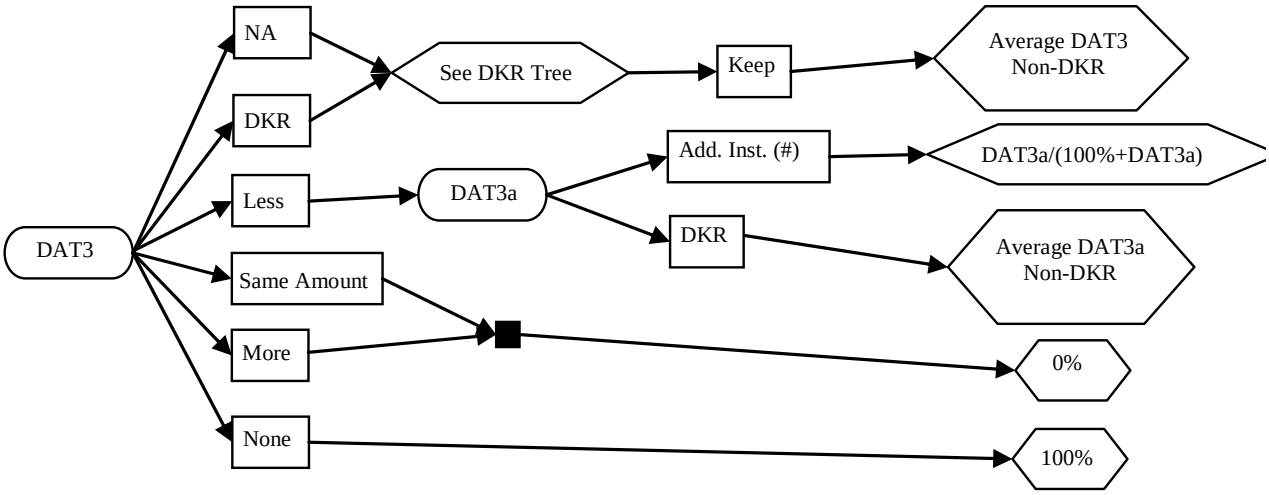
Quantity Attribution, A_Q, gives the program credit for increasing the quantity of a measure above what would have been installed in the absence of the program. The two relevant questions are DAT3 and DAT3a. For round 2, question DAT 3 was changed to allow the customer to respond that they would not have installed anything without SmartStart.

DAT3: "If SmartStart did not exist, how different would the [number/size] of [equipment type] installed have been? Would you say you would have installed the same amount, less, or more?"

DAT3a: "What percentage of equipment would you have installed without SmartStart?" (DAT3a is only asked if DAT3 is "Less.")

Figure A-7 shows a decision tree for DAT3 and DAT3a.

Figure A-7: Decision Tree for Quantity Attribution



The program receives Quantity Attribution if the respondent indicates that they would have installed a smaller measure without the influence of SmartStart. Quantity Attribution is

A_Q = Inc / (Inc + 100%)

Where

Inc = percent increase in quantity because of SmartStart.

If the respondent answers DAT3 with Same Amount or More then the survey skips to the next section and there is zero Quantity Attribution. If quantity is not applicable to this measure but efficiency is applicable and the measure would have been installed anyway then the survey skips to the next section and the Quantity Attribution will not affect the Simple Program Attribution. If the respondent answers DAT3 or DAT3a with Don't Know or Refused but does provide answers to inform the Efficiency Attribution and Acceleration Period then the measure is assigned the average Quantity Effect for all measures in the same sector.

What If They Don't Know or Refuse?

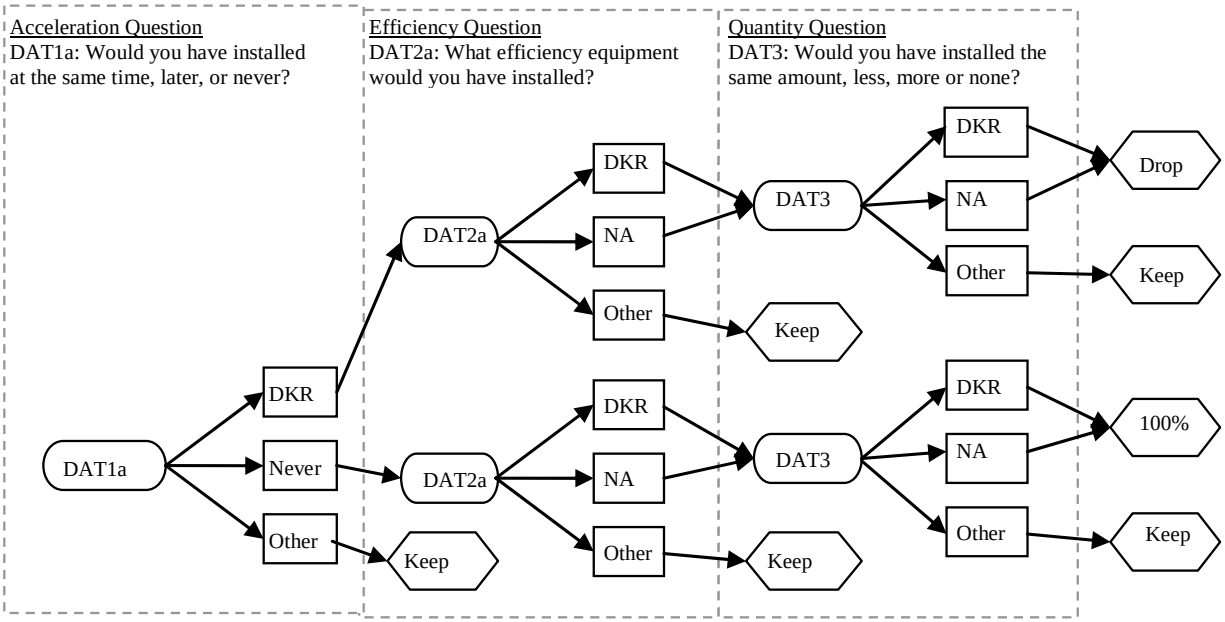
Some respondents are unable or unwilling to answer the relevant questions in the survey attribution sequence. If a participant is unable or unwilling to answer any of the attribution questions then the participant is dropped from the attribution analysis. However, the respondent information will still be included as part of the installation rate.

When Efficiency and Quantity Don't Apply

Quantity and efficiency questions do not apply to all measures. Efficiency questions do not apply if the equipment type is inherently an efficiency improvement; that is, the "standard efficiency" baseline would be not to install anything. Variable frequency drives (VFDs) and insulation are examples. Quantity questions do not apply when only one unit of the measure could possibly have been installed through the program. Typical examples are boiler or chiller replacements.

Figure A-8 shows a decision tree that indicates the relationship between the question responses and how they affect attribution. If a measure goes to the "Keep" decision then the ultimate resolution of each effect is shown in Figure A-5, Figure A-6, and Figure A-7.

Figure A-8: NTG Case Retention Decision Tree for Don't Know/Refused/Not Applicable



APPENDIX B: Responses to Attribution Questions

Over the years, KEMA has developed a series of self-report program attribution survey question batteries used to determine net program impacts. This section shows the SmartStart program participant responses to these questions and how they are combined into program attribution. First we discuss the CATI survey[28] responses by themselves, and then we address the attribution received from each sequence of survey responses.

OVERVIEW

The direct attribution sequence is the sequence of questions that are used to calculate attribution. That is, the responses to these questions are fed into the attribution algorithm with the results of a program attribution value for each measure. The direct attribution sequence is comprised of three sections of questions that determine how the SmartStart program affected the timing, efficiency, and quantity of the measures that were installed.[29]

Prior to the direct attribution questions there is a series of set up questions that remind the participant of their interactions with Program. The sequence starts with the interviewer reminding the participant of the measure installed and the amount of the rebate provided by SmartStart. The interview continues with a discussion of other energy efficiency projects completed by the participant, involvement of the Program in those projects, and the initial decision making process prior to moving forward with the project (e.g. when learned of SmartStart, when did you learn about the installed equipment, why installed equipment, what role did Program play, etc.).

Table B-1shows the attribution questions from the survey. The questions shown here are paraphrased; for the exact wording, please refer to the survey document in Appendix D. The first question in each section is a screening question to indicate whether or not SmartStart had an effect on timing, efficiency, or quantity of the measure. The follow-up questions are used to determine the portion of the timing, efficiency, or quantity that is attributable to SmartStart. The attribution for each section is a function of the combination of the responses to all of the questions. The three attribution sections are combined to determine the overall attribution for the measure.

[28] See APPENDIX F for the complete version of the CATI survey.

[29] See APPENDIX A: for a detailed discussion of attribution methodology.

Table B-1: Attribution Question Sequence

Number	Question
Timing	
DAT1	Without SmartStart, how likely is it that you would have installed the same type of equipment at this time?
DAT1a	Without SmartStart, how different would the timing have been?
DAT1b	Approximately how many months later?
Efficiency	
DAT2	Without SmartStart, how likely is it that you would have installed the same level of efficiency?
DAT2a	Without SmartStart, would you have installed the same, greater, or lesser efficiency?
DAT2b	Without SmartStart, what efficiency would you have installed?
Quantity	
DAT3	Without SmartStart, how different would the quantity/size have been?
DAT3a	What percentage would you have installed without SmartStart?

The table entries in this section are un-weighted; therefore, each counted response corresponds to one measure. The tables do not reflect survey weights or the relative savings of one measure compared to another; it simply reflects the answer to each individual survey sequence. The last row in each table indicates the total number of responses included in the table.

TIMING

Respondents are asked a sequence of questions that addresses the timing of the equipment installation. First, respondents are asked how likely it is that they would have installed the same type of equipment at the same time without SmartStart (DAT1a). Then respondents are asked how different the timing would have been (DAT1b).

A response of “Same Time” means that the customer would have installed the measure(s) at that time regardless of SmartStart involvement.

A response of “Later” indicates that they would have waited to install them if SmartStart had not been there and therefore SmartStart accelerated the installation of the measure. Respondents who answered “Later” are asked a follow up question (DAT1b) about how much later they would have installed the equipment without SmartStart.

Table B-2 shows the responses to the DAT1a question.

Table B-2: Responses to the DAT1a Question on Timing

DAT1a	Without SmartStart, how different would the timing have been?	
Response	**Number of Responses**	**Percentage of Responses**
Same Time	120	40%
Earlier	4	1%
Later	112	37%
Never	59	20%
Don't Know	4	1%
Total	**299**	**100%**

The table shows that 40 percent of survey responses indicate that the measures would have been installed at the same time without the SmartStart services and incentives. Approximately 60 percent of responses will receive at least partial timing attribution (later, never, or don't know responses).

EFFICIENCY

Respondents were asked a sequence of questions that addressed the efficiency of the equipment installed. First, respondents were asked how likely it is that they would have installed the same, lesser, or greater efficiency without SmartStart (DAT2a). Then respondents were asked how different the efficiency would have been (DAT2b).

A response of "Same" means that the customer would have installed the same level of efficiency regardless of SmartStart involvement.

A response of "Lesser" indicates that they would have installed a less efficient piece of equipment if SmartStart had not been there. Respondents who answered "Less" are asked a follow up question (DAT2b) about what efficiency of equipment they would have installed without SmartStart.

Table B-3 shows the responses to the DAT2a question.

Table B-3: Responses to the DAT2a Question on Efficiency

DAT2a	Without SmartStart, would you have installed the same, greater, or lesser efficiency?	
Response	**Number of Responses**	**Percentage of Responses**
Same	180	61%
Lesser	46	16%
Greater	25	8%
Don't Know	9	3%
Not applicable	36	12%
Total	**296**	**100%**

Table B-3 shows that 61 percent of all survey responses indicate that the participant would have installed the same equipment efficiency without SmartStart services and incentives. Twelve percent of the measures are “Not Applicable”, or measures that do not have a variable efficiency component to them or where the variation in efficiency is not a consideration when installing the measure. Variable frequency drives (VFDs) are an example: a VFD has an efficiency associated with it and, in theory; there are some VFDs that are more efficient than others. However, the savings for a VFD measure are not driven by the efficiency of the VFD but rather by whether the VFD is installed or not. Heat recovery is another example of a Not Applicable measure.

QUANTITY

Respondents were asked a sequence of questions that addressed the quantity of the equipment installed. First, respondents were asked how likely it is that they would have installed the same quantity of equipment without SmartStart (DAT3). Then respondents were asked how much they increased the quantity (DAT3a).

A response of “Same amount” means that the customer would have installed the same size or quantity regardless of SmartStart involvement.

A response of “Less” indicates that they would have installed fewer units if SmartStart had not been there. Respondents who answered “Less” are asked a follow up question (DAT3a) about quantity of equipment they would have installed without SmartStart.

A response of “None” indicates that the customer would not have installed anything without SmartStart.

Table B-4 shows the responses to the DAT3 question.

Table B-4: Responses to the DAT3 Question on Quantity

DAT3	Without SmartStart, how different would the quantity/size have been?	
Response	**Number of Responses**	**Percentage of Responses**
Same amount	178	60%
Less	56	19%
More	2	1%
Nothing	49	16%
Don't Know	6	2%
Not applicable	8	3%
Total	**299**	**100%**

Table B-4 shows that 60 percent of all survey responses indicate that the participant would have installed the same quantity of equipment without SmartStart services and incentives. The quantity questions determine what portion of the size of the project is attributable to SmartStart. Measures where quantity is "Not Applicable" would include single pieces of equipment that are not really variable in size, such as injection molding machines.

DETERMINING ATTRIBUTION

Appendix A provides a detail explanation of how the attribution components are determined. In this section we review the survey responses that are used to calculate attribution and show the frequency of responses that would produce a given attribution answer.

OVERALL

Table B-5 shows the distribution of responses across the timing attribution sequence (DAT1a and DAT1b). The table includes a column to indicate the timing attribution that would result from each response combination.

Table B-5: Determining Timing Attribution

DAT1a	Without SmartStart, how different would the timing have been?			
DAT1b	**Approximately how many months later?**			
DAT1a Response	**DAT1b Response**	**Number of Responses**	**Percentage of Responses**	**Timing Attribution**
Same Time	**N/A**	120	40%	0
Earlier	**N/A**	4	1%	0
Later	**Value < 4 years**	97	32%	# Months/48
	Value > 4 years	2	1%	100%
	Don't Know	13	4%	Average of DAT1b
Never	**N/A**	59	20%	100%
Don't Know	**N/A**	4	1%	Average of DAT1a
Total		**299**	**100%**	**N/A**

Forty-one percent of responses indicate that SmartStart had no impact on the timing of their equipment installation (DAT1a = “Same” or “Earlier”). Of the remaining responses, 32 percent said that the measure would have been installed within four years. Twenty percent of the responses would result in full program attribution (DAT1a = “Never”).

Table B-6 shows the distribution of responses across the efficiency attribution sequence (DAT2a and DAT2b).

Table B-6: Determining Efficiency Attribution

DAT2a	Without SmartStart, would you have installed the same, greater, or lesser efficiency?				
DAT2b	Without SmartStart, what efficiency would you have installed?				
DAT2a Response	DAT2b Response	Number of Responses	Percentage of Responses With N/A	Percentage of Responses W/o N/A	Efficiency Attribution
Same	N/A	180	61%	69%	0
Lesser	Standard Efficiency	29	10%	11%	100%
	Slightly > Standard	5	2%	2%	70%
	Between Std. and High	2	1%	1%	50%
	Slightly < High	9	3%	3%	30%
	Don't Know	1	0%	0%	Average of DAT2b
Greater	N/A	25	8%	10%	0
Don't Know	N/A	9	3%	3%	Average of DAT2a
Not Applicable	N/A	36	12%	-	-
Total		296	100%	88%	N/A

Efficiency was not applicable for 12 percent of the responses. As mentioned in the previous section, efficiency attribution does not apply to all measures. The “Not Applicable” measures are most likely variable frequency drive or heat recovery projects. If the “Not Applicable” measures are disregarded, then 69 percent of the responses indicate that SmartStart did not influence the efficiency of the equipment that was installed.

Table B-7 shows the distribution of responses across the quantity attribution sequence (DAT3 and DAT3a).

Table B-7: Determining Quantity Attribution

DAT3	Without SmartStart, how different would the quantity/size have been?				
DAT3a	What percentage would you have installed without SmartStart?				
DAT3 Response	DAT3a Response	Number of Responses	Percentage of With N/A	Percentage of W/o N/A	Quantity Attribution
Same Amount	NA	178	60%	61%	0
Less	0-50%	39	13%	13%	Value > 50%
	51-100%	14	5%	5%	Value <= 50%
	Don't Know	3	1%	1%	Average of DAT3a
More	NA	2	1%	1%	0
None	N/A	49	16%	17%	100%
Don't Know	N/A	6	2%	2%	Average of DAT3
Not Applicable	N/A	8	3%	-	-
	Total	299	100%	97%	N/A

Quantity was not applicable for 3 percent of the responses. As mentioned in the previous section, quantity attribution does not apply to all measures. If the “Not Applicable” measures are disregarded, then 61 percent of the responses indicate that SmartStart did not influence the quantity of the equipment that was installed. Seventeen percent of responses result in full quantity (100 percent) program attribution.

Table B-8 shows the effect of all three attribution components together. In the table, a “1” represents responses that received some (not necessarily full) attribution while a “0” represents responses that did not receive any attribution. A “na” attribution indicates the responses that were dropped from the attribution analysis. Refer to Appendix A for more information on why measures are dropped.

Table B-8: Simple Representation of Overall Attribution

Attribution			CATI	
Timing	Efficiency	Quantity	Quantity	Percent
0	0	0	95	32%
0	0	1	10	3%
0	1	0	10	3%
0	1	1	9	3%
1	0	0	60	20%
1	0	1	40	13%
1	1	0	15	5%
1	1	1	56	19%
na	na	na	4	1%
Total			299	100%

Table B-8 shows that 32 percent of measures did not result in any program attribution. That is, the program did not affect timing, efficiency, or quantity installed. Nineteen percent of

responses resulted in some attribution from all three sections. The most common attribution (besides zero attribution) was for timing alone. For an explanation of how attribution is determined when efficiency or quantity are not applicable, see APPENDIX A:

APPENDIX C: Ratio Expansion—Sample to Population Results

This appendix provides the ratio estimation computation KEMA employed to develop estimates of evaluation verified gross and net impacts; followed by an example of this technique in action.

RATIO ESTIMATION

KEMA used the statistical procedure of ratio estimation to develop estimates of evaluation verified gross and net impacts. There are two basic steps in the process. The first step is to verify energy savings in a sample of participating customers. KEMA accomplished this first step via engineering reviews, customer interviews, supplier interviews, and on-site visits. The second step is to expand the sample results to the population of customers. This is accomplished by calculating the ratios of verified-to-reported and attributable-to-verified for the sample. The ratios are also referred to in this analysis as adjustment factors. The adjustment factors estimated from the data collection and analysis include:

Gross savings adjustment factor: This factor combines the installation rate and the engineering verification factor. It corresponds to the ratio of the verified gross savings to the tracking estimate of savings.

Attribution factors: This factor adjusts verified gross savings for program attribution. It is the estimated proportion of verified gross savings attributable to the SmartStart Program. It corresponds to the ratio of net savings to verified gross savings.

Realization rate: This factor combines the gross savings adjustment factor and the attribution factor. It corresponds to the ratio of the net savings to the tracking estimate of savings.

Expansion of sample results to the population via ratio analysis

The calculation of the adjustment factors for tracking system gross and net savings uses appropriate weights corresponding to the sampling rate. The three primary adjustment factors are the installation rate, the engineering verification factor, and the attribution factor. Each of these is calculated as a ratio estimator over the sample of interest (Cochran, 1977, p.165). The formulas for these factors are given below.

Notation: The following terms are used in calculating the adjustment factors:

G_{Tj} = tracking estimate of gross savings for project *j*

G_{Ij} = tracking estimate of gross savings for project *j*, adjusted for non-installation

G_{Vj} = verified gross savings for project *j* based on engineering review

N_{Cj} = net savings determined from the CATI survey.

w_{Ej} = weighting factor for project *j* used to expand the engineering sample to the full population

w_{Cj} = weighting factor for project j used to expand the survey sample to the full population

E denotes the engineering sample

C denotes the survey sample

Installation rate

The installation rate R_I is calculated from the survey sample as

$$R_I = \frac{\sum_{j \in C} G_{Ij} w_{Cj}}{\sum_{j \in C} G_{Tj} w_{Cj}}.$$

Engineering verification factor

The engineering verification factor R_V is calculated from the engineering sample as

$$R_V = \frac{\sum_{j \in E} G_{Vj} w_{Ej}}{\sum_{j \in E} G_{Ij} w_{Ej}}.$$

Attribution factor

The attribution factor R_{FR} is calculated from the survey sample as

$$R_{FR} = \frac{\sum_{j \in C} N_{Cj} w_{Cj}}{\sum_{j \in C} G_{Vj} w_{Cj}}.$$

Standard errors

The ratio estimator is calculated using a SAS® macro provided by SAS for ratio estimation by domains. The procedure also returns the standard error of the estimate. The standard error is calculated using two methods.

The first method recognizes the sample as drawn from a finite population: the projects completed within the analysis period with associated energy impacts in the program-tracking database. This calculation uses the Finite Population Correction (FPC) factor. This factor is a reduction to the calculated variance that accounts for the fact that a relatively large fraction of the population of interest has been observed directly and is not subject to uncertainty. It is appropriate to apply precision statistics, such as confidence intervals, based on the standard error calculated in this manner when quantifying the results of the program during the study period only.

The second calculation treats the population of interest as essentially infinite. Thus, the projects completed to date and the sample selected from them is regarded as random instances of a virtually infinite number of projects that could have been completed under the program. In this case, the FPC is not included. It is appropriate to apply standard errors calculated in this manner when applying the verification factors developed from this study to tracked savings from other years to estimate verified savings in those years.

Gross verification factor and overall realization rate

The gross verification factor is the ratio of verified gross to tracking estimate of gross savings. This factor is calculated by chaining together the installation rate, based on the survey sample, and the engineering verification factor, based on the engineering sample:

$$R_G = R_I R_V = \left[\frac{\sum_{j\in C} G_{Ij} w_{Cj}}{\sum_{j\in C} G_{Tj} w_{Cj}}\right]\left[\frac{\sum_{j\in E} G_{Vj} w_{Ej}}{\sum_{j\in E} G_{Ij} w_{Ej}}\right].$$

This is an example of a chained ratio estimator using a nested sample. The standard error for the chained ratio is approximated by the formula

$$\mathrm{SE}(\mathrm{AB}) \simeq \mathrm{AB}\sqrt{\left[\left(\frac{\mathrm{SE(A)}}{\mathrm{A}}\right)^2 + \left(\frac{\mathrm{SE(B)}}{\mathrm{B}}\right)^2\right]}.$$

(This formula overstates the standard error, because it ignores the correlation between the numerator of R_I and the denominator of R_V, which reduces the variance of the product.)

Likewise, the overall realization rate is calculated by chaining together the gross verification factor with the attribution factor. The same approximation formula allows (an over-estimate of) the standard error of the realization rate to be calculated from the two separate standard errors.

APPENDIX D: Other Adjustment Factors

This appendix provides the installation rate and engineering verification factors.

OTHER ADJUSTMENT FACTORS

The installation rate and engineering verification factors are provided in the appendix instead of the main body of the report because the combined effect is reported as the gross savings adjustment factor. Table D-1 and Table D-2 give the installation rates and engineering verification factors by sector.

Table D-1: Installation Rates by Sector

	kWh						kW						Therms					
			90% Confidence Interval						90% Confidence Interval						90% Confidence Interval			
Segment	n	Installation Rate	Relative Error (%)	+/-	Lower Bound	Upper Bound	n	Installation Rate	Relative Error (%)	+/-	Lower Bound	Upper Bound	n	Installation Rate	Relative Error (%)	+/-	Lower Bound	Upper Bound
New Const.	20	100%	<0.1%	<0.1%	100.0%	100.0%	17	100%	<0.1%	<0.1%	100.0%	100.0%	4	100%	<0.1%	<0.1%	100.0%	100.0%
Retrofit	184	99%	0.9%	0.9%	98.5%	100.0%	178	99%	1.2%	1.2%	98.1%	100.0%	19	100%	<0.1%	<0.1%	100.0%	100.0%
Schools	8	100%	<0.1%	<0.1%	100.0%	100.0%	9	100%	<0.1%	<0.1%	100.0%	100.0%	3	100%	<0.1%	<0.1%	100.0%	100.0%
SmartStart Overall	212	100%	0.8%	0.8%	98.7%	100.0%	204	99%	1.0%	1.0%	98.4%	100.0%	26	100%	<0.1%	<0.1%	100.0%	100.0%

Table D-2: Engineering Verification Factors by Sector

	kWh						kW						Therms					
			90% Confidence Interval						90% Confidence Interval						90% Confidence Interval			
Segment	n	Engineering Verification Factor	Rel. Error (%)	+/-	Lower Bound	Upper Bound	n	Engineering Verification Factor	Rel. Error (%)	+/-	Lower Bound	Upper Bound	n	Engineering Verification Factor	Rel. Error (%)	+/-	Lower Bound	Upper Bound
New Const.	9	94%	10.4%	9.8%	84.3%	103.8%	8	88%	12.0%	10.6%	77.8%	98.9%	2	150%	173.0%	259.7%	-109.6%	409.8%
Retrofit	38	107%	7.1%	7.6%	99.4%	114.6%	38	83%	5.3%	4.4%	78.9%	87.7%	4	63%	50.8%	32.1%	31.1%	95.2%
Schools	4	130%	39.2%	50.8%	78.9%	180.5%	4	167%	61.3%	102.6%	64.8%	270.0%	2	161%	3.6%	5.8%	154.9%	166.6%
SmartStart Overall	51	105%	6.1%	6.4%	98.7%	111.4%	50	86%	5.7%	4.9%	81.5%	91.4%	8	66%	45.7%	30.2%	35.9%	96.4%

Figure D-1 and Figure D-2 provide a comparison between installation rates and engineering verification factors by energy units and sector. The gross savings adjustment factors discussed earlier are a product of the installation rates and the engineering verification factors.

Figure D-1: Installation Rates by Sector

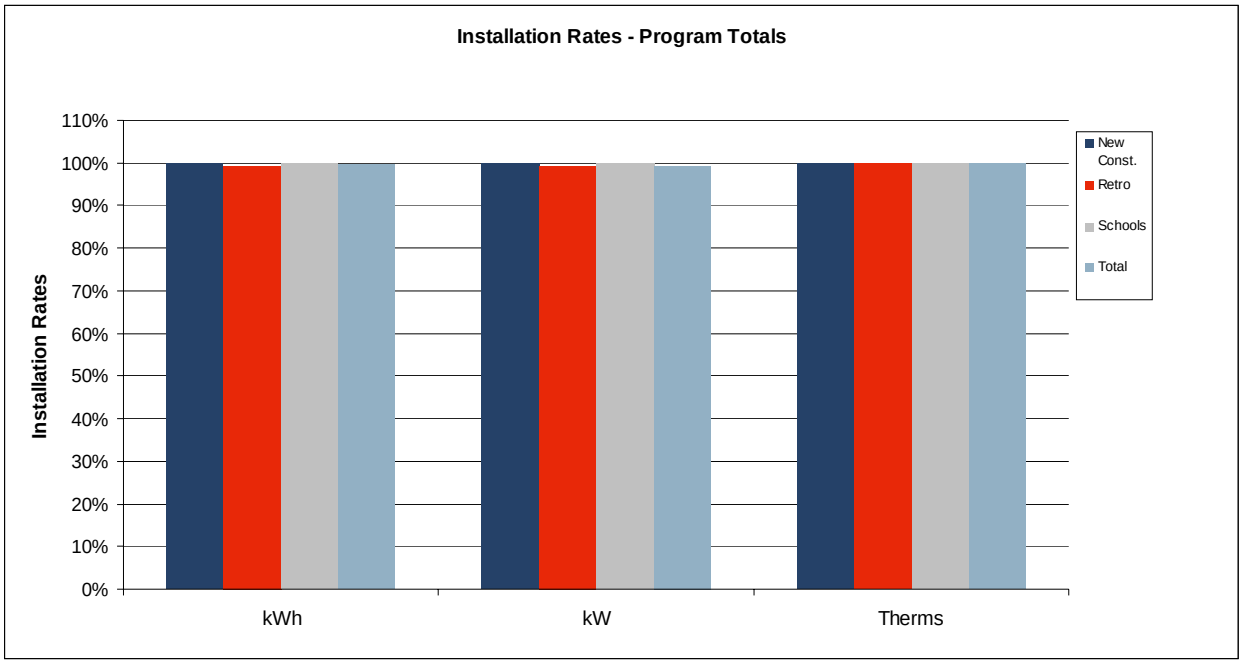
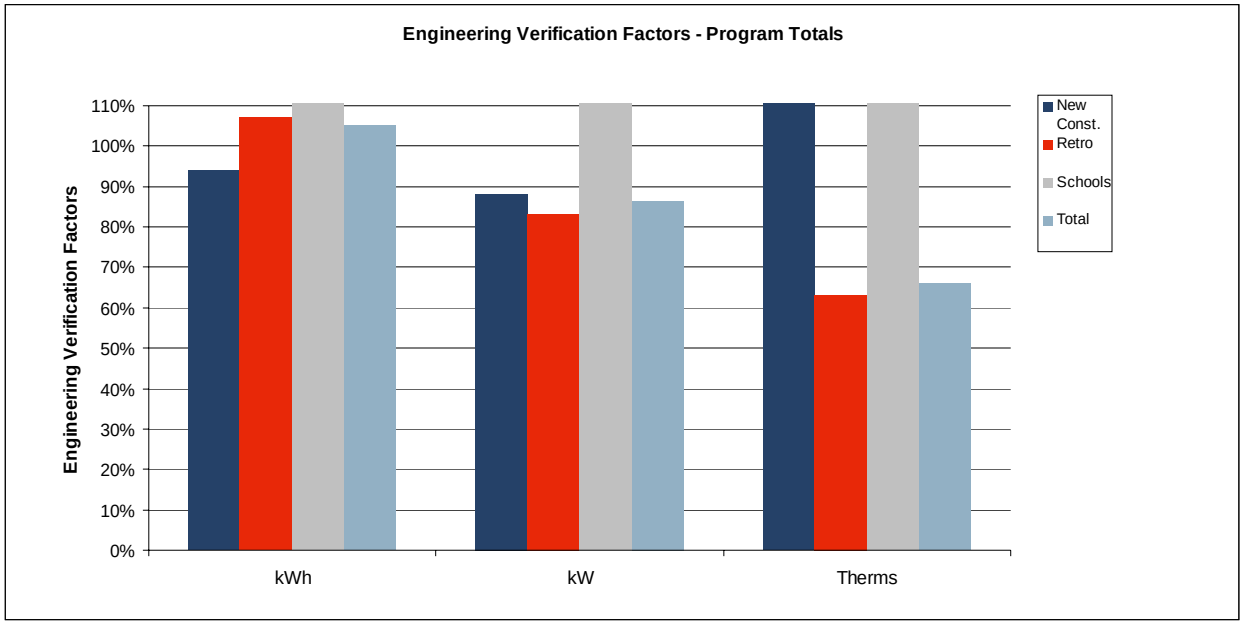


Figure D-2: Engineering Verification Factors by Sector



APPENDIX E: Additional CATI Survey Results

The goals of this evaluation were to assess the energy impacts of the SmartStart Program. However, because we needed to speak to program participants to collect data necessary for the impact evaluation, we also took the opportunity to ask them a series of process-related questions. Although these process-related questions were outside the scope of the evaluation, we report those results in this appendix. This appendix provides the results of the participant satisfaction, rebound effect, and participant commitment to energy efficiency.

CUSTOMER SATISFACTION

Customer Satisfaction with the Overall Program

Participant satisfaction with the SmartStart program was high. The evaluators asked program participants how satisfied they were with the overall program, and found that 90 percent of the participants were satisfied (Table E-1).[30] Generally, satisfaction levels above 90 percent are considered good, and it is rare to find near universal levels of program satisfaction. Table E-1 also shows that satisfaction levels were consistently high for projects across all three sectors, including retrofit, new construction, and school projects.

Table E-1: Participant's Overall Satisfaction with the Program

DAT 5. Overall, how satisfied or dissatsified were you with the SmartStart Program?	By Sector			
	Retrofit (n=260)	New Construction (n=26)	Schools (n=11)	Overall (n=297)
Very Satisfied (1)	70%	68%	63%	70%
2	19%	23%	37%	20%
3	10%	4%	0%	8%
4	1%	5%	0%	2%
Very Dissatisfied (5)	0%	0%	0%	0%
Total	**100%**	**100%**	**100%**	**100%**
Mean Satisfaction Rating	**1.43**	**1.46**	**1.37**	**1.43**

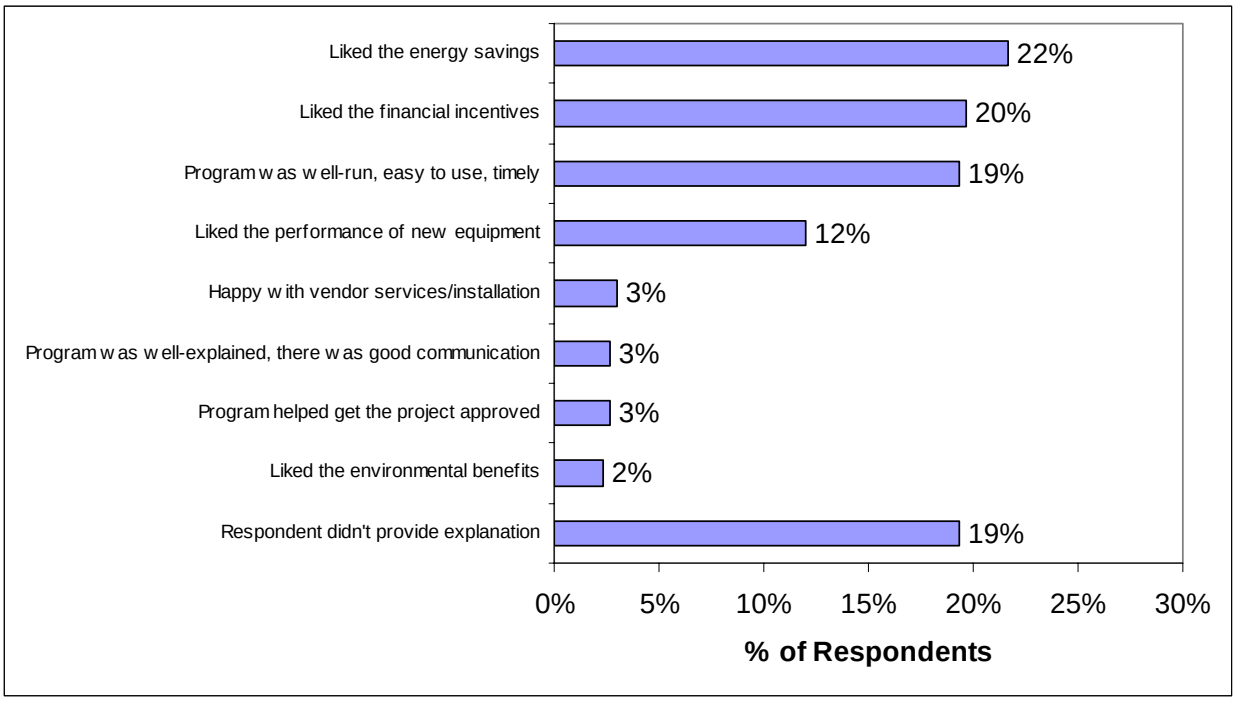
Participants were also asked why they were satisfied or dissatisfied with the program. KEMA sorted these open-ended responses into coherent response categories. Figure E-1 shows that

[30] The term "satisfied" means the participant gave a score of 1 or 2 as to their organization's satisfaction with the program. They used a scale of 1 to 5 where 1 means "very satisfied" and 5 means "very dissatisfied."

22 percent of respondents cited the energy savings resulting from their project as the reason for their organization's satisfaction with the program. Many participants were also happy with the financial incentives they received, and the ease of using the program. One participant thought that the SmartStart program was "simple and easy," while another participant was happy that SmartStart was able to "finish the project in a timely manner."

Many participants also mentioned that they were happy with the performance of their newly installed equipment, with one participant stating that "the quality of light is much better." Other popular reasons for satisfaction with the program included satisfaction with the responsiveness of program staff, the way that the program helped get projects approved, and the belief that they received a good explanation of how the program worked.

Figure E-1: Reasons for Organization's Satisfaction with Program[31]



As noted in Figure E-1, a small percentage (2 percent) of participants were dissatisfied with the program overall. Some of these participants thought that the program application forms and

[31] There were a total of 299 respondents. The total percentage exceeds 100% because each respondent was allowed to give multiple reasons. Results are not weighted by strata.

requirements were burdensome, while others reported experiencing problems or delays when working with their vendor. A few participants were dissatisfied with either the rebate dollar amount or the length of time it took to receive the rebate. One participant mentioned that their organization "found it difficult to get information concerning the program and found some of the representatives confused about the program at times."

Customer Satisfaction with Rebate Levels

Participant satisfaction levels with the dollar amount of financial incentives were also high, although somewhat lower than overall program satisfaction levels, with 78 percent of respondents indicating they were satisfied with their rebate amount (Table E-2). Very few respondents actually reported being dissatisfied, with more choosing to report indifference[32] with regard to rebate dollar amounts.

Table E-2: Participant's Satisfaction with Financial Incentive

DAT 6. How satisfied or dissatsified were you with the dollar amount of the rebate you received?	By Sector			Overall (n=270)
	Retrofit (n=235)	New Construction (n=25)	Schools (n=10)	
Very Satisfied (1)	56%	36%	66%	55%
2	21%	37%	22%	23%
3	20%	27%	12%	20%
4	1%	0%	0%	1%
Very Dissatisfied (5)	1%	0%	0%	1%
Total	**100%**	**100%**	**100%**	**100%**
Mean Satisfaction Rating	**1.70**	**1.90**	**1.46**	**1.71**

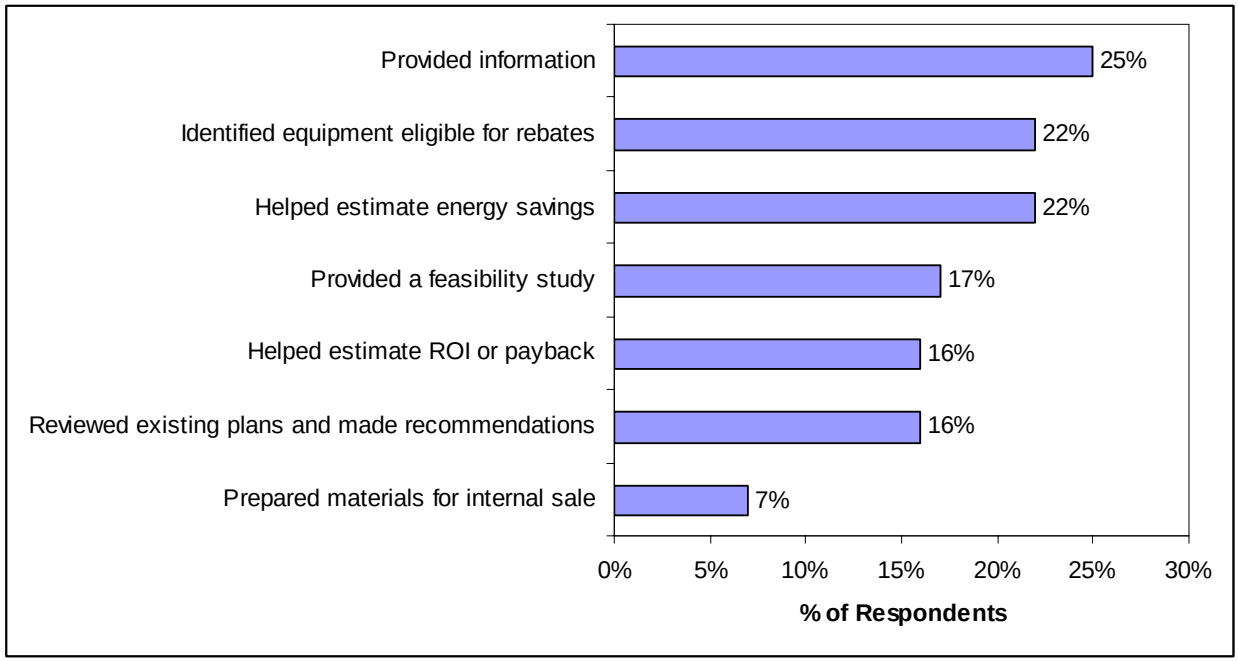
Customer Satisfaction with Specific Program Services

Participants were asked if SmartStart played a role in helping their organization select and install equipment, and if so, how satisfied they were with this assistance. Forty-five percent of respondents reported that SmartStart played a role in assisting them with equipment selection and installation. When asked in an open-ended question to further describe the role that SmartStart played, 25 percent of participants said that they received assistance in the form of information provided by SmartStart, while 44 percent reported that SmartStart helped them

[32] Participants used a scale of 1 to 5 where 1 means "very satisfied" and 5 means "very dissatisfied" to respond to this question. "Indifference" refers to a response of 3 which corresponded to "neither satisfied nor dissatisfied."

estimate energy savings or identify equipment eligible for rebates (Figure E-2). Others described the program's role to include providing a feasibility study (17 percent), assistance estimating return on investment (ROI) or payback period (16 percent), and assistance reviewing existing plans and making recommendations (16 percent).

Figure E-2: SmartStart Role in Equipment Selection and Installation[33]



With two exceptions, all participants were satisfied with the help they received from the program to select and install equipment. The two dissatisfied participants cited problems with equipment installation rather than SmartStart assistance, with one participant stating that the project "installation was not up to code."

Suggestions for Improvement

Participants were also asked to provide additional comments about the SmartStart program. Eighteen participants used this opportunity to provide suggestions for program improvements (Table E-3). The most-cited suggestion for program improvement was to simplify the program

[33] There were a total of 300 respondents. The total percentage exceeds 100% because each respondent was allowed to give multiple reasons.

application process. Four other participants either requested additional information about programs services, or suggested that additional explanation of services would be helpful.

Table E-3: Participant's Suggestions for Program Improvements

Feedback	# of Respondents
Program delivery and process	
Simplify, speed-up application process	5
Improve clarity in application process	2
Program information, marketing	
Increase marketing of program	1
Improve explanation of program services, requests for additional information	4
Rebate characteristics	
Increase rebate amount	3
Program funding	
Make more funds available	2
Adjust amount of funds available for each project	1
Total	**18**

Evaluators also asked participants if they planned on participating in the SmartStart program in the future. The large majority of respondents, 91 percent, said that they planned to participate again. While a small percentage of participants indicated that they did not plan on participating in the program again, most of these respondents said that the main reason they did not plan on participating was that they didn't have the need, or that they currently didn't have any projects planned.

THE REBOUND EFFECT

The rebound (or "take-back") effect has been defined and measured in a variety of ways, resulting in wide ranging estimates of the magnitude of its effect. Most studies have focused on measuring the rebound effect in the residential context, while studies in the Schools and Retrofit sectors are comparatively limited[34] [35]. Rebound effects are most commonly divided into three

[34] Greening, L.A., Greene, D.L., Difiglio, C. (2000). Energy efficiency and consumption – the rebound effect – a survey. *Energy Policy (28), 389-401*.

[35] Gottron, F. (2001). *Energy Efficiency and the Rebound Effect: Does Increasing Efficiency Decrease Demand?* Congressional Research Service Report RS2098 [electronic version]. The Library of Congress.

different types of effects: direct effects, indirect effects, and market effects. For the purposes of this study, KEMA considered all three types of potential rebound, but limited the scope of our data collection efforts to direct effects.

Direct rebound effects occur when energy efficiency improvements result in the consumer or firm choosing to use more of the resource instead of realizing the full energy savings associated with the efficiency improvement. For example, in the Schools/Retrofit context, a firm may choose to extend the operating hours of office or warehouse lighting following the installation of higher efficiency lighting because the costs of operation are lower. To evaluate the degree to which these direct effects occurred for SmartStart program participants, a series of survey questions were developed to inquire about possible increases in operating hours, quantity, and/or size of equipment following efficiency improvements.

Direct rebound effects were found to be small for the SmartStart program. The majority of participants did not report an increase in the amount of time they operated equipment, or an increase in the quantity or size of equipment in use. Fourteen participants representing 3.4 percent of the population reported increasing equipment operating time because of the energy savings they realized through energy efficiency improvements[36]. These 14 participants represent the direct rebound effect, reporting increased operating times between 5 percent and 30 percent.

Direct rebound effects due to increased equipment quantity or size were also very small. Four participants representing 3.3 percent of the population reported increasing equipment quantity or size because of the energy savings they realized through energy efficiency improvements[37]. The magnitude of this increase varied for each of the four participants, with one respondent reporting increasing cooling capacity by 40 tons, while another respondent reported increasing lighting by 45 percent.

COMMITMENT TO ENERGY EFFICIENCY

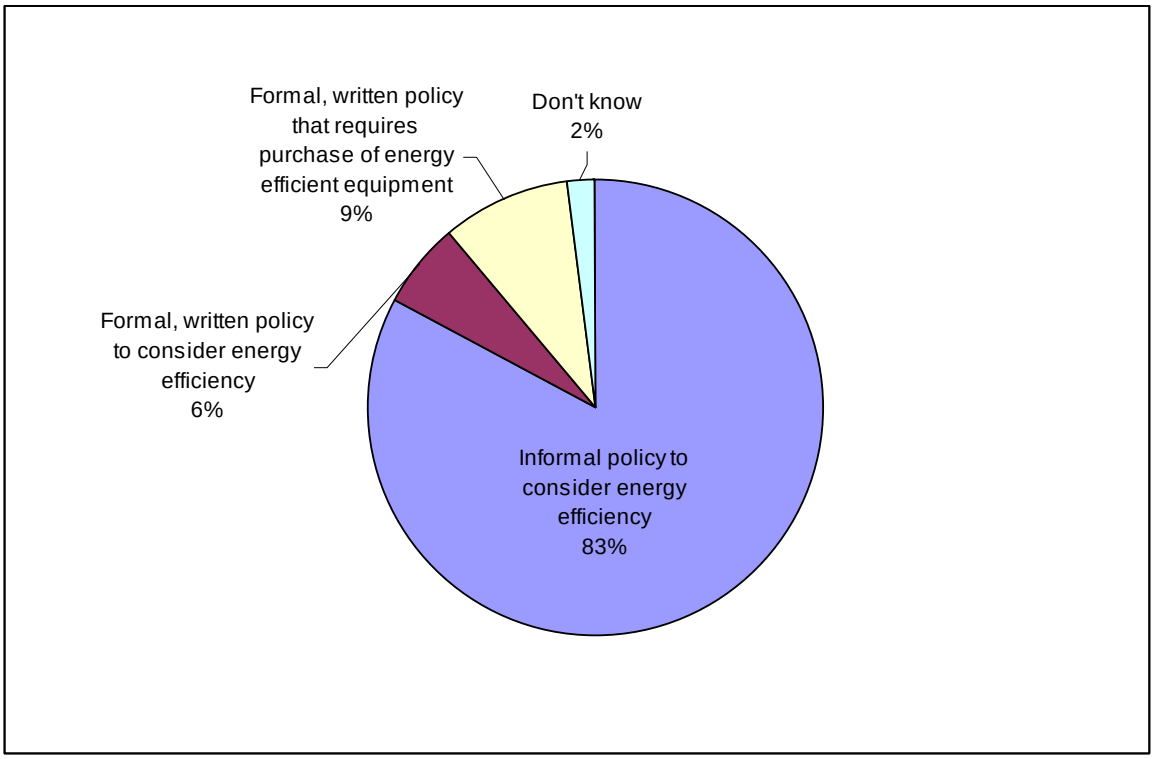
The evaluators also asked participants about their organization's policies regarding the purchase of energy using equipment. Fewer than half (39 percent) of the respondents reported having a policy, either formal or informal, regarding the purchase of energy using equipment. Of the organizations that reported having a policy, 83 percent (Figure E-3) had an informal policy to

[36] Note that equipment operating time was not applicable in the case of twenty-two participants.

[37] Note that equipment quantity and/or size was not applicable in the case of twenty-three participants.

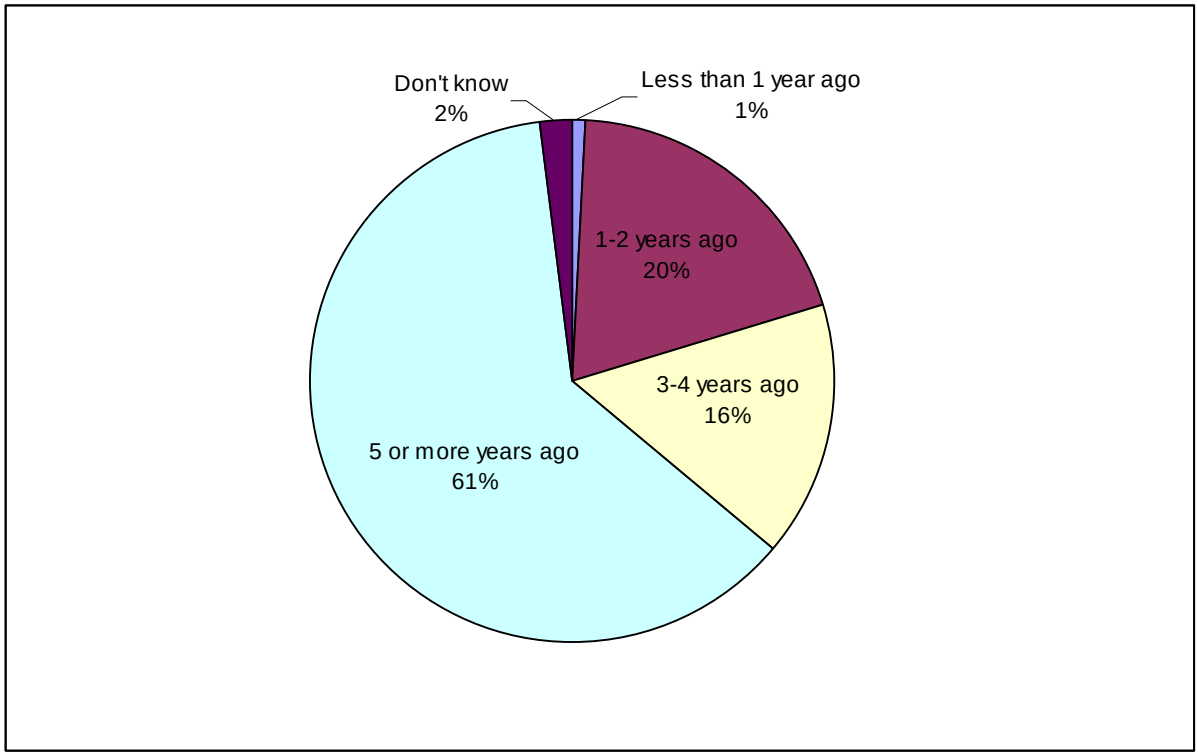
consider energy efficiency when making equipment purchases. Relatively few organizations (9 percent) had a formal, written policy requiring the purchase of energy efficient equipment.

Figure E-3: Policies regarding the purchase of energy using equipment (n=126)



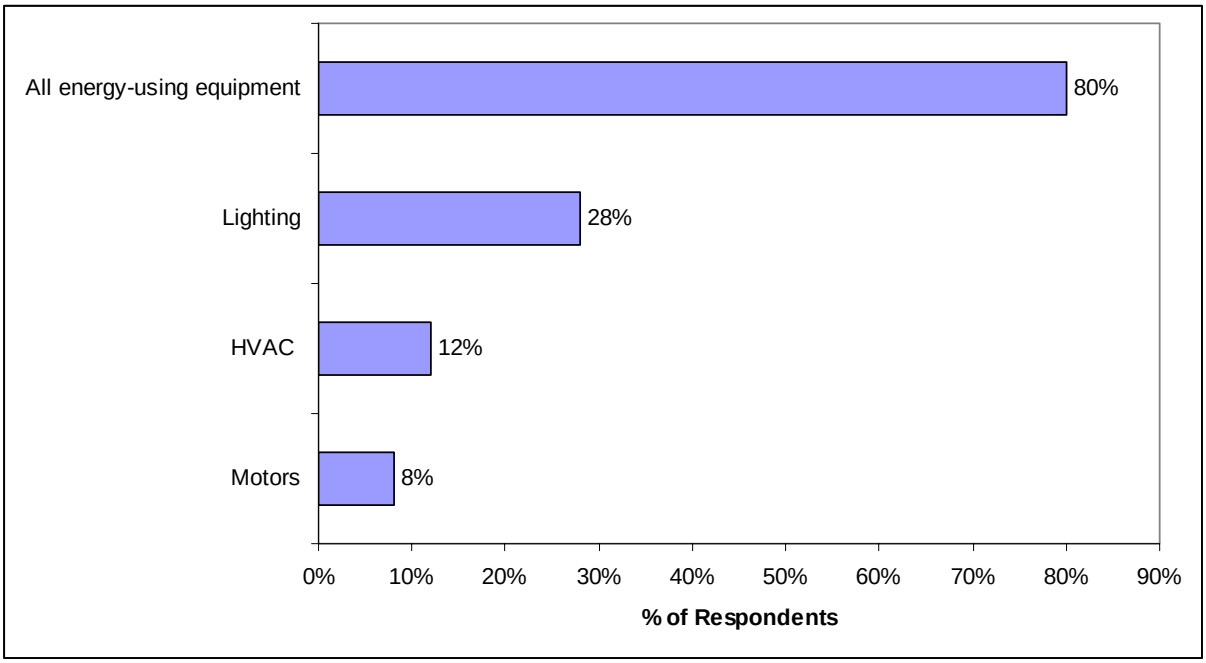
The evaluators also asked participants that reported having an energy efficiency policy approximately when the policy was established. Over half (61 percent) said that their organization's policy was five or more years old (Figure E-4), with 16 percent reporting a policy that was established 3-4 years ago, 20 percent reporting a policy that was established 1-2 years ago, and less than 1 percent reporting a policy established within the past year.

Figure E-4: When was energy-efficiency policies established? (n=123)



Finally, participants were asked what type of equipment their organization's energy efficient purchasing policy covered. Eighty percent of respondents said that their organization's policy covered all types of energy-using equipment (Figure E-5). Twenty-eight percent reported policies covering lighting, while 12 percent of policies covered HVAC equipment, and 8 percent covered motors.

Figure E-5: Which types of equipment does your policy cover? - (n=123)



APPENDIX F: CATI Survey

New Jersey's Clean Energy Program
Schools, New Construction, and Retrofit Programs (SmartStart Buildings)
Retrospective Evaluation Survey
Revised – January 15, 2009

INTERVIEWER INSTRUCTIONS
DO NOT READ THE LIST OF RESPONSES UNLESS INSTRUCTED TO DO SO. WHEN READING LISTS, NEVER READ "DON'T KNOW" OR "REFUSED."

1 FINDING AN INFORMED RESPONDENT (IR)

Variable Inputs: <CONTACT NAME>, <MEASUREDETAIL>, <REWARD AMOUNT>

[If <CONTACT NAME> is missing, skip to IRIa]

IR1. Hello, may I please speak with <CONTACT NAME>?

Contact available ..... [SKIP to IR2] 1
Contact currently unavailable ..... [ARRANGE CALL BACK] 2
No contact 3

IR1a. I'd like to speak with the person responsible for facility management such as energy-efficiency or productivity improvements or the purchase of energy-using equipment.

Person responsible for facility management available 1
[RECORD NAME]:_____
Person responsible for facility management currently unavailable ..... [ARRANGE CALL BACK] 2
No person responsible for facility management ..... [THANK AND TERMINATE THEN SKIP TO IR4] 3
Don't know ..... [THANK AND TERMINATE THEN SKIP TO IR4] -97
Refused ..... [THANK AND TERMINATE THEN SKIP TO IR4] -98

IR2. Hello, I'm _____ from _____ calling on behalf of the New Jersey Board of Public Utilities for the New Jersey SmartStart Buildings Program. The New Jersey SmartStart Buildings Program assists commercial, industrial, and municipal customers with design support, technical assistance, and financial incentives for installation of qualifying equipment and projects. This program was formerly run

by New Jersey's electric and gas utilities. The program is now run by the New Jersey Board of Public Utilities' Office of Clean Energy.

I would like to ask you a few questions regarding an energy efficiency improvement your organization has made. This is not a sales or marketing call. We're calling to help the SmartStart Program, which helped your organization with an energy efficiency improvement.

SmartStart is required by the State of New Jersey to conduct this type of research. Your responses will be kept entirely confidential.

According to SmartStart records, sometime between January 1, 2006 and December 31, 2006, your organization made the following energy efficiency improvement at one of your New Jersey facilities: [<MEASUREDETAIL_SINGULAR>.]

Are you familiar with your organization's decision to make this energy efficiency improvement?

Yes ..... [RECORD NAME BELOW THEN SKIP TO V1] 1
Respondent Name

_____

No 2
Don't know ..... –97
Refused ..... [THANK AND TERMINATE]–98

IR3. Do you know who is likely to be familiar with your organization's decision to make this energy efficiency improvement?

Yes ..... [RECORD NAME BELOW THEN START OVER WITH IR1] 1
Additional Contacts:

_____

_____

_____

No 2
Don't know ..... [THANK AND TERMINATE]-97
Refused ..... [THANK AND TERMINATE]-98

IR4. **[CHECK TO MAKE SURE ALL CONTACTS HAVE BEEN TRIED.]**

Not all contacts have been tried ..... [START OVER AGAIN WITH IR1] 1
All contacts have been tried ..... [TERMINATE]2

2 VERIFY MEASURE INSTALLATION (V)

V1. [SKIP to V1a if <REWARD AMOUNT> is missing]

Our records show that your organization received a rebate of <REWARD AMOUNT> from SmartStart in 2006 to install <MEASUREDETAIL_SINGULAR> at one of your New Jersey facilities. Was this equipment or something similar to it installed?

Yes ..... [SKIP TO G1] 1
No 2
Don't know ..... [SKIP TO G1] -97
Refused ..... [THANK AND TERMINATE]-98

V1a. Our records show that your organization received a rebate from SmartStart in 2006 to install <MEASUREDETAIL> at one of your New Jersey facilities. Was this equipment or something similar to it installed in 2006?

Yes ..... [SKIP TO G1] 1
No 2
Don't know ..... [SKIP TO G1] -97
Refused ..... [THANK AND TERMINATE]-98

V2. Why wasn't this equipment installed?

[RECORD RESPONSE]:

_____

_____

V3. Do you plan to install this equipment?

Yes 1
No 2
Don't know ..... -97
Refused ..... -98

3 GENERAL QUESTIONS (G)

I'd like to start by asking you a few questions regarding how your organization makes energy related purchase decisions.

G1. What is your job title?

[RECORD RESPONSE]: 1
Refused ..... -98

G2. Is there a person, group, or department in your organization that is assigned by top management to manage energy use and costs?

Yes 1
No ..... [SKIP TO G3] 2
Don't know ..... [SKIP TO G3] -97
Refused ..... [SKIP to G3]-98

G2a. What is the title of that person, group, or department?

[RECORD RESPONSE]: 1
Don't know ..... -97
Refused ..... -98

G2b. Who does this person, group, or department report to?

Plant or GENERALManager 1
Facilities Manager 2
Building or Plant Engineer 3
Office Manager 4
Treasurer or VP of Finance 5
Owner/Proprietor 6
Chief Operating Officer 7
President/CEO 8
Other [RECORD RESPONSE] 9
Don't know ..... -97
Refused ..... -98

G3. Does your organization have policy, either formal or informal, regarding the purchase of energy using equipment?

Yes **1**
No ..... **[SKIP TO E1] 2**
Don't know ..... **[SKIP TO E1] -97**
Refused ..... **[SKIP to E1]-98**

G4. Which of the following best describes your company's policy regarding the purchase of energy using equipment?

[READ ENTIRE LIST BEFORE ACCEPTING RESPONSE AND SELECT ONLY ONE RESPONSE]

We have an informal policy to consider energy efficiency when we make purchases **1**
We have a formal, written policy to consider energy efficient equipment when we make purchases **2**
We have a formal, written policy that requires the purchase of energy efficient equipment that meet specific criteria **3**
Other [RECORD RESPONSE]: **4**
Don't know ..... **-97**
Refused ..... **-98**

G4a. Approximately when was this policy established?

Less than 1 year ago **1**
1-2 years ago **2**
3-4 years ago **3**
5 or more years ago **4**
Don't know ..... **-97**
Refused ..... **-98**

G4b. Which of the following types of equipment does this policy cover?

[READ ENTIRE LIST BEFORE ACCEPTING RESPONSE AND SELECT ALL THAT APPLY]

Lighting **1**
HVAC **2**
Motors **3**
All energy using equipment **4**
Other [RECORD RESPONSE]: **5**
Don't know ..... **-97**
Refused ..... **-98**

4 EQUIPMENT TYPE QUESTIONS (E)

Next I'd like to ask you a few questions about energy efficient equipment your organization has installed in the past.

E1. Has your organization installed <MEASUREDETAIL_PLURAL> at the same energy efficiency level at this or another location? [Circle one answer.]

This location.....1
Another location.....2
This location and at another location(s)..... 3
This is the first time ..... [SKIP TO E2] 4
Don't know ..... [SKIP TO E2] -97
Refused ..... [SKIP TO E2] -98

E1a. Did your organization receive rebates from SmartStart for installing energy efficient <MEASUREDETAIL> for any projects completed before the project we're discussing?

Yes 1
No.....2
Don't know ..... -97
Refused ..... -98

E1b. Did your organization receive rebates from any other program for installing energy efficient <MEASUREDETAIL_PLURAL> for any projects completed before the projects we're discussing?

Yes 1
No.....2
Don't know ..... -97
Refused ..... -98

I'd like to understand how your organization made the decision to install this particular equipment at this time.

E2. When did your organization start thinking about purchasing this equipment?

[RECORD MONTH AND YEAR:]_____

E3. Why did you decide to install this equipment?

[RECORD RESPONSE AND PROBE FOR ANY OTHER REASONS:]

_____

E3a. [PROBE FOR ANY ANSWERS THAT WERE NOT DISCUSSED ABOVE. SELECT ALL RESPONSES THAT APPLY, WHETHER PROVIDED IN AN OPEN-ENDED RESPONSE OR AS THE RESULT OF A PROBE.]

New construction or major addition 1
Renovation or planned upgrade 2
Remodel 3
Replace broken or failing equipment 4
To improve equipment efficiency.....5
To improve operational efficiency.....6
Don't know ..... -97
Refused ..... -98

[Ask E4. only if answers not provided in E3. and E3a. above.]

E4. And why were you [installing, replacing, renovating**] the equipment at this time?**
[record response, probe: Why now? OR Why now and not later or earlier?, any other reasons]

E5. With whom did you discuss different efficiency options for this equipment?

[CIRCLE ALL THAT APPLY:]

[PROBE: ASK, "ANYONE ELSE?" THEN PROBE FOR OTHERS BY TYPE]

People internal to organization: 1
SmartStart Representative..... 2
Supplier/Vendor/Contractor.....3
Utility Representative 4
Other [SPECIFY]:_____....5
Don't know ..... -97
Refused ..... -98

E6. What role, if any, did your contractor play in helping you select <MEASURE DETAIL_GENERAL> equipment?

[RECORD ALL THAT APPLY]

No role 1
Provided bids 2
Recommended specific equipment 3
Identified equipment eligible for rebates 4
Informed my organization about the SmartStart program 5
Influenced the timing of equipment selection during the process 6
Other [RECORD RESPONSE]: 7
Don't know ..... -97
Refused ..... -98

E7. Did you become aware of SmartStart rebates and services. . .

[READ ENTIRE LIST BEFORE ACCEPTING RESPONSE AND SELECT ONLY ONE RESPONSE]

E8. From whom did you hear about SmartStart?

[RECORD ALL THAT APPLY]

Already knew before starting the project.....1
From contractor/vendor/supplier 2
From SMARTSTART representative.....3
From utility 4
From extension agent.....5
From colleague within my organization 6
From colleague or someone else outside my 7
From the internet.....8
Other:[RECORD RESPONSE]:_____ ..9
Don't know ..... -97
Refused ..... -98

E9. Where did you hear about the <MEASUREDETAIL_GENERAL> technology that you installed?

[RECORD ALL THAT APPLY]

Already knew before starting the project.....1
From contractor/vendor/supplier 2
From SMARTSTART representative.....3
From utility 4
From extension agent.....5
From colleague within my organization 6
From colleague or someone else outside my 7
From the internet.....8
Other:[RECORD RESPONSE]:_____ ..9
Don't know ..... -97
Refused ..... -98

E10. What role, if any, did SmartStart play in helping your organization select and install the equipment at this location?

[RECORD ALL THAT APPLY]

No role 1

Identified equipment eligible for rebates 2
Reviewed existing plans and made recommendations.....8
Provided information 3
Prepared materials for internal sale.....4
Helped estimate energy savings.....5
Helped estimate ROI or payback 6
Provided a feasibility study.....7
Other [RECORD RESPONSE].....9
Don't know ..... -97
Refused ..... -98

E10a. [ASK ONLY IF RESPONSE TO E10 INDICATED THAT SMARTSTART DID PLAY A ROLE IN HELPING THE ORGANIZATION SELECT AND INSTALL THEIR EQUIPMENT]

On a scale of 1-5, where 1 is very satisfied and 5 is very dissatisfied, how satisfied or dissatisfied were you with the help you received from SmartStart to select and install this equipment?

[RECORD ONLY ONE RESPONSE]:

Very Satisfied..... 1
Satisfied.....2
Neither satisfied nor dissatisfied.....3
Dissatisfied.....4
Very Dissatisfied.....5
Don't know .....[SKIP TO SECTION 5] -97
Refused .....[SKIP TO SECTION 5] -98

E10b: Why do you say that?

[RECORD RESPONSE VERBATIM:]_____

5 DIRECT ATTRIBUTION (DAT)

Now I'm going to ask you a series of questions to understand the effect, if any, that SmartStart had on your decisions regarding the purchase of <MEASUREDETAIL_SINGULAR>. When I ask about SmartStart I'm asking about the effect of the rebate, as well as the effect of other assistance that SmartStart provided such as design or technical assistance.

5.1 OVERALL INFLUENCE

DAT0. First, I'd like to know about the overall influence that the SmartStart Program had on your decision to purchase and install <MEASUREDETAIL_SINGULAR>.

If SmartSmart did not exist, would you say that it would be "*very* likely," "*somewhat* likely," "*not* very likely," or "not at all likely" that you would have installed <MEASUREDETAIL_SINGULAR>?

Very likely 1
Somewhat likely..... 2
Not very likely 3
Not likely at all.....4
Don't know ..... -97
Refused ..... -98

5.2 TIMING

DAT1. Next, I'd like to know about the effect, if any, that SmartStart rebates and other SmartStart assistance had on your decision to install <MEASUREDETAIL_SINGULAR> *at this particular time*.

If SmartStart did not exist, would you say that it would be "*very* likely," "*somewhat* likely," "*not* very likely," or "not at all likely" that you would have installed <MEASUREDETAIL_SINGULAR> *at this particular time*?

Very likely 1
Somewhat likely..... 2
Not very likely 3
Not likely at all.....4
Don't know ..... -97
Refused ..... -98

DAT1a. If SmartStart did not exist, how different would the timing of the installation have been? Would you say you would have installed <MEASUREDETAIL_SINGULAR> at the same time, earlier, later or never?

At the same time .....[SKIP to DAT2]1
Earlier.....[SKIP to DAT2]2
Later 3
Never.....[SKIP to DAT2]4
Don't know .....[SKIP to DAT2]-97
Refused ..... -98

[If DAT1 = -98 and DAT1a = -98, skip to DAT2.]

DAT1b. Approximately how many months later?

[TRY TO GET A NUMBER, USING BRACKETING IF NECESSARY BY BEGINNING WITH MORE OR LESS THAN FOUR YEARS LATER]

[RECORD # OF MONTHS: _____]1
Don't know ..... -97
Refused ..... -98

5.3 EFFICIENCY

DAT2. Next, I'd like to know about the effect, if any, that SmartStart rebates and other SmartStart assistance had on your decision to install *high efficiency* equipment.

If SmartStart did not exist, would you say that it was "*very* likely," "*somewhat* likely," "*not* very likely," or "*not at all* likely" that you would have installed <MEASUREDETAIL_SINGULAR > of the same *efficiency* as what you did install? Please respond "not applicable" if efficiency does not apply to the type of equipment you installed.

Very likely 1
Somewhat likely..... 2
Not very likely 3
Not likely at all.....4
Not applicable ..... [SKIP TO DAT3] 5
Don't know ..... -97
Refused ..... -98

DAT2a. If SmartStart did not exist, would you say you would have installed <MEASUREDETAIL_SINGULAR > of the same efficiency, lesser efficiency, or greater efficiency?

Same	[SKIP TO DAT3]1
Lesser	2
Greater	[SKIP TO DAT3]3
Not applicable	[SKIP TO DAT3]5
Don't know	[SKIP TO DAT3]-97
Refused	[SKIP TO DAT3]-98

[Make sure response is consistent with DAT2. If not, attempt to resolve.
If DAT2 = -97 and DAT2a = -97, attempt to resolve.
If DAT2 = -98 and DAT2a = -98, skip to DAT3.]

DAT2b. If SmartStart did not exist, would you have installed <MEASUREDETAIL_SINGULAR > that was "standard efficiency on the market at that time," "slightly higher than standard efficiency", "between standard efficiency and the efficiency that you installed," or "slightly lower than the high efficiency that was installed?"

Standard efficiency or according to code	1
Slightly higher than standard efficiency	2
Between standard efficiency and the efficiency that was installed	3
Slightly lower than the high efficiency that was installed	5
Don't know	-97
Refused	-98

5.4 QUANTITY

Next, I'd like to know about the effect, if any, that SmartStart rebates and other assistance had on how much <MEASUREDETAIL_GENERAL> equipment you installed.

DAT3. If SmartStart did not exist, how different would the [number/size] of <MEASUREDETAIL_GENERAL> equipment installed have been? Would you say you would have installed nothing, the same amount, less, or more? Please respond "not applicable" if number and size is not applicable to the type of equipment you installed.

Same amount	1

Less 2
More 3
Nothing 4
Not applicable .....[SKIP TO DAT4] 5
Don't know ..... [SKIP TO DAT4] -97
Refused ..... [SKIP TO DAT4] -98

[ONLY ASK QUESTION DAT3a IF RESPONDENT ANSWERED 1,2 or 3 TO DAT3.]

DAT3a. What percentage of <MEASUREDETAIL_GENERAL> equipment would you have installed without the SmartStart program?

0% 1
1-25% 2
26-50% 3
51-100% 4
More than 100% 5
Don't know ..... -97
Refused ..... -98

DAT4. We've just discussed the different effects that SmartStart had on your organization's decisions regarding the <MEASUREDETAIL_GENERAL> equipment that you installed. Now I'd like you to summarize the program's influence on the timing, efficiency and amount of <MEASUREDETAIL_GENERAL> equipment that you installed.

[RECORD RESPONSE:] _____

_____

5.5 SATISFACTION

[Next, I'd like to ask you about your satisfaction with the SmartStart program's rebates and services]

DAT5. On a scale of 1-5, where 1 is very satisfied and 5 is very dissatisfied, overall how satisfied or dissatisfied were you with SmartStart program?

Very Satisfied..... 1
Satisfied.....2
Neither satisfied nor dissatisfied.....3
Dissatisfied.....4

Very Dissatisfied.....5
Don't know ..... -97
Refused ..... [SKIP TO DAT 6] -98

DAT 5a: Why do you say that?

[RECORD RESPONSE:]_____
_____

DAT6. On a scale of 1-5, where 1 is very satisfied and 5 is very dissatisfied, how satisfied or dissatisfied were you with the dollar amount of the rebate you received through the SmartStart program?

Very Satisfied..... 1
Satisfied.....2
Neither satisfied nor dissatisfied.....3
Dissatisfied.....4
Very Dissatisfied.....5
Don't know ..... -97
Refused ..... -98

DAT7. In addition to the rebate you received through the SmartStart program, did you also take advantage of any design support or technical support services offered by the program?

[RECORD ALL THAT APPLY]:
Design Support..... 1
Technical Support .....[SKIP TO DAT7b] 2
Neither design nor technical support .....[SKIP TO DAT8] 3
Don't know ..... [SKIP TO DAT8] -97
Refused ..... [SKIP TO DAT8] -98

DAT7a. On a scale of 1-5, where 1 is very satisfied and 5 is very dissatisfied, how satisfied or dissatisfied were you with the design support you received through the SmartStart program?

Very Satisfied..... 1
Satisfied.....2
Neither satisfied nor dissatisfied.....3
Dissatisfied.....4
Very Dissatisfied.....5

Don't know ..... -97
Refused ..... [SKIP TO DAT 8] -98

DAT7b. On a scale of 1-5, where 1 is very satisfied and 5 is very dissatisfied, how satisfied or dissatisfied were you with the technical support you received through the SmartStart program?

Very Satisfied..... 1
Satisfied.....2
Neither satisfied nor dissatisfied.....3
Dissatisfied.....4
Very Dissatisfied.....5
Don't know ..... -97
Refused ..... -98

DAT8. Do you plan on participating in the SmartStart program again in the future?

Yes .....[SKIP TO DAT 9] 1
No.....2
Don't know ..... [SKIP TO DAT 9] -97
Refused ..... [SKIP TO DAT 9] -98

DAT 8a. What is the main reason you do not plan on participating in the SmartStart program in the future?

[RECORD RESPONSE VERBATIM]: _____
_____

DAT9. Do you have any additional comments about the SmartStart program?

[RECORD RESPONSE VERBATIM:]

5.5 REBOUND EFFECT

Next, I'd like to ask you about your usage of the <MEASUREDETAIL_GENERAL> equipment since it was installed.

DAT 10. Since you installed the new <MEASUREDETAIL_GENERAL> equipment, have you increased the amount of time that you operate this equipment? Please respond "not applicable" if operating time does not apply to the type of equipment you installed.

Yes 1
No.....[SKIP TO DAT 11]2
Not applicable .....[SKIP TO DAT 11]3
Don't know ..... [SKIP TO DAT 11] -97
Refused ..... [SKIP TO DAT 11] -98

DAT10a. Did you increase the operating time of this equipment because the energy savings you realized through increased efficiency of this <MEASUREDETAIL_GENERAL> equipment allowed you to afford to increase your operating time?

Yes 1
No.....[SKIP TO DAT 11] 2
Don't know ..... [SKIP TO DAT 11] -97
Refused ..... [SKIP TO DAT 11] -98

DAT10b. By what percentage have you increased the amount of time you currently operate this <MEASUREDETAIL_GENERAL> equipment?

RECORD ..... _____ %
Don't know ..... -97
Refused ..... -98

DAT 11. Since you installed the new <MEASUREDETAIL_GENERAL> equipment, have you increased the quantity or size of the equipment in use? Please respond "not applicable" if quantity or size does not apply to the type of equipment you installed.

Yes 1
No.....[SKIP TO D1]2
Not applicable .....[SKIP TO D1] 3
Don't know .....[SKIP TO D1] -97
Refused .....[SKIP TO D1] -98

DAT11a. Did this increase occur because the energy savings you realized through the increased efficiency of the <MEASUREDETAIL_GENERAL> equipment allowed you to afford an increase in the quantity or size of the equipment?

Yes 1
No.....[SKIP TO D1] 2
Don't know .....[SKIP TO D1] -97
Refused .....[SKIP TO D1] -98

DAT11b. Can you describe the increase in quantity or size of the <MEASUREDETAIL_GENERAL> equipment?

RECORD RESPONSE VERBATIM:_____
_____

6 DEMOGRAPHICS (D)

The final questions I have for you are about the facility at which your organization made the energy efficiency improvements we discussed earlier.

D1. What is the principal activity of your organization at this location?
Agricultural: e.g., production crops, livestock, agricultural services [SKIP TO d3] 1

Water or wastewater treatment facility [SKIP TO d3] 2

Retrofit: manufacturing/Retrofit process 3

Warehouse nonrefrigerated [SKIP TO d3] 4

Warehouse refrigerated [SKIP TO d3] 5

Education: including preschool, daycare [SKIP TO d3] 6

Food service: e.g., restaurant, bar, fast food, cafeteria [SKIP TO d3] 7

Food sales: e.g., grocery store [SKIP TO d3] 8

Enclosed mall [SKIP TO d3] 9

Strip mall [SKIP TO d3] 10

Retail excluding enclosed or strip mall: e.g., auto dealership, showroom, and store

[SKIP TO d3] 11

Public order and safety: including courthouse, probation office, jail[SKIP TO d3] 12

Nursing home/Assisted living (Skilled nursing) [SKIP TO d3] 13

Lodging: e.g., hotel/motel/inn/resort, dormitory/fraternity/sorority [SKIP TO d3] 14

Lodging: residential [SKIP TO d3] 15

Health care inpatient: e.g., hospital [SKIP TO d3] 16

Health care outpatient: e.g., doctor/dentist office, clinic [SKIP TO d3] 17

Laboratory [SKIP TO d3] 18

Religious worship [SKIP TO d3] 19

Public assembly: incl. theater, nightclub, library, museum, gym, bowling alley

[SKIP TO d3] 20

Service: e.g., auto service/repair, dry cleaner/laundromat, repair shop, post office

[SKIP TO d3] 21

Office/Professional: including bank, government [SKIP TO d3] 22

Other [SPECIFY d3_o] _____
_____ [SKIP TO d3] 23

[Don't know] [SKIP TO d3] -97

[Refused] [SKIP TO d3] -98

D2. Briefly describe what is done at this location. [Accept multiple responses]

Textile manufacturing 1

Wood manufacturing 2

Plastics manufacturing 3

Food manufacturing 4

Metal manufacturing 5

Goods manufacturing 6

Assembly 7

Other [Specify_____] 96

[Don't know] -97

[Refused] -98

D3. How many full-time employees work for your organization at this location?
[Record number of employees]_____

[Don't know] -97

[Refused] -98

D4. How many part-time employees work for your organization at this location?
[Record number of employees]_____

[Don't know] -97

[Refused] -98

D5. What is the total enclosed square footage of the space your organization occupies at this location? Your best estimate is fine.

[RECORD # SQ FT]......_____
[Don't know] -97

[Refused] -98

D6. At this location, does your organization [read list]
Own all of the space it occupies? 1

Lease all of the space it occupies? 2

Or own some and lease some of the space it occupies? 3

[Don't know] -97

[Refused] -98

D7. Does your organization operate at a single location, at multiple locations, or is it a franchise organization?

Single location.....[SKIP TO D9] 1
Multiple locations—not including franchise organization 2
Franchise organization.....3
Don't know.....-97
Refused .....-98

D8. Is your organization headquartered in New Jersey?

Yes.....1
No.....2
Don't know.....-97
Refused .....-98

D9. Thank you for taking the time to talk with me today. Would it be okay if I called you back to clarify my notes, if necessary?

Yes 1
No.....2
Don't know.....–97
Refused .....-98