LIPA EFFICIENCY LONG ISLAND 2010 ANNUAL REPORT – VOLUME II

Final

Prepared for:

LONG ISLAND POWER AUTHORITY

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1. INTRODUCTION

The 2010 Annual Report is divided into two volumes. Volume I provides an overview of the portfolio evaluation, including findings from the evaluation team's impact and process evaluations. The information in this volume (Volume II) provides a program-by-program impact analysis review, specific findings from the evaluation team's engineering review, and program level process findings. In Volume I, we compared impacts between program level evaluation findings and program goals. This document focuses on comparing evaluation findings against expected savings, as opposed to comparing evaluation findings to goals. Additionally, we provide program level impacts as well as end use impacts.

The terms associated with impact evaluations can vary. For this volume, the evaluation team uses the following terms to describe program impact results:

- Ex Ante – Assumed impacts tracked and reported by National Grid and contained in program tracking spreadsheets. This term is referred to as "Expected Savings" in Volume I.
- Ex Post – Estimated impacts determined through an evaluation process. This term is referred to as "Evaluated Savings" in Volume I.
- Gross Impacts – The change in energy consumption and/or demand that results directly from program-related actions taken by participants, regardless of why they participated.
- Net Impacts – The total change in energy or demand that is attributable to the program.
- Realization Rate – Ex post impacts divided by ex ante impacts.

This introduction includes a comparison of the estimated demand and energy impacts determined through our evaluation (ex post impacts) results to 2010 program goals and a summary of cost effectiveness results. The remainder of this volume is organized as follows:

- Section 2 provides a program-by-program review of ex post net energy and demand savings and process evaluation findings. For each program, this section outlines the energy and demand savings accrued from PY2010 programs and provides measure specific recommendations for updating the energy savings calculations. The process evaluation effort included an assessment of program implementation, marketing and outreach, data tracking, and quality assurance and control procedures and provides recommendations for program improvements.
- Section 3 provides a summary of the study methodology, including information on the primary and secondary data collection, as well as the analytical methods used to derive ex post savings estimates.
- The appendices present supporting documents for the impact and process evaluation. These include Technical Reference Manuals (TRMs) for the Commercial Construction program, Energy Efficient Products program, Cool Homes program, Residential Energy Affordability Partnership program and Home Performance Direct

program (Appendices C-G). Each TRM details measure specific energy savings and algorithms for these programs.

Summary of Demand and Energy Impacts

The portfolio of ELI programs delivered considerable demand and energy savings to electric customers on Long Island. Specifically, the ELI Portfolio accounted for more than 27 MW and 142,737 MWh in total evaluated net savings for 2010. The ELI Portfolio performed well though fell short of the net demand and energy goals by 5 and 9% respectively.

Table 1-1. Net Impacts: ELI Portfolio Evaluated Impacts versus Goals

Program	2010 Ex Post Net Impacts		2010 Net Impact Goals		Percent of Goal	
	MW	MWh	MW	MWh	MW	MWh
Commercial Efficiency	10.60	47,580	10.13	45,023	105%	106%
Total Commercial	*10.60*	*47,580*	*10.13*	*45,023*	*101%*	*105%*
Efficient Products	9.97	80,474	8.72	92,959	114%	87%
Cool Homes	3.90	3,697	5.13	2,969	76%	125%
Residential Energy Affordability Partnership	0.39	3,940	0.75	6,022	52%	65%
Home Performance with ENERGY STAR / Home Performance Direct	0.49	2,851	2.72	5,710	18%	50%
Information / Education	1.49	2,746	1.15	3,250	129%	85%
ENERGY STAR New Homes	0.81	1,449	0.38	739	214%	196%
Total Residential	*17.05*	*95,156*	*18.86*	*111,649*	*90%*	*85%*
Total ELI	*27.65*	*142,737*	*28.99*	*156,672*	*95%*	*91%*

Total evaluated net savings for 2010 indicate that the Energy Efficient Products (EEP) program and the Commercial Efficiency (CE) program are key drivers to portfolio performance—combined accounting for 74% of evaluated net demand savings and 90% net energy savings. The CE program, and thus the Commercial portfolio exceeded both net demand and energy goals for 2010. The EEP program accounts for the largest share of demand and energy savings among the residential programs and dictates the performance of the residential portfolio, particularly with respect to energy savings. EEP

exceeded net demand savings goal by 14% and did not exceed the energy savings goal by a similar margin causing the residential portfolio to fall short of goal as well. The Cool Homes, REAP and Home Performance with ENERGY STAR® / Home Performance Direct programs fell short of their 2010 net demand goals offsetting the results of the EEP program when examined at the residential portfolio level. ENERGY STAR New Homes and Information/Education both exceeded their 2010 net demand savings goals by 114% and 29% respectively, but the Info/Ed program fell short of its 2010 energy goal by 15%.

The portfolio of renewable programs exceeded net demand and goals by 65% and 86%, respectively. Similar to the 2009 program year, these goals were achieved largely through the success of the Solar program. This program exceeded MW and MWh goals by 68% and 110%, respectively. This achievement was largely due to the fact that the program provided rebates for more than 1,350 photovoltaic systems in 2010, far more than was originally planned. The Small Wind program obtained 39% and 20% of the demand and energy savings goals, respectively. This was the second year of the program and a total of six installations, two residential and four commercial, were completed.

Table 1-2: Net Impacts: Renewable Portfolio Evaluated Impacts versus Goals

Program	2010 Ex Post Net Impacts		2010 Net Impact Goals		Percent of Goal	
	MW	MWh	MW	MWh	MW	MWh
Solar	4.57	12,297	2.72	5,869	168%	210%
Small Wind	0.02	168	0.06	832	39%	20%
Total Renewable	***4.59***	***12,466***	***2.78***	***6,701***	***165%***	***186%***

Summary of Cost Effectiveness Results

Based on an analysis of program and portfolio level impacts and costs, the savings generated by the ELI portfolio and each program are cost effective. The evaluation team used two separate tests to establish a Benefit/Cost ratio for each program, the Program Administrator (PA) test and the Total Resource Cost (TRC) test. The tests are similar in all respects but consider different costs in determining a Benefit/Cost ratio. The PA test measures the net costs of an energy efficiency program as a resource option based on the costs incurred by the program administrator, including all program costs and any rebate and incentive costs, but excludes costs incurred by the participant. The TRC test is a test that considers costs to the participant but excludes rebate and incentive costs, as these are viewed as transfers at the societal level. To allow for direct comparison with LIPA's assessment of all supply-side options, we apply the PA test as the primary method of determining cost effectiveness and used assumptions similar to those used by LIPA's resource planning team.

The PA test Benefit/Cost ratio is 6.1 for the ELI portfolio and 1.1 for the Renewable Energy portfolio indicating that portfolio benefits exceed Program Administrator costs in both cases (a Benefit/Cost ratio greater than 1 indicates that portfolio benefits outweigh costs). The portfolio level TRC values are 4.0 and 0.5 for the ELI and Renewable portfolios respectively.

Table 1-3: Cost Effectiveness for the ELI and Renewable Portfolios

Program	NPV Benefits	Total Resource Cost		Program Administrator	
		Costs	Benefit Cost Ratio	Costs	Benefit Cost Ratio
Commercial Efficiency Program	**$86,073,056**	**$12,669,992**	**6.8**	**$8,648,061**	**10.0**
Energy Efficient Products	$57,057,362	$16,793,596	3.4	$6,535,303	8.7
Cool Homes	$18,513,593	$3,674,635	5.0	$3,819,280	4.8
REAP	$4,479,722	$4,305,624	1.0	$2,781,033	1.6
Information Education	$1,329,065	$556,157	2.4	$556,157	2.4
Home Performance Direct/Home Performance with ENERGY STAR	$6,355,266	$5,450,159	1.2	$5,660,650	1.1
Existing Homes Subtotal	$30,677,647	$13,986,575	2.2	$12,817,119	2.4
Residential New Homes	$7,857,827	$1,878,567	3.5	$1,994,126	3.9
Subtotal Residential	**$95,592,835**	**$32,658,737**	**2.9**	**$21,346,547**	**4.5**
Subtotal ELI	**$181,655,891**	**$45,328,730**	**4.0**	**$29,994,608**	**6.1**
Solar	$39,169,952	$78,404,660	0.5	$34,884,220	1.1
Backyard Wind	$340,185	$986,770	0.3	$368,062	0.9
Subtotal Renewable	**$39,510,137**	**$79,391,430**	**0.5**	**$35,252,282**	**1.1**
Total	**$221,176,028**	**$124,720,159**	**1.8**	**$65,246,890**	**3.4**

A levelized cost analysis is a way to quickly compare the cost of energy efficiency programs with the energy or demand saved from the programs. Levelized costs are expressed as $/kW or $/kWh, meaning that the result can readily be compared to the cost of alternative supply additions or the cost of generating electricity. However, different from how power is typically purchased where capacity is purchased first and then the additional cost of energy is added, the levelized costs here are either/or values. That is, the total costs are included in the calculation for levelized costs for kWh and then the same costs are included in the kW value. Regardless, if the cost of the efficiency investment is less than the cost of capacity additions or generated electricity, efficiency is considered a wise investment.

The levelized costs of capacity and energy for the ELI Portfolio savings is $126.94 per kW and $0.027 per kWh — less than the comparable costs of alternative supply side

resources and less than the cost of generating the displaced energy. In contrast, the levelized costs associated with the Renewable Energy portfolio are higher than the comparable marginal costs of supply-side alternatives[1] However, when taking both portfolios together, LIPA's efficiency and renewable options compare favorably to the cost of alternative supply.

Table 1-4: Levelized Costs for the ELI and Renewable Portfolios

Program	Total Program Costs ($)	Levelized Costs	
		$/kWh	$/kW-yr
Commercial Efficiency Program	**$8,648,061**	**0.018**	**78.78**
Energy Efficient Products	$6,535,303	0.014	110.42
Cool Homes	$3,819,280	0.104	98.54
REAP	$2,781,033	0.075	712.98
Information Education	$556,157	0.110	203.12
Home Performance Direct/Home Performance with ENERGY STAR	$5,660,650	0.203	1,177.61
Existing Homes Subtotal	$12,817,119	*0.104*	*216.07*
Residential New Homes	$1,994,126	0.138	248.71
Subtotal Residential	**$21,346,547**	**0.036**	**168.72**
Subtotal ELI	**$29,994,608**	**0.027**	**126.94**
Solar	$34,884,220	0.214	575.75
Backyard Wind	$368,062	0.165	1,112.92
Subtotal Renewables	**$35,252,282**	**0.214**	**579.94**
Total	**$65,246,890**	**0.052**	**219.62**

[1] Note that separate energy and capacity payments are typically made for supply alternatives, whereas, in this analysis, the costs are assigned entirely to energy to calculate $/kWh and then those same costs are allocated entirely to demand to arrive at $/kW.

2. PROGRAM–BY–PROGRAM FINDINGS

Below we provide our program-by-program findings.

2.1 Commercial Efficiency Program

LIPA's Commercial Efficiency Program (CEP) is multi-faceted and comprehensive. It provides incentives to business and not-for-profit customers with facilities in LIPA's service territory. The Commercial Efficiency program features three distinct components:

- Prescriptive: Offers predefined replacement and retrofit measures that are rebated at set incentive amounts.
- Not-for-profit: Offers same equipment replacement and retrofit measures as the prescriptive component, but features higher incentives for most lighting and HVAC measures. This component is offered to not-for-profit and municipal customers only.
- Custom/Whole Building Design: Offers incentives for more complex and less common energy efficient equipment and for new construction projects that integrate energy efficient building shell and operating systems and result in a building that exceeds standard practice. Custom projects offer a certain degree of flexibility in terms of equipment choices and incentive amounts, thus allowing LIPA to better meet customers' needs and engage customers with the program.

In addition to these core components, LIPA's Commercial Efficiency program also offers no-cost energy audits, cost-shared technical assistance studies, building commissioning co-funding, and LEED certification incentives.

Net Impacts

Table 2-1 lists the CEP impacts. These impacts also include the not-for-profit and fall lighting stimulus savings in the results for the prescriptive program. Values in Table 2-1 include line losses of 6.8% on energy consumption, whereby a multiple of 1.073 = (1/(1-0.068) has been applied to the reported numbers, and a line loss of 9.2% on peak demand which is a multiple of 1.1013 = (1/(1-0.092). We used program-supplied net-to-gross factors.

Table 2-1. Net Impacts – CEP Summary

Measure Category	Number of Units	Net Ex Ante		Net Ex Post		Realization Rate	
		kW Saved	kWh Saved	kW Saved	kWh Saved	kW	kWh
Lighting	35,846	3,579.2	14,963,240	4,169.3	15,054,787	116%	101%
HVAC	420	681.5	1,560,194	583.4	1,248,008	86%	80%
Motors and VFDs	274	89.4	1,500,924	89.4	1,500,924	100%	100%
Compressed Air	73	46.9	910,787	202.4	1,100,526	432%	121%
Vending Machines	168	0.0	251,974	0.0	266,320	-	106%
Kitchen Equipment	2	0.3	1,284	0.4	1,366	127%	106%
Prescriptive Totals	36,783	4,397.3	19,188,403	5,044.9	19,171,931	115%	100%
All Custom	*457*	*4,880*	*32,146,789*	*5,553*	*28,408,504*	*114%*	*88%*
CEP Total	**37,240**	**9,277**	**51,335,195[a]**	**10,598**	**47,580,435**	**114%**	**93%**

[a] Value differs from year end savings reported by National Grid due to rounding in National Grid value.

Prescriptive Program Component

This section provides the results of the evaluation team's analysis of energy and demand savings associated with prescriptive measures installed through the CEP. For purposes of analysis, we grouped prescriptive measures into six end-use categories: lighting, motors and drives, compressed air, HVAC, kitchen equipment, and vending machines. In addition to providing ex post net savings estimates for each end-use category, we also recommend revisions to the prescriptive measure savings algorithms used to estimate ex ante savings.

To determine ex post energy and demand savings, the evaluation team implemented a two-stage approach. First, we conducted an engineering review of the savings algorithms for prescriptive measures documented in the program Technical Resource Manual (TRM) for which incentives were paid in 2010. This included a review of measures introduced to the program in 2010, as well as existing program measures that we believe necessitated updates to their savings algorithms. We reviewed the following new refrigeration measures and adjusted LIPA's savings estimates in our TRM documentation:

- **New Refrigeration Measures**: We updated this category to include the new prescriptive measures introduced in 2010, including electronically commutated (EC) and permanent-split capacitor (PSC) motors in coolers and freezers, new glass or solid door coolers and freezers, case covers, door heater controls, and energy efficient ice makers.

We also significantly updated the savings algorithms from LIPA's estimated values in 2009 for the following measures:

- **HVAC**: We updated algorithms for AC and heat pump equipment to increase the baseline equipment efficiency standards from 1999 levels to 2004 levels. The updates also include a correction to the baseline energy efficiency ratio (EER) values that significantly increased demand savings values.
- **Compressed Air**: We adjusted algorithms for all compressed air measures from LIPA's savings assessments. For air receivers, we corrected motor efficiencies in the algorithms. For variable speed and variable displacement compressors, we substantially increased peak demand.
- **Kitchen Equipment**: We adjusted algorithms for kitchen equipment according to ENERGY STAR requirements, with some measures reducing energy and demand savings estimates, and others increasing these estimates.

In the second stage of the prescriptive program evaluation, the evaluation team applied the revised savings algorithms to the measure-specific tracking data to determine ex post savings. We used the characteristics of the installed measures specified in the tracking data, such as equipment size (in tons, horsepower, or watts) and efficiency as input to the savings algorithms. The evaluation team applied the planning assumptions for free ridership and spillover to all measures to determine ex post net energy and demand savings[2]. Appendix H provides the planning assumptions for all programs.

Table 2-2 presents net ex post energy and demand savings associated with the prescriptive program component by end-use category. Values include line losses of 6.8% on energy consumption, whereby a multiple of 1.073 = (1/(1-0.068) has been applied to the reported numbers, and a line loss of 9.2% on peak demand which is a multiple of 1.1013 = (1/(1-0.092). We used program-supplied net-to-gross factors.

Table 2-2. Net Impacts—Prescriptive Program Component

Measure Category	Number of Units	Net Ex Ante		Net Ex Post		Realization Rate	
		kW Saved	kWh Saved	kW Saved	kWh Saved	kW	kWh
Lighting	35,846	3,579.2	14,963,240	4,169.3	15,054,787	116%	101%
HVAC	420	681.5	1,560,194	583.4	1,248,008	86%	80%
Motors and VFDs	274	89.4	1,500,924	89.4	1,500,924	100%	100%
Compressed Air	73	46.9	910,787	202.4	1,100,526	432%	121%
Vending Machines	168	0.0	251,974	0.0	266,320	-	106%
Kitchen Equipment	2	0.3	1,284	0.4	1,366	127%	106%
Totals	**36,783.0**	**4,397.3**	**19,188,403**	**5,044.9**	**19,171,931**	**115%**	**100%**

[2] For 2010, the program planners assume free ridership and spillover rates based on the measure category.

In total, our evaluation of the prescriptive component of CEP found higher net demand and comparable net energy savings for prescriptive measures. However, we found a number of discrepancies across measure categories. We explain these discrepancies as follows:

- Compressed Air: The high realization rate for demand in the Compressed Air category was due to a much higher demand savings expected for variable speed and variable displacement compressors than LIPA was predicting. The increase was based on the compressor savings algorithm that National Grid developed for NYSERDA, where demand savings is determined to be a percentage of the compressor size. The evaluation team's demand savings factors are 2-4 times the values currently used in LIPA's program. The evaluation team was unable to compare the individual variables or assumptions for this method to LIPA's deemed savings for this category due to lack of documentation.
- HVAC: LIPA's savings algorithms specify baseline conditions as mandated by ASHRAE 90.1 1999. We revised baseline values so they meet ASHRAE 90.1 2004. We recommend that the program adopt either ASHRAE 90.1 2004 or 2007 as a baseline, as these assumptions are more comparable to those being used in other regional efficiency programs.

  After applying the new algorithms to HVAC measures in the program-tracking database, we noticed that realization rates for some measure categories did not match our expectations. For example, we expected a demand realization rate of 162% for Split A/C units of less than 65,000 Btu/h. However, the realization rate from the tracking database demand savings to our updated value was only about 46%. We recommend a thorough review of the savings algorithms embedded in the program-tracking database to ensure calculations more closely align with tracked savings values.
- Kitchen Equipment: For kitchen equipment, we calculated ex post savings based on industry standards for baseline and efficient equipment. The savings values currently used to estimate ex ante savings reference documents and sources that are no longer valid. The evaluation team recommends that the program adopt the updated savings values.

Custom Program

We based impacts from the custom program on the evaluation of 20 sites via engineering measurement and verification (M&V) and 20 more sites via engineering desk review.

Custom projects varied from the installation of efficient lighting fixtures with occupancy sensors, to an enthalpy wheel for energy recovery on a cooling system, to computer center controls that reduce energy usage. To do custom project analysis, we first determine site-specific realization rates for a stratified random sample of projects. We stratify projects according to their ex ante energy savings values. The analysis essentially compares the program estimated savings values to the adjusted values obtained from site M&V and desk reviews for the various projects in our sample. We apply a weighted realization rate from the sample back to the overall program population to obtain gross impacts. The

resulting net values include line losses of 6.8% on energy consumption, whereby a multiple of 1.073 = (1/(1-0.068) has been applied to the reported numbers, and a line loss of 9.2% on peak demand which is a multiple of 1.1013 = (1/(1-0.092). We used program-supplied net-to-gross factors.

Table 2-3. Net Impacts – Custom Program Component

Measure Category	Number of Units	Net Ex Ante		Net Ex Post		Realization Rate	
		kW Saved	kWh Saved	kW Saved	kWh Saved	kW	kWh
All Custom	457	4,880	32,146,789	5,553	28,408,504	114%	88%

Overall, ex post savings for the custom component of the program exceeded ex ante estimates for capacity but fell short for energy. On a project-specific basis, realization rates varied widely, from a low of 22% to a high of 371%. As is typical for custom programs, errors found when assessing sites sometimes increase realization rates, and sometimes decrease them, but the overall effects even out so realization rates tend towards 100%. The lowest realization rate of 22% was due to an error in the assumed operating hours of a computer center's controls (we assumed 61,320 operating hours, even though a year has 8,760 hours). The highest realization rate of 371% was seemingly due to an error in the savings recorded in the database for a lighting project (393,000 kWh was recorded, versus application calculations of 895,000 kWh), as well as additional savings found in the site visit, due to better than estimated lighting control operation. Appendix I provides site-specific results and reasons for the discrepancies.

We found some common errors during custom ex ante estimates that were responsible for both high and low realization rates:

- **The interactive effects of measures in a system were not always estimated and accounted for in the ex ante estimates of savings.** Custom projects often encompass multiple technologies that affect the operation of other equipment when changes are made. For example:

  The interactive effects of lighting and lighting controls are not always properly accounted for in savings calculations, as was the case in the project that earned our highest realization rate, 371%.

  Another site did not account for the extra fan power needed to operate an enthalpy wheel. Inclusion of the added fan energy use reduced the estimated savings.

- **Tighter Quality Control may be needed.** While all custom projects went through the requisite engineering reviews and pre- and post-install inspections (Table 2-7), we found errors during our desk reviews and M&V visits.

  – We found operating hours to be incorrect. In addition to the 61,320 operating hour error described above, some projects assumed constant operation 24 hours a day, when actual operating hours were based on 16 hours a day.

– During several site visits, the numbers of installed light fixtures or other equipment did not match what was listed in the project application.

Process Findings

The 2010 process assessment of the Commercial Efficiency program included four data collection and analysis efforts:

- **Review of program-tracking databases and other program materials**: The evaluation team reviewed program participant and audit-tracking databases, program application forms, and other program materials.
- **In-depth interviews with program staff**: The evaluation team conducted four in-depth interviews with program and project managers
- **Participant telephone survey**: The evaluation team conducted a telephone survey with 107 program participants.
- **In-depth interviews with program trade allies:** The evaluation team conducted seven in-depth interviews with program trade allies, including interviews with rebate administrators and contractors.

The goals for 2011 CEP have doubled over the 2010 goals (to ~92 GWh). These are aggressive goals, attempting to reduce the commercial sector energy use by about 1.3%[3]. As a comparison, some Midwestern utilities have goals of 0.2% portfolio reduction for a first-year goal, moving up to 2% portfolio savings of annual energy use over a seven-year timeline.[4]

Program Participation

In 2010, similar to the previous program years, LIPA offered incentives for both prescriptive and custom program components. Custom projects were predominant, with the remaining applications being divided between prescriptive program, not-for-profit program, and the Fall Stimulus Lighting Initiative (Table 2-4).

Table 2-4. 2010 Participation by Program Component

Program Component	Number of Applications	% of Applications
Energy Audits	643	-
Technical Assistance	Unknown[a]	-
Prescriptive	346	32%
Not-for-profit	190	18%
Fall Stimulus Pilot	73	7%
Custom	456	43%
Total not including audits	**1065**	

[a]The data on the total number of TA studies was unavailable to the evaluation team.

[3] The 92 GWh value is compared to energy use for all 2009 commercial accounts.

[4] Please note that these are portfolio goals, as opposed to commercial programs goals.

Program Processes

The CEP has several different components to the program, each focused on a specific need of the nonresidential sector. We present our findings by component to draw out the specific changes that could be implemented to improve the specific component and the CEP program overall.

Energy Audits

The Commercial Efficiency program offers free audits to qualifying customers. National Grid manages the audit program, while an outside contracting firm delivers the actual audits. The Commercial Efficiency program offers two types of assessments:

- **Energy audits**: A standard energy assessment with a follow-up report.
- **Energy consults**: A simplified version of the standard energy assessment offered to small business customers (electric demand of 60 kW or less). A consult involves a walk-through survey that provides energy efficient improvement recommendations.

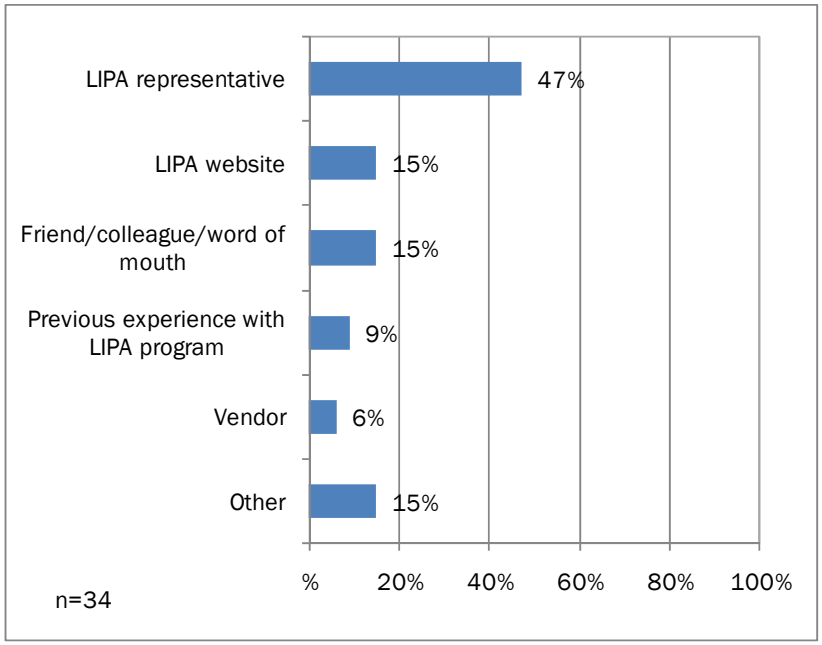
Historically, the audit program component has not been overtly marketed to LIPA customers; yet the number of audits has grown from about 150 in 2006 to over 600[5] in 2010. According to National Grid program staff, it is probable that less than 20% of audits translated into actual projects within the Commercial Efficiency program.[6]

We found that slightly over a third (36%) of program participants report having an audit conducted at the facility that participated in the Commercial Efficiency program. Prescriptive program participants are slightly less likely than participants of the other program components to report having an audit conducted at their facility. Nearly half (47%) of program participants learned about the audit opportunities from a LIPA representative and another 15% from the LIPA website.

[5] These values are from the Program Manager and represent 376 Level 1 audits (consults) and 267 Level 2 or 3 audits performed in 2010 .

[6] Because the audits are not tracked in a program-tracking database and because of the way the audit data are tracked, we were unable to link audits to completed projects to estimate the share of audits that turned into projects.

Figure 2-1. Sources of Information about the Audit Program*



Source: 2010 Participant Survey
**Multiple response question*

Over three quarters of program participants who had an audit (77%) find audit results useful[7] and close to a half (46%) find them very useful.[8]

The audit program component can be a powerful outreach and channeling tool. Many utilities across the nation successfully use audits to market their Demand-Side Management (DSM) programs. In contrast, the audit component of the Commercial Efficiency program appears to function independently from the other components of the program. As such, the audits are being underutilized as a program marketing mechanism. Our interviews with program staff indicate that staff recognize this missed opportunity. National Grid program staff identified four main reasons for the underutilization of audits and described actions they are implementing to address the issue. The issues and associated actions taken to address them include:

Issue 1 – Purpose of audits. Currently, Major Account Executives and Commercial Energy Consultants at National Grid are responsible for marketing the audits and conducting follow-up calls on the audit recommendations. According to the National Grid program staff, Major Account Executives often use audits solely as a "customer satisfaction" tool, offering them to customers who are calling to express their discontent with high energy bills.

***Actions taken in response to issue*:** The practice of offering audits to "dissatisfied" customers is expected to be curtailed by ending the practice of Major Account Executives offering audits to their customers. Instead, the Solution Provider and National Grid

[7] A rating of 6 and 7 on a scale from 1 to 7 where 1 is "not at all useful" and 7 is "very useful."

[8] A rating of 7 on a scale from 1 to 7 where 1 is "not at all useful" and 7 is "very useful."

Commercial Energy Consultants will be responsible for promoting the audits to qualified customers. Any incoming calls to Major Account Executives with requests for audits will be forwarded to a designated Solution Provider representative. This could be an effective step toward more appropriate use of the audit program resources. When two distinct entities are involved in working towards a goal, clear communication is paramount. We recommend that clear communication and coordination protocols be established between the Solution Provider and the Major Account Executives to eliminate any customer confusion and delays in processing audit requests and scheduling audits.

Issue 2 – Budget and staffing constraints. According to the audit program manager, the audit program is currently limited in funding as well as in the number of staffing resources dedicated to processing and invoicing the audits and maintaining the audit-tracking database. At the same time, the program is hoping to increase the number of audits to over 1,000 in 2011.

***Actions taken in response to issue*:** The Audit Contractor is expected to increase the staffing of the audit program, as they will be charged with performing some of the audit work in 2011. A ramp-up in the number of audits planned for 2011 might warrant allocation of additional resources to the program for accurate tracking of audit projects.

Issue 3 – Lack of marketing, and confusion in the marketplace. With little to no marketing of the audit program, customers who are potentially interested in making energy efficient improvements but do not know what improvements to make may not be getting the assistance they need. According to the audit program manager, there is some confusion around audits being a prerequisite for program participation. That is, some customers wrongfully believe that audits are required to apply for program incentives.

***Actions taken in response to issue*:** The audit program is expected to be marketed more heavily in 2011. The Solution Provider, Commercial Energy Consultants, and project managers are expected to be more involved and proactive in using audits as a sales tool and following up on the audit leads. We recommend that clear protocols and procedures be established around following up on audit leads and coordinating these efforts. This will help ensure smooth program flow and avoid duplication of efforts.

Issue 4 – Data entry and tracking. To understand if audits are effective in generating leads for and increasing participation in the Commercial Efficiency program, it is necessary to integrate program-tracking data. Currently, the audit data are tracked independently of the program data, and opportunities identified through audits are not communicated to CEP project managers for follow-up.

***Actions taken in response to issue*:** The Siebel database is expected to address issues with audit data entry and tracking. Audit information will be linked to program applications, with every audit request entered into the database as a project lead. This should ensure not only full integration of the audit efforts with the Commercial Efficiency program efforts, but also allow for easy reporting and tracking of the degree to which audits ultimately lead to program participation.

As documented above, National Grid and LIPA program staff are currently working to better integrate the audit program with other components of the Commercial Efficiency

program and leverage audits to inform and engage customers with the program. We will revisit this topic in our subsequent evaluations to assess the extent to which these planned changes and modifications were implemented, as well as to assess their effectiveness.

Overall, considering the aggressive program goals for 2011 and beyond, we recommend utilizing the audit program to its fullest capacity. Audits can generate interest in the marketplace and channel interested customers into the Commercial Efficiency program, thus serving as an effective marketing and lead generation tactic.

Technical Assistance Studies

As part of the Commercial Efficiency program, Whole Building Design and LEED projects require Technical Assistance (TA) studies, with LIPA sharing the cost of the study with program participants. Large custom projects can also request to have a TA study performed. National Grid oversees and partially administers TA studies. Twelve TA firms are helping National Grid with the administration of the TA projects. According to program staff, requests for Technical Assistance come from a variety of sources, including customers themselves, building designers, architects, and engineers. In 2010, marketing or promotion of the technical assistance studies was not actively pursued.

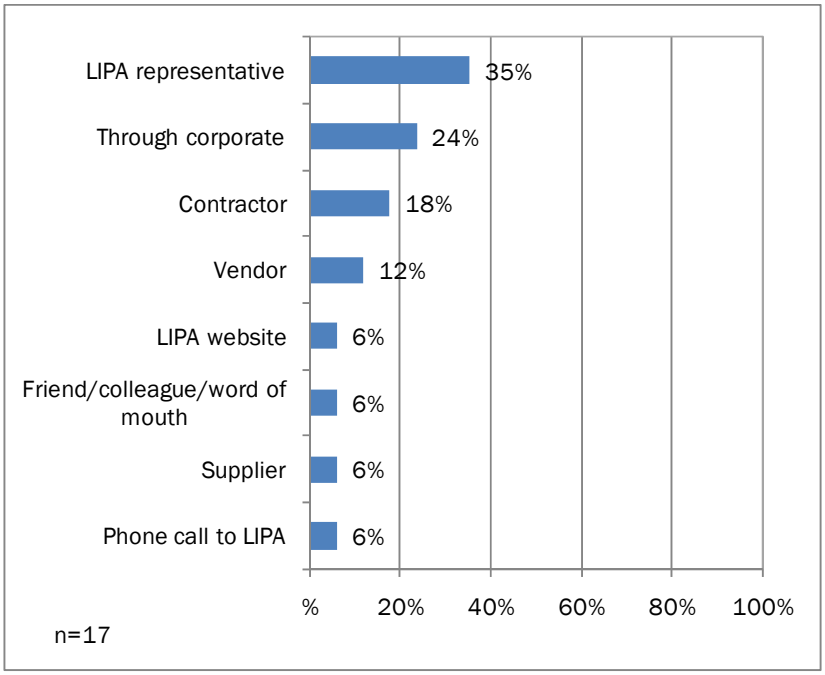
The majority of the Commercial Efficiency program participants (82%) did not have a TA study performed at the facility or facilities that participated in the Commercial Efficiency program. Of those who did, a third (35%) learned about an opportunity for a TA study from a LIPA representative, a quarter (24%) through their corporate office, and 18% through their contractor.

Eight in ten program participants who had a TA study administered at their facility or facilities (81%) are satisfied[9] with the recommendations provided in the technical assistance study report, with 56% being very satisfied.[10]

[9] A rating of 6 and 7 on a scale from 1 to 7 where 1 is “very dissatisfied” and 7 is “very satisfied.”

[10] A rating of 7 on a scale from 1 to 7 where 1 is “very dissatisfied” and 7 is “very satisfied.”

Figure 2-2. Sources of Information about TA Study*



Source: 2010 Participant Survey
**Multiple response question*

Our analysis did not delve into the specific processes for the TA studies and we have no specific recommendations for this component. However, TA studies, due to their cost-sharing nature, present an excellent opportunity for LIPA to reach a pool of potential customers who are already *interested* in making energy efficient improvements. They can also be an effective sales tool to help meet the program's increased goals for 2011.

LEED Certification

In 2010, in addition to its Whole Building Design program, LIPA offered additional financial incentives to building owners and developers to help them meet LEED Green Building goals. For projects seeking LEED certification, LIPA offers:

- A $100,000 increase in the incentive cap
- A complete reimbursement of energy modeling costs (up to $50,000) and costs associated with fundamental and additional commissioning of energy-related systems (up to $100,000)
- Additional financial incentives for earning LEED points up to $25,000

While these financial incentives are designed to deliver additional energy savings to the Commercial Efficiency program, building codes in certain areas of Long Island already require new building construction to adhere to LEED requirements. More specifically, the town of Huntington adopted the *Green Building Commercial Standard* that requires commercial construction projects 4,000 sq. ft. or greater to achieve LEED certified status at a minimum, and main buildings in Light Industry Districts to achieve LEED Silver

certification.[11] The town of Babylon, according to the provisions of the 2006 Resolution, requires all new commercial and industrial buildings to be LEED certified.[12] LEED certification is met based on several different activities within building construction and operation. Energy efficiency is only one part. New buildings may be able to make LEED certification and not necessarily be as efficient as possible.

We recommend that any commercial or not-for-profit entity applying for LEED incentives in the above-mentioned towns be closely reviewed and thoroughly documented to assure that the LIPA incentives are helping move the project beyond the planned energy efficiency level.

Custom and Prescriptive

Application Forms

Prescriptive and custom programs used different application forms in PY2010. The prescriptive side used a single, comprehensive application form. According to National Grid program staff, this made the application fairly complex and confusing causing difficulty for customers and contractors attempting to determine which section they needed to complete, a belief that was supported by some participants and trade allies. This issue resulted in the submission of incomplete applications, missing information, and prolonged application processing times.

Overall, 64% of program participants filled out at least some of the application forms for their energy efficiency project. In the majority of cases where the program participant did not fill out program application (66%), the contractor, consultant, supplier, vendor, or distributor completed the application for them.

Program participants who filled out their application forms nearly universally (92%) agree that the application form clearly explained program requirements, while over half (57%) rate the application process overall as easy.[13] Custom and Fall Stimulus Lighting program participants are more likely than prescriptive and not-for-profit program participants to rate the application process as overall easy. Program participants who found the application process difficult, rated it as such because of their inability to provide responses to technical questions, the large number of questions in the application form, and a confusing application form layout.

Among trade allies that we interviewed, satisfaction with the application forms was overall high. However, a few contractors thought that the forms were lengthy and that the information required from them was often difficult to obtain from equipment manufacturers.

For 2011, LIPA has simplified the prescriptive application considerably. Each end use now has an application form of its own. Equipment worksheets within each of these applications are tailored to each individual end use, while contact information and program requirement sections are consistent across the applications. We reviewed the

[11] Source: http://www.ecode360.com/?custId=HU0566&guid=12185304&j=23 (§197-4)

[12] Source: http://www.usgbc.org/ShowFile.aspx?DocumentID=2164

[13] A rating of 6 and 7 on a scale from 1 to 7, where 1 is "very difficult" and 7 is "very easy."

2011 application forms and found them to be much easier to understand and fill out than the 2010 prescriptive applications.

Satisfaction with Program Components

Telephone survey and trade ally in-depth interviews explored participant satisfaction with a variety of program components, as well as overall satisfaction with the Commercial Efficiency program and with LIPA.

Satisfaction with the Commercial Efficiency program is fairly high—seven in ten program participants (70%) are satisfied[14] and nearly a half (47%) are very satisfied.[15] Satisfaction with individual program components, however, varies, with experiences with the technical support team and infoline personnel yielding more positive feedback[16] and incentive levels being the area of lower satisfaction.

Less than six in ten (57%) program participants are satisfied with the amount of time it took them to receive their incentive.[17] Generally, customers who have received their incentives within eight weeks of submitting final application paperwork are twice as likely to be satisfied with the timing of incentive receipt than the program participants who had to wait more than eight weeks for their incentive. Perception of the rebate processing times was mixed among the trade allies. While some were happy with the timelines within which they received their rebate, a couple of trade allies mentioned that LIPA is very difficult to work with because of the slow rebate processing times and checks getting lost in the mail.

Sixty five percent of program participants are satisfied with the variety of equipment types offered through the program.[18] Interestingly, while prescriptive and not-for-profit customers are offered the same selection of equipment, prescriptive program participants are significantly more likely to report higher satisfaction with the selection than not-for-profit program participants. Dissatisfaction with equipment stems from a limited variety of qualifying equipment and equipment brands, and difficulty finding the right equipment.

Overall, 57% of program participants are satisfied with LIPA.[19] Not-for-profit program participants are significantly less satisfied with LIPA than any other segment of program participants. High rates, poor communication and customer service, and poor program management were mentioned among the reasons for dissatisfaction with LIPA.

[14] A rating of 6 and 7 on a scale from 1 to 7 where 1 is “very dissatisfied” and 7 is “very satisfied.”

[15] A rating of 7 on a scale from 1 to 7 where 1 is “very dissatisfied” and 7 is “very satisfied.”

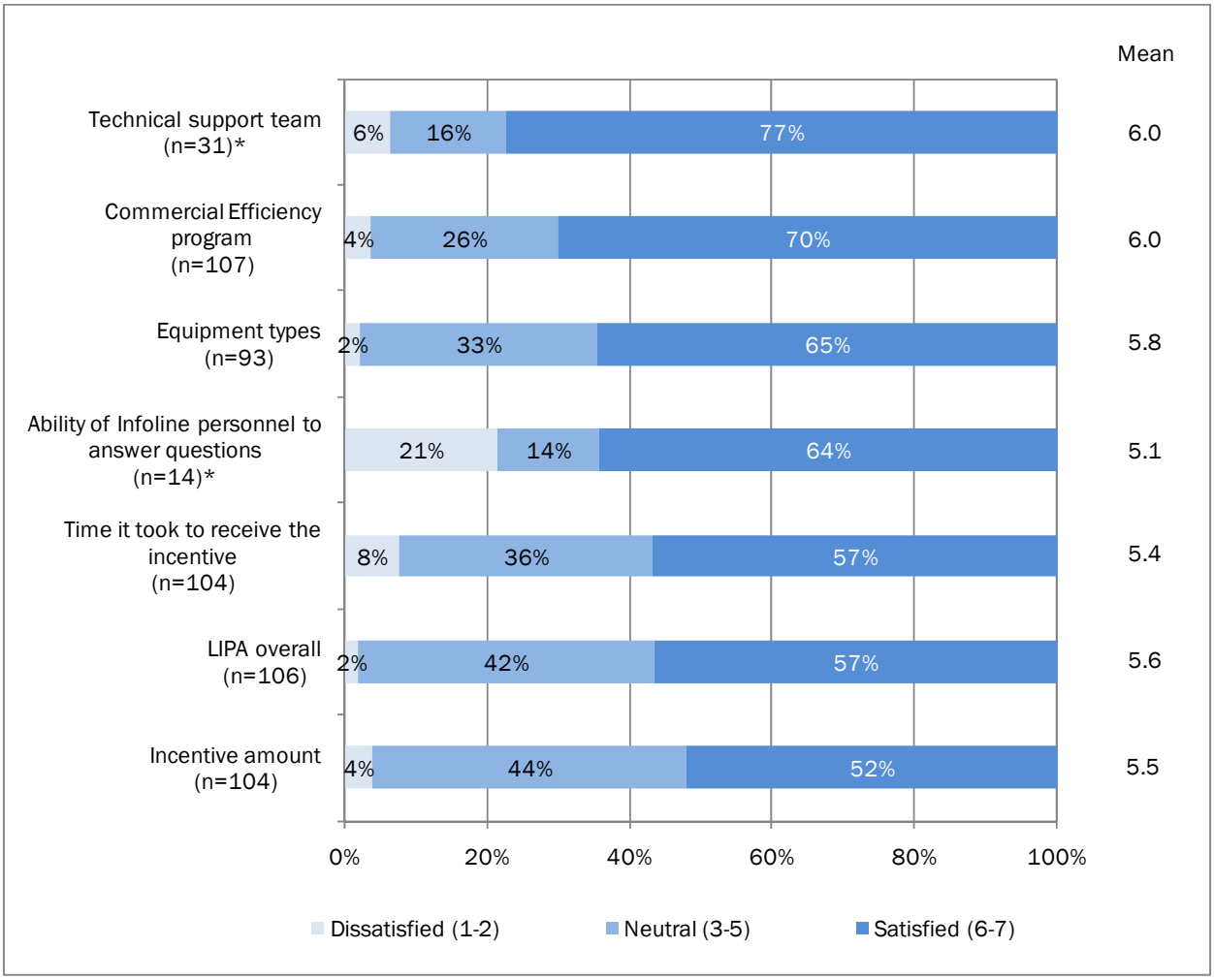
[16] Please note that the question gauging participant satisfaction with the Technical Support Team was only asked of program participants who said they had experience with the team.

[17] A rating of 6 and 7 on a scale from 1 to 7 where 1 is “very dissatisfied” and 7 is “very satisfied.”

[18] A rating of 6 and 7 on a scale from 1 to 7 where 1 is “very dissatisfied” and 7 is “very satisfied.”

[19] A rating of 6 and 7 on a scale from 1 to 7 where 1 is “very dissatisfied” and 7 is “very satisfied.”

Figure 2-3. Satisfaction with Program Components



Source: 2010 Participant Survey
**Please note small base sizes*

A third of program participants (34%) had a project scoping meeting with a LIPA representative. Of those, 84% rate the meeting as being useful.[20]

Overall, over half of program participants (55%) say that program requirements were easy to understand[21], and over a third (36%) say that the program requirements were extremely easy to understand.[22] Participants cited frequent changes to the program, complicated paperwork, and issues with technical aspects of the program as obstacles to better understanding program participation requirements.

[20] A rating of 6 and 7 on a scale from 1 to 7 where 1 is "not at all useful" and 7 is "very useful."

[21] A rating of 6 and 7 on a scale from 1 to 7 where 1 is "extremely difficult" and 7 is "extremely easy."

[22] A rating of 7 on a scale from 1 to 7 where 1 is "extremely difficult" and 7 is "extremely easy."

As a result of fairly high satisfaction with the program, six in ten program participants (62%) say they will be likely[23] to participate in the program again within the next year, with 51% saying they will be very likely to participate in the program.[24] Customers unlikely to participate in the program within the next year cite primarily lack of need for any other energy efficient improvements (59%). This might be indicative of the fact that the Commercial Efficiency program does a good job of reaching the needed depth of savings at the program-treated facilities.

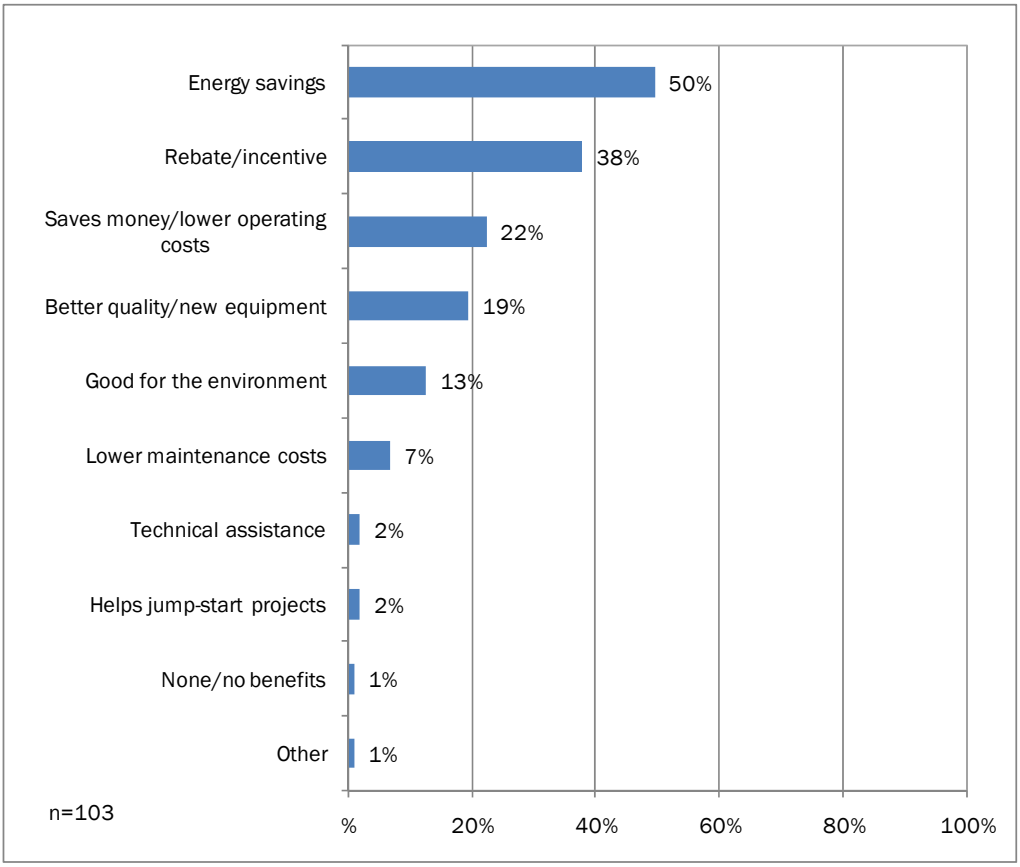
Program Benefits and Barriers to Program Participation

When asked about the key benefits of the Commercial Efficiency program, participants mentioned energy and bill savings, as well as rebates and incentives. Custom program participants are slightly more likely to cite energy and bill savings, while prescriptive and not-for-profit program participants are slightly more likely to name rebates and incentives as one of the key benefits of the program. Our interviews with trade allies and rebate administrators also confirmed that incentives are very important in alleviating barriers associated with high initial costs of energy efficient equipment and encouraging customers to participate in the program. Nearly all trade allies voiced this sentiment. These findings suggest that emphasizing the fact that the Commercial Efficiency program can help overcome initial equipment costs and save money on energy bills is likely to be an effective messaging option.

[23] A rating of 6 and 7 on a scale from 1 to 7 where 1 is "very unlikely" and 7 is "very likely."

[24] A rating of 7 on a scale from 1 to 7 where 1 is "very unlikely" and 7 is "very likely."

Figure 2-4. Benefits to Program Participation*



Source: 2010 Participant Survey
**Multiple response question*

Among the barriers to program participation, trade allies mentioned a misperception by building owners and facility managers that lighting retrofits are more complicated than they actually are, and general distrust in LIPA. Program participants unlikely to participate in the program within the next year also mentioned financial barriers (24%) as one of the reasons and consequently barriers to increased program participation.

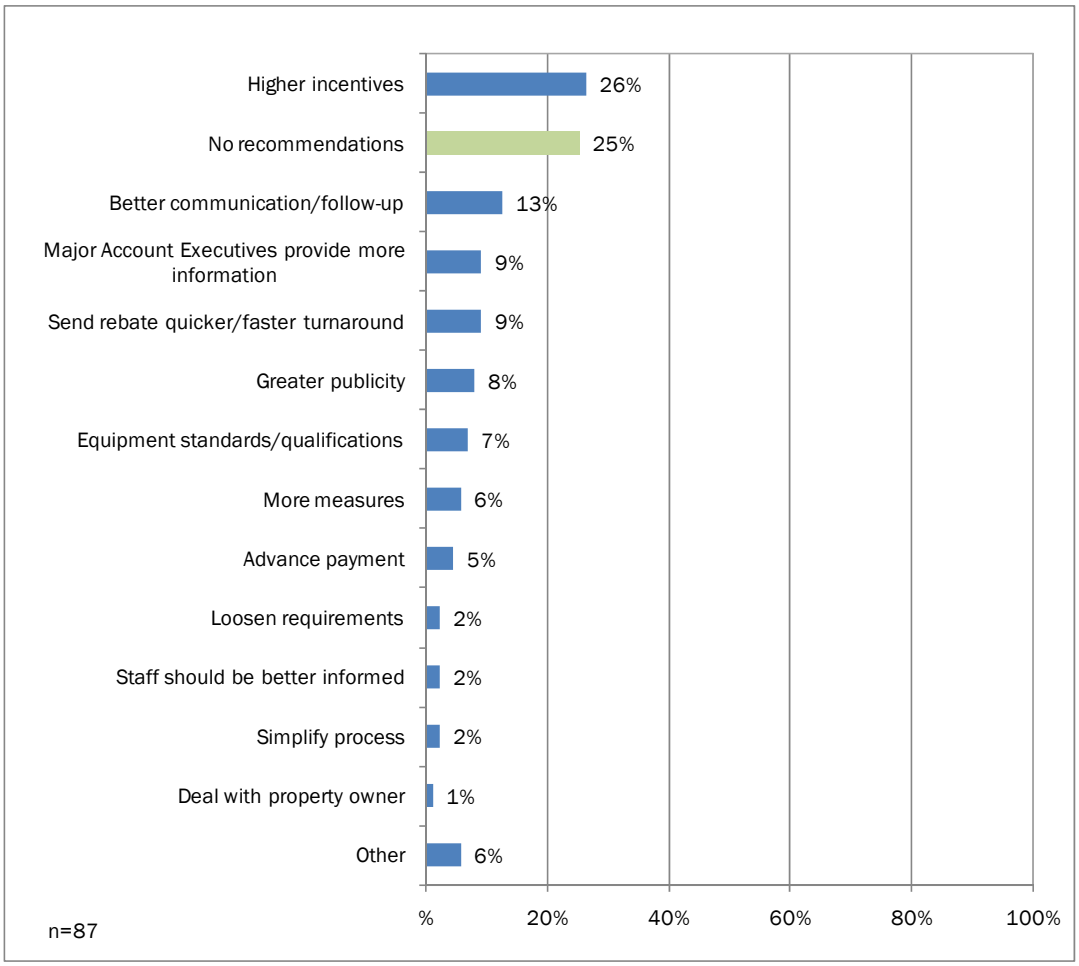
Areas for Program Improvement

In addition to exploring participant and trade ally satisfaction with various program processes, we asked program participants and trade allies about desired improvements to the program. As seen in Figure 2-5, a quarter of participants (25%) do not have any recommendations on how the program can be improved moving forward. Another quarter of participants (26%) would like to see an increase in program incentives, and 13% would like to see better communication and follow-up, among other things. Interestingly, 9% of program participants call for Major Account Executives being able to provide more program-related information.

Trade allies had mixed responses regarding program satisfaction, which was contingent primarily on two factors: consistency in the point of contact at LIPA and timeliness of rebate processing. In general, trade allies who had one point of contact at LIPA were very

satisfied with the program, whereas the trade allies who spoke to a different person every time they contacted LIPA, felt that their projects often got lost in the shuffle. LIPA might want to consider developing protocols around handling trade ally inquiries.

Figure 2-5. Areas for Program Improvement*



Source: 2010 Participant Survey
**Multiple response question*

Fall Lighting Stimulus Pilot

To increase program participation at the end of the program year, LIPA launched a special lighting program for a limited time. This pilot program, offered from September 22 to November 15, 2010, featured lighting measures with the highest energy savings potential. The program included a simplified application form, an easy preapproval process, and increased incentive levels. To facilitate the processing of applications, customers could submit pictures of existing lighting systems via email and obtain email preapproval. The program employed special calculations to simplify analysis of expected savings and incentive levels. According to the program staff, simplified preapproval and application processes led to shorter application processing times.

LIPA used trade allies, the LIPA website, and email blasts to promote the stimulus program. According to the program staff, the marketing stimulated not only interest in the pilot itself, but also increased customer inquiries into other commercial incentive opportunities. Based on these metrics, National Grid program staff considers the pilot to be a success.

Overall, 53 unique customers completed 73 projects that contributed 2.643 MWh and 500 kW to the Commercial Efficiency program's ex ante savings total. Table 2-5 below provides an overview of the Fall Stimulus Lighting Pilot results.

Table 2-5. Overview of the Fall Stimulus Lighting Pilot Results by Sector

	Applications		Unique Customers		Ex Ante Gross kW Savings		Ex Ante Gross kWh Savings		Incentives	
	#	%	#	%	kW	%	kWh	%	$	%
Commercial	58	79%	418	84%	418	84%	2,224,782	84%	360,190	83%
Not-for-profit	15	21%	82	16%	82	16%	418,169	16%	72,900	17%
Totals	**73**		**500**		**500**		**2,642,951**		**433,090**	

Source: Fall Lighting Stimulus Program Tracking Database

As part of the participant survey, we were able to reach only nine Fall Stimulus Lighting Pilot participants. In addition, we also spoke to two Fall Pilot participants who also participated in other program components. Small sample sizes prevent us from drawing conclusions about any meaningful differences in responses of this participant segment as compared to the rest of the program, but overall satisfaction with the Fall Pilot appears to be on a par with the rest of the programs in the Commercial Efficiency program portfolio.

The two customers who participated in the other program components and could therefore compare program processes were asked how the Fall Pilot fared with the rest of the program. Both participants say that the Fall Pilot was easier to participate in than the rest of the program due to the much more straightforward nature of the program and the application process. These two participants were also much more satisfied with the incentives that they had received through the program.

In the 7.5 weeks of the pilot, weekly savings were obtained that were greater than the lighting component of the prescriptive program (Table 2-6).

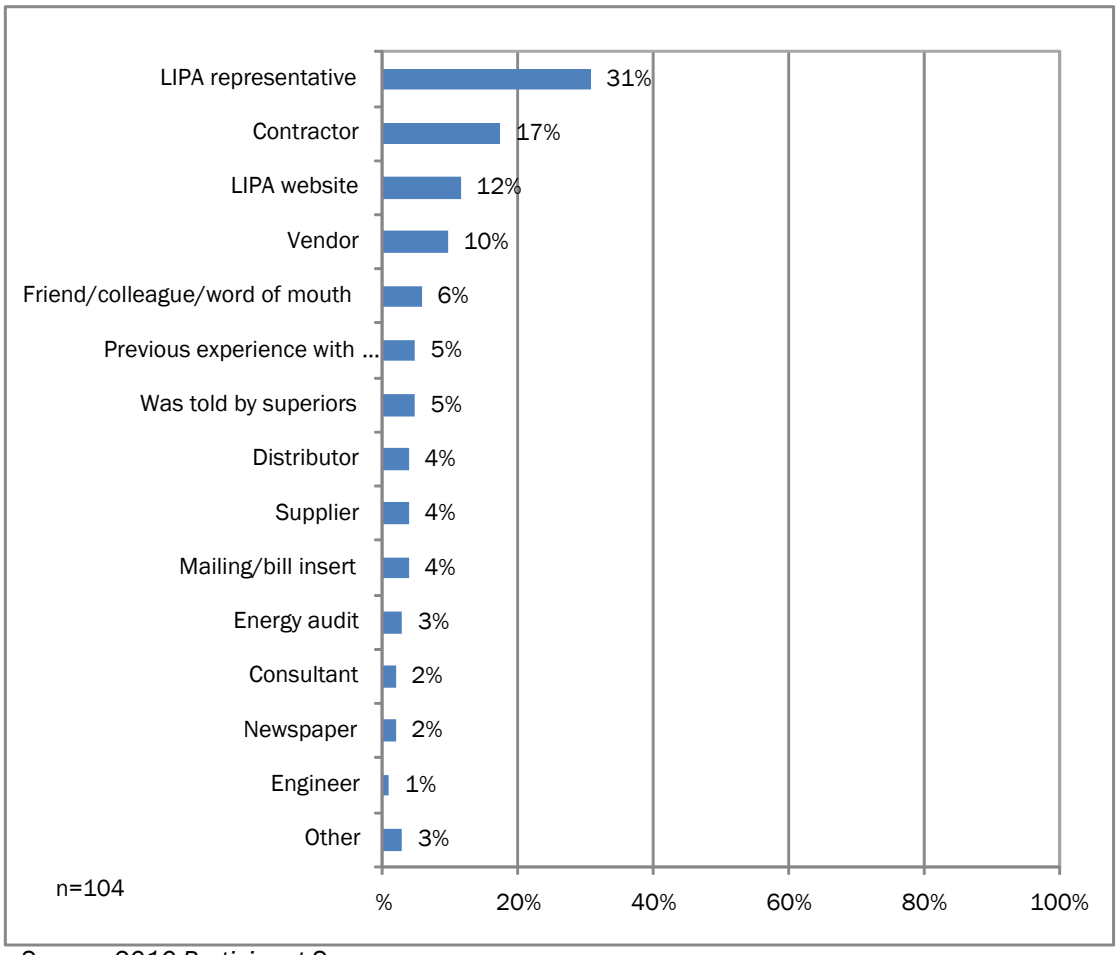
Table 2-6. Fall Stimulus Weekly Savings

Component	Ex Ante Net Savings	Weeks to obtain Savings	Savings / Week
Prescriptive Lighting without Fall Stimulus	12,320,289	52	236,929
Fall Stimulus	2,642,951	7.5	352,393

Marketing and Outreach

Commercial Efficiency program marketing was limited in 2010. Based on the information gleaned from interviews with program staff, participant telephone survey, and our review of program materials, the program relied primarily on word of mouth, Major Account Executives, and Commercial Energy Consultants to educate customers and promote energy efficient equipment installations. In 2010, as well as in previous program years, the Commercial Efficiency program targeted larger accounts as their project scopes usually yield higher energy and demand savings. The majority of program participants learned about the program through LIPA, trade allies, or word of mouth. Custom program participants are more likely than participants of other program components to say they have learned about the program through a LIPA representative. This is not surprising as custom program participants are likely managed account customers who get information through Major Account Executives.

Figure 2-6. Sources of Information about the Program*



Source: 2010 Participant Survey
**Multiple response question*

With the considerable increase in program energy and demand savings goals in 2011, the program will require more aggressive marketing and outreach tactics to ensure the breadth and depth of reach. This includes not only employing a variety of marketing strategies, but also more active involvement of the program implementation staff in identifying potential projects and proactively marketing the program to their customer base.

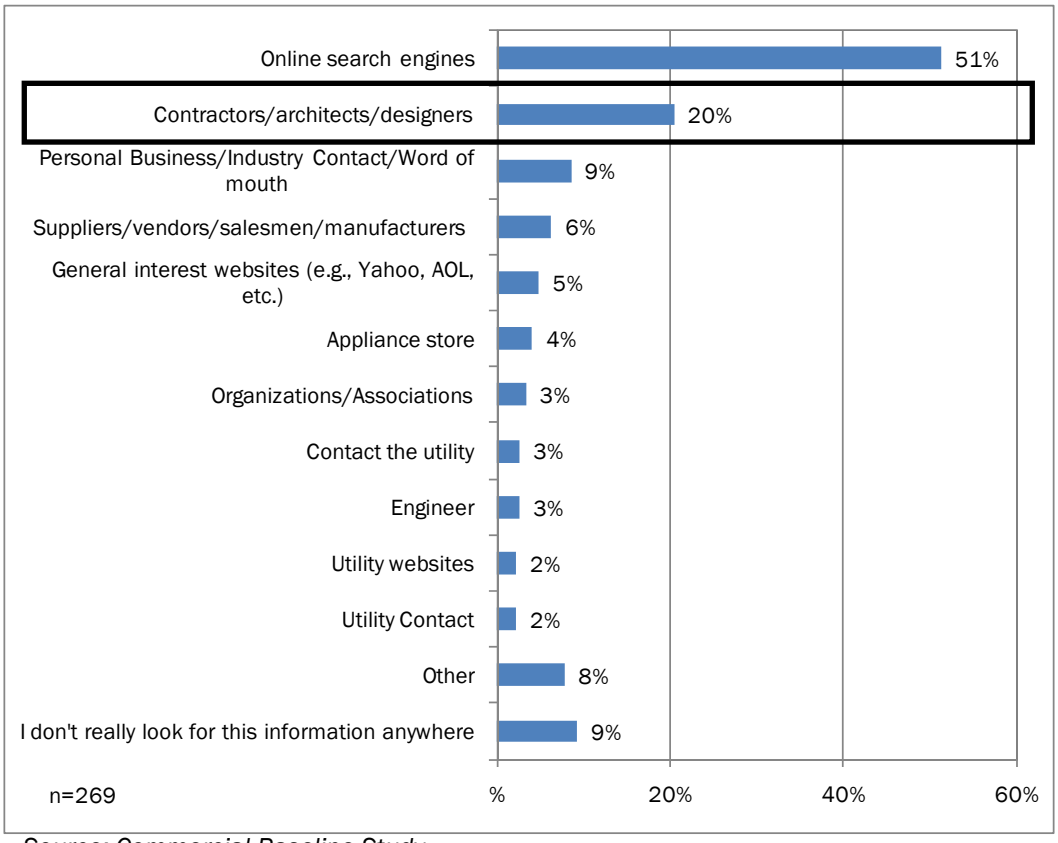
Based on our experience conducting evaluations for other Program Administrators across the nation, as well as our review of best practices for marketing and outreach in commercial programs, we recommend that the program consider the following marketing and outreach strategies:

- Trade ally network: In 2010, aside from occasional events and an annual award, little effort was made to establish and develop relationships with trade allies for the Commercial Efficiency program. Leveraging energy efficiency program offerings through trade allies has historically been one of the most successful ways to increase program participation. Trade allies familiar with program processes can promote the program offerings effectively, as well as increase customer satisfaction. LIPA is planning to enhance relationships with trade allies in 2011, which will be a key step in program marketing and outreach. LIPA can use tactics such as: 1) developing and offering co-branded materials that trade allies could use to promote their services to customers; 2) email blasts to inform trade allies of the program changes and any upcoming program initiatives; and 3) giving incentives to trade allies (e.g., gift cards) for bringing in a certain number of projects. LIPA should also consider developing rigorous data tracking mechanisms that classify trade allies into areas of expertise (e.g., lighting, HVAC) and append trade ally information to completed projects (see the Program Data Tracking section later in this section for more detail).
- Trade associations and organizations: Membership in various professional organizations and associations, including American Institute of Architects (AIA), U.S. Green Building Council (USGBC), and others, can be an additional marketing channel for reaching designers, building architects, and contractors and promoting the Commercial Efficiency program to these entities. In interviews, program staff mentioned several challenges to creating a trade ally network, including the liability associated with contractor performance, as well as legal implications of recommending one contractor over the others. Working with professional associations might be a way to recommend qualified contractors to LIPA customers.
- Chambers of Commerce: Establishing relationships with chambers of commerce and using chamber of commerce communication tools with its membership base can be an effective outreach mechanism, especially to smaller business customers. LIPA can provide information to chambers of commerce about opportunities for program incentives, limited time initiatives, program testimonials, case studies, or a simple description of the program and a link to the program website.

- **Mailing lists and email blasts**: With the launch of Siebel, the Commercial Efficiency program staff should be able to generate and manage their own mailing lists. Periodic mailings can help establish communication channels for informing potential program participants of the current program offerings, program updates and changes, and limited time promotions.
- **Major Account Executives**: As previously mentioned, the Solution Provider will actively promote the program to managed accounts in 2011. However, LIPA should continue its outreach to key managed accounts through Major Account Executives. Major Account Executives have established relationships with their customers and can be trustworthy messengers of program offerings. The Commercial Efficiency program should consider finding ways to encourage Major Account Executives to talk to their customers about the program. This can include additional education about the program or incented equipment, as well as limited time monetary rewards for bringing projects into the program. Major Account Executives can become more passionate advocates of the program through this approach.
- **Outreach to past customers**: During interviews, program staff indicated that most of the projects are one-time program participants. Past customers can present an additional opportunity for outreach—they have experience with the program and might be interested in making additional energy efficiency improvements.
- **Case studies, testimonials, success stories, and videos**: These materials create trust in the program and its offerings and can excite potential customers about increasing energy efficiency at their facilities. LIPA can use these materials in many ways—from postings on the program website to attachments to mailings or email blasts.

When asked what information sources they use to search for new equipment options, 20% of LIPA customers said they rely on contractors for this information.

Figure 2-7. Sources of Program Information*



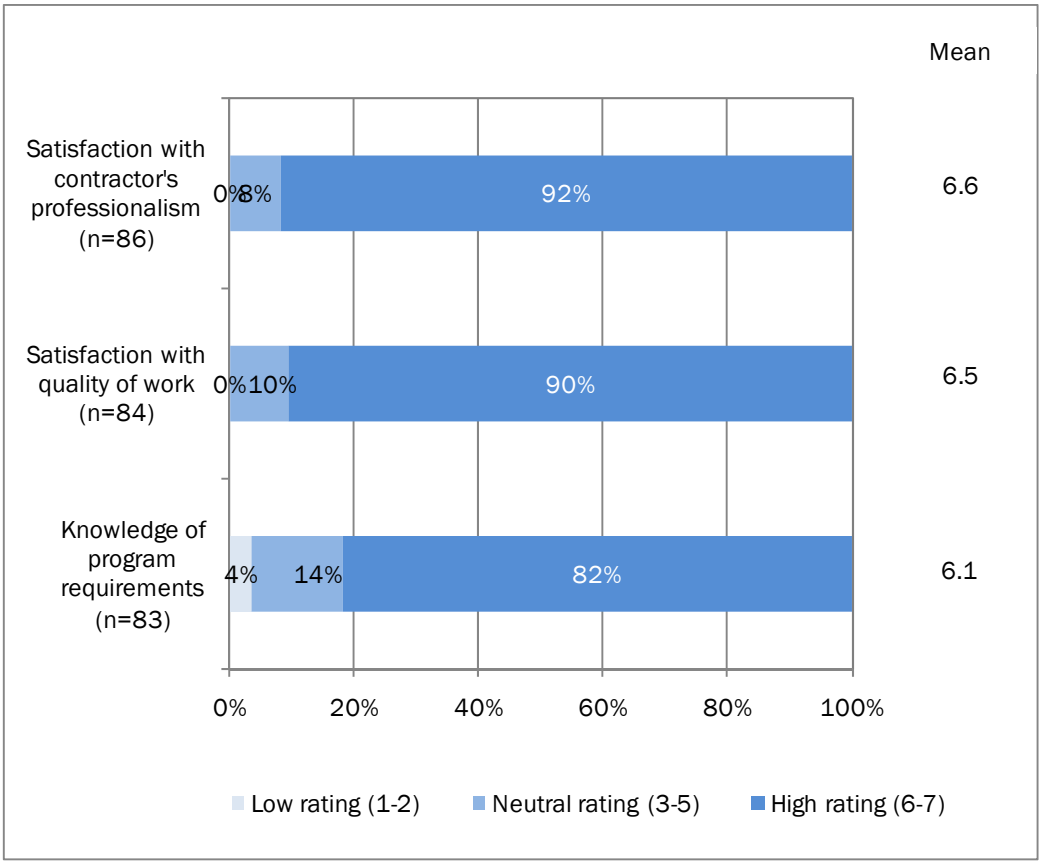
Source: Commercial Baseline Study
**Multiple response question*

The participant telephone survey also explored participant use of and satisfaction with contractors and vendors. Eight in ten program participants (82%) used a contractor or vendor who helped them with the choice of energy efficient equipment. Overwhelmingly, program participants give high ratings to the contractors they worked with. As seen in Figure 2-8, eight in ten program participants (82%) find contractors knowledgeable about program requirements[25] and nine in ten are satisfied with the quality of work performed by their contractor (90%) as well as their professionalism (92%).[26]

[25] A rating of 6 and 7 on a scale from 1 to 7 where 1 is "not at all knowledgeable" and 7 is "very knowledgeable."

[26] A rating of 6 and 7 on a scale from 1 to 7 where 1 is "very dissatisfied" and 7 is "very satisfied."

Figure 2-8. Ratings of Contractor Performance



Source: 2010 Participant Survey

Trade allies that we interviewed have been aware of the program for a very long time and consider themselves knowledgeable about the program processes. Most of the trade allies that we interviewed were enthusiastic about collaborating more with LIPA in an effort to promote the program among potential customers. They cited such materials as case studies, technical handouts, and brochures about LIPA programs among other sources of marketing assistance that LIPA can provide.

These findings suggest that contractors in LIPA's service territory are program-savvy and capable of effectively guiding their customers through the program, and further support the idea that building relationships with trade allies and promoting the program through these outlets might prove an effective marketing mechanism.

Aside from the above-mentioned marketing and outreach channels, program staff should also consider developing and facilitating periodic educational sessions for sales staff, Major Account Executives, and trade allies.

While rebate administrators that we interviewed generally consider themselves knowledgeable about energy efficiency news and trends and did not express particular desire to receive additional training, contractors expressed a great degree of interest in getting more training on energy efficient equipment and applications. In fact, several

contractors have attended LIPA training in the past and found it useful. Trade allies also expressed interest in getting updates about changes to the Commercial Efficiency program, with emails, webinars, and website updates being the preferred means of communication.

For Major Account Executives specifically, program participants mentioned a desire for greater knowledge among other improvements that the Commercial Efficiency program should consider moving forward. Educational and training sessions will help keep these groups well informed about program features, changes to the program design, and special initiatives. In interviews, program staff mentioned that Major Account Executives and Commercial Energy Consultants lack sales training and often do not possess adequate knowledge about the program or technical knowledge about the equipment incented through the program.

Quality Assurance / Quality Control Procedures

LIPA's Commercial Efficiency program calls for rigorous quality assurance and quality control procedures. All custom projects and prescriptive projects with incentives over $10,000 are to be preapproved, as well as pre- and post-inspected. In addition, a random sample of 10% of prescriptive projects with incentives under $10,000 requires post-inspection for equipment verification purposes. Our interviews with National Grid program staff indicate that the program strictly follows these protocols and performs these quality assurance requirements on a monthly basis. However, in the program-tracking database, a considerable number of large incentive projects that should have been pre- and post-inspected have not been flagged as such. Table 2-7 provides results of the program-tracking data review by program component. For the custom program component, every application has been marked as pre- and post-inspected, as required by program protocols. For the prescriptive program component, on the other hand, applications with incentives under $10,000 may have been over-inspected (or marked as such in the database), while applications with incentives of $10,000 or higher are under-inspected (or marked as such).

Table 2-7. Overview of Pre- and Post-Inspection Tracking

	Total # of applications	Pre-inspections		Post-inspections	
		% Required to be pre-inspected	% Marked as pre-inspected	% Required to be post-inspected	% Marked as post-inspected
Prescriptive and not-for-profit projects with incentives of less than $10,000*	457	0%	6%	10%	14%
Prescriptive and not-for-profit projects with incentives of $10,000 or more	79	100%	39%	100%	80%
Custom projects**	453	100%	100%	100%	100%

Source: Program Tracking Database

**Please note that kWh savings are missing for two prescriptive applications. Neither of those applications has a pre- or post-inspection flag.*

*** Excludes three projects that had zero kWh savings associated with them*

It is unclear whether the results we found between stated program requirements and the information being tracked stems from inconsistent data entry, inspections not being performed as required by program protocols, or whether projects grew in scope and incentive value between initial contact and the final application so that a project did not start out as a $10k project but became one in the course of the customer working with NGRID.[27] Ensuring the implementation of rigorous inspection procedures and accurate tracking of those efforts is crucial to accurate estimation of savings and proper disbursement of program incentives. We therefore recommend that LIPA look further into this issue in 2011, so that the QA efforts are accurately recorded in paper format and tracked in the program database when they occur.

[27] As part of the Commercial Efficiency program evaluation, we are conducting a review of several post-inspection forms that program staff has to fill out internally when conducting a post-inspection of a project. We will supplement this and other relevant sections with findings from the research effort once they are available.

Program Data Tracking

Collection and management of program data is a crucial part of any DSM program. Tracking participant and project data supports a variety of purposes, including marketing and outreach, program performance monitoring, workflow management, and evaluation and verification. Collecting data that satisfies all of the program design requirements in an accurate and timely manner can ensure successful program implementation and evaluation, and present insights on program improvements and opportunities for program growth. Below is an overview of the application areas of data tracking systems, as well as the degree to which LIPA uses its tracking mechanisms in each area:

- **Marketing and outreach**: Accurate tracking of participant information and improvements undertaken as part of the project, has an added benefit of helping program staff identify additional marketing and outreach opportunities, be it reaching out to repeat customers or identifying customer segments that have not participated in the program as actively as desired.

  In 2010, LIPA worked towards implementation of the Siebel tracking software. Siebel was delayed until 2011 and for 2010, LIPA was unable to make use of the additional capabilities within this package. As such, for 2010, LIPA made minimal use of the tracking database to reach out to existing customers with additional program offerings, or to analyze program participation to develop additional marketing strategies. Inability to link audit and technical assistance data to the participant database also presents a missed opportunity in 2010 in following up with customers who have already had an audit or received technical assistance, but have not yet participated in the rebate program. It is expected that the Siebel software will alleviate these difficulties moving forward and enable lead generation from audits and technical assistance projects.

- **Internal performance monitoring**: Accurate tracking of projects, savings, and other performance indicators facilitates assessment of the performance of the program to date against its goals.

  In 2010, LIPA monitored the Commercial Efficiency program performance through periodic (monthly) reports. The process of generating these reports was manual and labor-intensive. Internal performance monitoring lacked guidelines on when to enter projects into the program-tracking database, leading, in many cases, to last-minute project entry, when all project paperwork was complete and ready for payment. Improving this process could more easily reveal projects that have lapsed and help the Program Manager better follow up on incomplete projects. As stated above, the Siebel software will enable lead generation. For CEP, entry of projects into the system before completion of the project will allow LIPA to monitor lagging projects more closely.

- **Evaluation and verification**: Accurate tracking of participant information, measure specifics, as well as incentives and savings are vital elements for verifying program impacts and evaluating program processes.

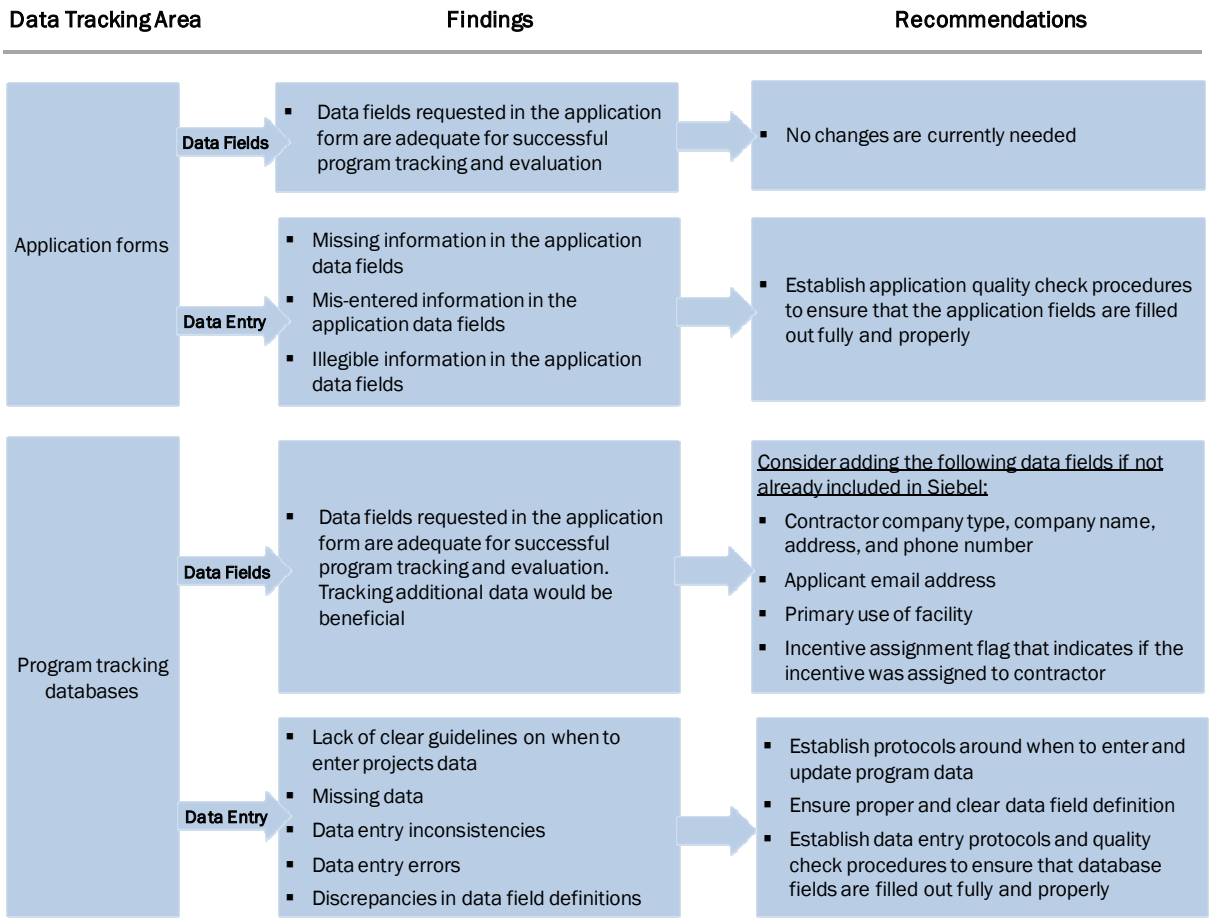
  In 2010, LIPA's program and measure tracking database is missing a fairly significant amount of participant information, though measure application

forms contain fields to collect these data. Due to these omissions, the evaluation team was unable to create a sample from which we were comfortable we could produce an unbiased Net-to-Gross assessment. In addition, we were unable to clearly assess implementer-driven measure verification efforts due to missing data.

There are areas for improvement, and LIPA is dedicated to ensuring comprehensive and high-quality recordkeeping practices. Currently, the Commercial Efficiency program application forms contain all of the necessary participant, trade ally, and equipment information. Also, the Siebel database, expected to launch in the first quarter of 2011, is designed to improve data entry processes and automate and standardize periodic reporting, which should help to address the issues identified above.

To ensure rigorous tracking of the program data in 2011 and beyond, we conducted a thorough review of the program application forms and tracking databases with an eye toward 1) verification of the presence of data fields needed for successful program-tracking and evaluation and 2) quality of data entry. Figure 2-9 below presents an overview of the findings and recommendations by two topic areas: original program data and entry of program data. The table following the figure contains a more detailed discussion of the findings from the application and database review. The program staff can use the findings and recommendations outlined below as a checklist against which to assess Siebel data tracking capabilities. The evaluation team will continue to revisit and assess this aspect of program implementation in future evaluation cycles.

Figure 2-9. Data-Tracking Findings and Recommendations



Next, we provide more detailed information around specific variables and our findings.

Table 2-8. Detailed Application and Database Findings

Program	Data Field Name	Data Field Definition[28]	Finding
Application Forms			
Prescriptive Custom	Contact name Contact title		Data missing Data illegible Third-party data entered instead of participant data
Prescriptive Custom	*Multiple fields with this finding.*		Data missing Data illegible
Tracking Databases			
Prescriptive Custom	TA_CNTC_SALUTATN CTRC_CNTC_FRSTNAME CTRC_CNTC_LASTNAME	TA firm's contact person first and last name	There are four unique names present in these fields – three of them are National Grid employees and one is a contractor. Expected TA firm name
Prescriptive Custom	CTRC_SEQ_ID_NUM	TA identification number	The entry is either a "zero" or a "one." Expected a unique identifier
Prescriptive Custom	TA_STUDY_REQ_BY	Date TA report is due	Data entered into the field appears to be an employee ID number. Expected date
Prescriptive Custom	TA_COST_OF_STUDY	Price of TA study	The entry is either a "zero" or missing. Expected a cost value
Prescriptive Custom	COFUND_AMT	Amount customer pays	The entry is either a "zero" or missing. Expected a cost value
Prescriptive Custom	COFUND_AGRD_DT	Date customer agreed to co-fund the TA study	Dates entered in each of these four fields vary by one day maximum. Expected four distinct dates that allowed for awareness of the start-to-finish timeline
Prescriptive Custom	TA_APPRVD_DT	Date TA study is approved by management	
Prescriptive Custom	TA_ACCPT_DT	Date TA study is accepted	
Prescriptive Custom	TA_COMPL_DT	Date TA study is completed	
Prescriptive	ITEM_UNIT_SIZE *data fields*	Unit tons	All data are missing for cooling equipment

[28] We took the data field definitions from a 2009 data dictionary provided to us.

Program	Data Field Name	Data Field Definition[28]	Finding
Prescriptive Custom	*Cross-field*		There appears to be a variety of data entry errors, including misspelled names, mis-entered phone numbers, and various spellings of the same company name and address
Prescriptive Custom	ACCT_NUM	Account number	Could not match 149 out of 933 account numbers with customer tracking database
Prescriptive Custom	APPL_BUS_FULL_NAME APPL_STR_ADDR APPL_CITY_ADDR	Applicant address	Applicant business names are often abbreviated, truncated, and misspelled, street addresses are missing street numbers, and city names are abbreviated.
Prescriptive	APPL_SALUTATN APPL_FRST_NAME APPL_LAST_NAME	Applicant information	All data missing
Prescriptive	EST_COMPL_DATE	Estimated project completion date - provided by customer	All data missing
Prescriptive	ENERGY_AUDIT_COMPLETED	Flag to identify customers who have energy audits	All data missing
Prescriptive	*CNTC_ data fields*	Contractor contact information[29]	Contain information for participants along with rebate agents[30] and third-party contractors
Prescriptive	APPL_ *data fields*	Applicant information	The difference between these data fields is unclear
Prescriptive	CNTC_ *data fields*	Contractor information[31]	
Custom	EST_PRJ_START_DT EST_PRJ_END_DT ACT_PRJ_START_DT ACT_PRJ_END_DT	Estimated and actual project start and end dates	Data are missing for 327 out of 430 applications. For the 103 applications where the data are present, the dates in all four fields are identical
Custom	DCNTC_ labeled data fields	Contact information (unclear from the data dictionary what type of contact this is)	All data missing

[29] We believe that these fields were mislabeled in the data dictionary and should contain participant information, as opposed to contractor information.

[30] Rebate agents are companies who range from full service ESCO type entities that use rebates to sell their services to ones who focus on finding rebates for their customers without the installation service.

[31] We believe that these fields were mislabeled in the data dictionary and should contain participant information, as opposed to contractor information.

Program	Data Field Name	Data Field Definition[28]	Finding
Custom	FCNTC_PER_SALUTATION FCNTC_PER_FRSTNAME FCNTC_PER_LASTNAME	Contact information (unclear from the data dictionary what type of contact this is)*	Data are missing for 118 out of 430 records
Custom	TA_COST_OF_STUDY COFUND_AMT PAYOUT_AMT	TA study costs and their allocation	All data missing
Custom	APPL_ *data fields*	Applicant information	The difference between the data fields APPL, CNTC, DCNTC, and FCNTC is unclear
Custom	CNTC_ *data fields*	Contractor information[32]	
Custom	DCNTC_ *data fields*	Contact information	
Custom	FCNTC_ *data fields*		
Audit[33]	Main Acct # Facility Name		The audit data could not be matched to the customer energy usage database using either the account number or the customer name in 34% of the cases[34]

*Our understanding is that these data fields include information pertaining to the facility contact person.
Source: Program Tracking Database

In addition to the issues listed above, the evaluation team identified inaccuracies in the tracked deemed savings values for some measures. Specifically, we determined that for some measures included in the program-tracking database, the reported ex ante savings value did not equal the savings value calculated using the deemed savings algorithm for the measure. For example, we expected a demand realization rate of 162% for Split A/C units of less than 65,000 Btu/h. However, the realization rate from the tracking database demand savings to our updated value was only about 46%. We identified no specific pattern in this discrepancy as we identified reported ex ante savings values that were both higher and lower than the savings values we derived using the measure's savings algorithm. These discrepancies are limited to a subset of program measures and more often affect the tracked savings demand savings values. The table below shows the specific measures for which we identified this discrepancy.

[32] We believe that these fields were mislabeled in the data dictionary and should contain participant information, as opposed to contractor information.

[33] We used the audit database provided to us in August 2010.

[34] A total of 22 of the 64 cases under consideration at that point were unable to be mapped.

Table 2-9. Measures with Inconsistency in Ex Ante Value and Expected Value

Measure	kW	kWh
Packaged AC < 65,000 Btu/h	X	
Packaged Heat Pump < 65,000 Btu/h	X	
Split AC < 65,000 Btu/h	X	
Split Heat Pump < 65,000 Btu/h	X	
Water-Cooled Chiller < 300 ton		X
Water-Cooled Chiller > 300 ton	X	X

Conclusions and Recommendations

LIPA's Commercial Efficiency program has an aggressive twofold increase in program goals for 2011. Program implementers will need to make a considerable effort to achieve the desired participation levels. LIPA has a full suite of intervention points for commercial customers that they will need to integrate and run collaboratively to meet the ultimate energy and demand goals. We recommend that LIPA consider the following key improvements to the program design and processes to help the Commercial Efficiency program achieve its ambitious goals:

- **Marketing and Outreach:** Given the importance of marketing and outreach in achieving program goals, along with employing a range of marketing and outreach strategies, program staff should take a more proactive and collaborative approach to marketing the program to current and potential customers. This will ensure the breadth of customer coverage and result in fewer missed opportunities. LIPA should consider enhancing relationships with trade allies, as well as linking audit and Technical Assistance data to the program-tracking database. Both of these are opportunities to identify program leads and engage them with the program.
- **Project Timelines:** Considering lack of clarity around average project length as well as timing of each of the project components, it is important that such timelines be developed. Doing so will ensure a more structured and consistent delivery of the program and help to better manage customer expectations and satisfaction level. We recommend not only developing timelines for various program components, such as project preapproval and application processing, but also establishing protocols around when to enter the data into the database.
- **Data Tracking Quality Assurance:** Accurate data-tracking mechanisms is integral to proper program administration and assessment of program success. We recommend that LIPA develop protocols around data entry and verification. After Siebel is up and running, we recommend that LIPA performs regular quality checks on data entry and reporting for the first two months to assure good data and ability to track the program well. If high-quality data are found, LIPA can reduce that check to twice a year for the rest of the program year.

- **Clear Articulation of Roles, Responsibilities, and Communication Mechanisms:** Three program implementers are expected to deliver the program in 2011. While each implementer will be working with a distinct customer segment, overlaps in certain function areas, such as program marketing or audits, is inevitable. Given that this represents a significant change in the program implementation model, we recommend that LIPA work to develop and communicate a clear description of roles, responsibilities, and information-sharing mechanisms across, as well as within, the three program implementers (National Grid, Solution Provider, and Direct Install program implementer). This will eliminate duplication of efforts, streamline program delivery, and ensure consistent program implementation standards from one implementer to the other.

2.2 Residential Programs

2.2.1 Energy Efficient Products Program

The objective of the Energy Efficient Products (EEP) program is to increase the purchase and use of energy efficient appliances and lighting among LIPA residential customers. The program provides rebates on ENERGY STAR CFLs, dehumidifiers, refrigerators, and room air conditioners. The program also provides rebates on variable and two-speed pool pumps. EEP added an appliance-recycling component in 2010 in which the program pays residents to recycle older working refrigerators and freezers.

The overall goal of the program is market transformation so that consumers regularly choose energy efficient appliances and lighting over less efficient alternatives. In addition to financial incentives, the program educates customers about the benefits of using energy efficient products in their homes through the LIPA website and program marketing materials.

The EEP program coordinates its requirements with ENERGY STAR, the Environmental Protection Agency (EPA), and the U.S. Department of Energy (DOE), and updates efficiency requirements whenever any of these programs make a change. ENERGY STAR standards lag the market at times. As a result, the program will also select efficiency measures outside of the ENERGY STAR program. For example, the EEP program provides incentives for two-speed and variable-speed pool pumps, a category that ENERGY STAR does not currently support.

Net Impacts

The evaluation of the EEP Program consisted of a number of phases. First, the evaluation team obtained updated algorithm documents and incentive applications to determine any new or significantly updated measures as compared to 2009. We conducted a thorough, measure-specific evaluation in 2009, resulting in the submittal of a Technical Resource Manual (TRM). The 2010 TRM (Appendix D) was updated to reflect new measures and significant changes to preexisting measures. These changes included:

- The Lighting_category was updated to separate "common" CFLs and "specialty" CFLs. The analysis of the two types of lamps used different free rider and spillover rates, with a higher Net to Gross (NTG) value for specialty bulbs.
- Appliance recycling was added as a new measure in 2010.

The basis for the evaluation of EEP impacts was the program-tracking spreadsheet which contains deemed savings values on an aggregate and per unit basis. While this prevented us from consulting the sources or algorithms used to generate ex-ante deemed savings, we determined evaluated savings for each measure based on industry standards. Often, external references were cited to determine baselines, energy savings, run hours and/or coincidence factors in the deemed savings calculations. In addition, the measure quantities were verified by comparing tracking data to annual reports, and the net-to-gross ratios were updated for two measures (dehumidifiers and appliance recycling).

Table 2-10 provides a category-by-category review of net impacts for the program in 2010. As shown in the table, the evaluation determined that the ex post kW savings estimates exceeded the ex ante estimates (realization rate of 117%), while the ex post kWh estimates were below ex ante estimates (realization rate of 80%).

Table 2-10. EEP Net Impacts

Measure Category	Number of Units	Net Ex-Ante		Net Ex Post		Realization Rate	
		kW Saved	kWh Saved	kW Saved	kWh Saved	kW	kWh
Lighting	1,654,861	6,060.9	91,554,104	8,002.1	72,771,863	132%	79%
Refrigerator Recycling	4,557	380.8	4,069,176	307.3	3,283,896	81%	81%
Appliances*	34,566	974.7	3,892,215	644.5	3,696,251	66%	95%
Room AC	15,021	979.0	562,637	862.1	419,998	88%	75%
Pool Pumps	334	149.7	292,318	154.0	301,816	103%	103%
Totals	**1,709,339**	**8,545**	**100,370,449**	**9,970.1**	**80,473,823**	**117%**	**80%**

*Appliances consists of clothes washers, dehumidifiers, and refrigerators (no dishwashers were rebated in 2010)

The differences from ex ante to ex post resulted from the following findings:

Lighting and Pool Pumps: The annual install counts as totaled by the program did not match the summed quantity of installs in measure-specific databases. The evaluation team used information from the measure-specific databases in the total realization rate calculation. The evaluated total count was higher than the program-level install count for lighting by 13,036 units and lower for pool pumps by two pumps We recommend a thorough review of the program's monthly install summation process to ensure that all files are consistent.

Lighting: We found realization rates of 132% for kW and 79% for kWh. We were unable to determine specific algorithms and inputs within the ex ante estimates for demand impacts. In the ex post analysis, we developed estimates for a number of parameters, including:

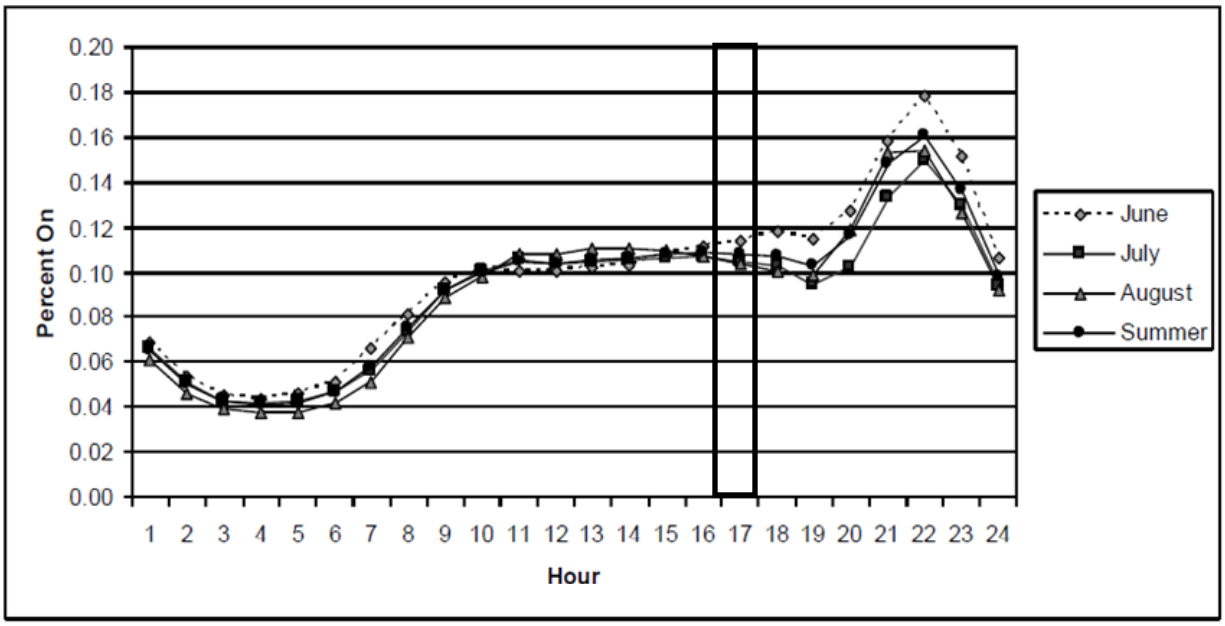
- ***Delta watts***. We used the program-tracking database to categorize each of the program bulbs by wattage category, and assign an assumption regarding the pre-program wattage for each category. In total, the average incented bulb was 16.3 watts, and the average assumed pre-program wattage was 69.3 watts, for a delta watts of 53.1.
- ***Hours of use***. We used a recent residential lighting metering study conducted for a number of Northeast utilities, which found daily CFL usage of 2.8 hours/day (or 1,022 hours/year).[35]
- ***Coincidence factor***. We used the same residential CFL metering study to estimate peak coincidence. As shown in Figure 2-10, the peak period for this evaluation was defined as 5:00 p.m., resulting in a coincidence factor of 0.11.
- ***In-service rates***: The LIPA residential baseline study found that 83% of CFLs are currently installed, with 17% in storage.[36] These values were assumed to be applicable for the 2010 bulbs (i.e., the long-term in-service rate of 83% was applied to 2010 program bulbs). In addition, a recent study in California estimated a trajectory of future installation for stored program bulbs, and found 98% of program bulbs are expected to be installed within two years following the program.[37] Based on the 2009 CFL evaluation, which assumed an 89% in-service rate, an additional 5% of the 2009 program bulbs were credited to the 2010 program.

[35] http://www.env.state.ma.us/dpu/docs/electric/09-64/12409nstrd2ae.pdf

[36] The LIPA Residential Baseline Study was still being conducted at the time of this study, with full results expected in spring 2011.

[37] See Table 72 from the Final Evaluation Report: Upstream Lighting Program, California Public Utilities Commission, February 2010.

Figure 2-10. Residential CFL Coincidence



Source: Nexus Market Research. Residential Lighting Markdown Impact Evaluation. 2009.

Appliances: The *ex ante* energy savings value used for the ENERGY STAR Dishwasher and Dehumidifier measures were found to be low as compared to evaluated savings. However, this had a minimal impact on reported savings for appliances, as no dishwashers were rebated in 2010, and the savings for the approximately 3,700 dehumidifiers rebated are small compared to other appliances. Moving forward, we recommend that the deemed savings values be increased to match the energy savings values recommended by ENERGY STAR (where applicable). The surveys with participating customers also revealed that dehumidifiers also had a low NTG ratio, as discussed below.

Room Air Conditioners: An inconsistency was found between the capacity thresholds as listed by the program and those listed in the install database for 2010: the database had incorrectly placed units at 6,000 Btu/h in the category for greater than 6,000 Btu/h, as opposed to 6,000 Btu/h or less The total of installs is equal (15,021 units), but about 30% of the units had to be shifted from the higher savings category to the lower savings category, resulting in lower demand and energy savings.

Pool Pumps: We found that the savings values were reasonable, although we recommend further research to measure the pre- and post conditions to fine tune the savings values used for this program. The ex post savings were slightly lower than the ex ante assumptions due to quantity adjustments.

Appliance Recycling: The surveys with customers found that the ex post NTG value was less than the ex ante value, as discussed below.

Net-to-Gross Estimates

LIPA uses deemed NTG values for planning and evaluation. As part of the 2010 EEP evaluation, the evaluation team conducted research to update the NTG values for the three program measures—excluding lighting—with the largest demand and energy saving. The program measures included dehumidifiers, appliance recycling and room air conditioners.

The study used a participant self-report method to estimate NTG for dehumidifiers and appliance recycling. The dehumidifiers and appliance recycling participant surveys contained a battery of questions designed to measure free ridership and spillover. The new estimates from the surveys are displayed in Table 2-11 along with the LIPA ex ante values. The free ridership rates we estimated from the surveys were higher than the program ex ante values, and we did not find evidence of spillover resulting from either program. The higher free ridership and lack of spillover combined to produce a lower NTG ratio than the program had been using for these program measures.

Table 2-11. Dehumidifier and Appliance Recycling Net-to-Gross Values

Factor	Dehumidifier		Appliance Recycling	
	Program ex ante	2010 Evaluation	Program ex ante	2010 Evaluation
Free Ridership (FR)	.30	.72	.43	.54
Spillover (SO)	.15	0	0	0
Net-to-Gross (1-FR+SO)	.85	.28	.57	.46

The evaluation team also attempted to study the NTG ratio for room air conditioners. Because the program offers discounts for room air conditioners at the retail level and not as a rebate program (i.e., an "upstream" incentive), program records did not include contact information for program participants. The alternative method for estimating NTG for an upstream program like the room air conditioner program is to interview participating retailers to learn about the impact of the program on sales. We conducted interviews with 10 of the most active participating retailers, but most retailers were unable to quantify sales in a manner that would enable us to calculate a reliable NTG estimate. As a result, we used the program deemed value to estimate net savings for room air conditioners. The retailers were able to provide a more qualitative assessment of program impact. The process results section below discusses these results.

Process Findings

Lighting

We based our process assessment of the 2010 Lighting program on data from four data collection and analysis efforts, including:

- **Participating retailer telephone interviews**: We conducted telephone interviews with 13 participating lighting retailers, including representatives from a mix of the different distribution channels, including the largest (e.g., Do It Yourself [DIY] and big box) channels.
- **In-depth interviews with program staff and program implementation contractors**: We conducted interviews with three LIPA staff members, one Applied Proactive Technologies, Inc. (APT) staff member, and two Energy Federation, Inc. (EFI) staff members.
- **Review of program databases and materials**: We reviewed the program-tracking database and program promotional materials.
- **Residential baseline study**: As part of the residential baseline study, we conducted a phone survey and in-home audits with residential customers to characterize LIPA's market potential for energy saving programs.

Program Participation

As shown in Table 2-12, the lighting component of the EEP program exceeded its unit sales goals in both the standard and specialty categories. The program did not meet its solid-state lighting (SSL) or fixture goals due to lack of product availability for most of the year.

Table 2-12. Lighting Goal versus Actual Units by Product Type

Lighting Type	2010 Unit Goals	2010 Actual Units	Actual as Percentage of Goal
CFLs – common	800,000	988,087	124%
CFLs – specialty	450,000	654,263	145%
ENERGY STAR SSL	10,000	3,438	34%
Fixtures	15,000	9,073	60%
Total	**1,275,000**	**1,654,861**	**130%**

The program discounts lighting through three different channels. As shown in Table 2-13, most program bulbs (96%) were purchased at retailers that mark down the price of program CFLs on the shelf, charging customers a reduced price when they check out. LIPA reimburses these retailers only after they sell participating products and submit an invoice for the purchases. Markdown retailers tend to be retailers that are part of a larger national or regional chain.

Retailers that do not have the sales and tracking systems necessary to participate in a markdown program discount CFLs with instant coupons that LIPA has provided. Customers fill out a coupon at the register and receive the discount immediately. Coupon sales account for 4% of program sales. Most coupon retailers are smaller, independently owned stores.

In 2010, one retailer participated in both the markdown and coupon program. The coupons allowed this retailer to participate in special holiday promotions. In 2011,

retailers will only be able to provide discounts through one avenue, the markdown or the coupons.

Customers can also purchase discount lighting through the LIPA website, although few program bulbs (<1%) were purchased this way.

Table 2-13. Lighting Units Sold by Discount Type (2010)

Discount Mechanism	Number of Units Sold	Percentage of Total Units
In-store Markdown	1,557,204	96%
Instant Coupon	67,549	4%
On-line Catalog	108	<1%
Total	**1,654,861**	**100%**

As shown in Table 2-14, the Lighting program is well represented across a number of different types of stores in LIPA territory. Drugstores, big box, and DIY retailers represent just over two-thirds (69%) of all participating locations though the vast majority (89%) of program bulbs were sold through either DIY/big box (49%) or warehouse (40%) distribution channels. Program staff is pleased with the program's penetration into the lighting retailer market in the territory, and only references one chain big box retailer it would like to enlist; however, the staff understands this retailer is unlikely to participate because of its policy against outside promotional materials. Program staff also believes that variety store retailers where the owners and patrons do not speak English as a first language offer excellent potential. Unsurprisingly, the greatest limitation with enlisting these shops is the language barrier. Nevertheless, program staff reports they are happy with the level of participation among participating retailers.

Table 2-14. Total Participating Stores and Lighting Program Sales by Retailer Type

Retailer Type	Number of Stores	Percentage of Stores	Units Sold	Percentage of Total Units
Do It Yourself/Big Box	77	17%	817,996	49%
Warehouse	15	3%	659,706	40%
Drugstore	232	52%	80,153	5%
Grocery	71	16%	44,166	3%
Discount/Variety	21	5%	41,338	2%
Hardware	21	5%	8,103	<1%
Other	8	2%	3,286	<1%
LIPA On-Line Catalog	1	<1%	108	<1%
Totals	**446**	**100%**	**1,654,861**	**100%**

Marketing and Outreach

The LIPA Lighting program conducts extensive marketing and outreach by partnering with retailers and manufacturers, promoting the program directly to LIPA customers, and producing in-store marketing materials. APT, the program implementer, conducts periodic

trainings for retailers to teach them about the products, visits each store every one to four weeks, and regularly performs in-store promotions where it exposes customers to CFLs and their benefits.

The LIPA Lighting program produces a number of marketing materials:

- In-store signage that indicates discounts are on behalf of LIPA
- Coupons and coupon wobblers alongside the products in the store
- Bill inserts sent to LIPA customers
- Product information sheets available on the LIPA website
- Advertisements on television and in print (*Newsday* and LIPA's newsletter and electronic newsletter)

In addition, the program supports participating retailers through cooperative advertising: LIPA provides retailers with ENERGY STAR and LIPA logos, and also provides supplemental funding towards the costs of the print advertising. LIPA must approve advertisements before retailers can run them.

Participating lighting retailers reported that they are promoting LIPA-discounted bulbs in their stores though product placement and Point of Purchase (POP) materials. Half of store-level respondents (6 of 12) say they "very often" place LIPA-discounted bulbs in more prominent places than they do other lighting products. Only two retailers said they "never" do so. Nine of the twelve report receiving POP materials from LIPA, and they make use of "all" or "most" of the signage. When asked to rate their satisfaction with the LIPA-provided signage on a 1 to 7 scale, where 1 is "extremely dissatisfied" and 7 is "extremely satisfied," five of nine are neutral (a rating a 5) while four are satisfied (a rating of 6).

Retailer Satisfaction

Retailers are largely neutral to positive about the Lighting program. Across the 13 retailers interviewed, average satisfaction was a 5.7 (on a scale of 1 to 7, where 1 is "extremely dissatisfied" and 7 is "extremely satisfied"). Much of their neutrality is because store-level retailers are not involved in buying and pricing decisions nor are they involved in program participation steps. However, when asked about ways of improving the program so that it is more accessible to retailers like themselves, they make a variety of suggestions that could be useful to the program:

- Increase incentives (buyer suggestion)
- Deliver greater information about *all* eligible products
- Give presentations about the difference between CFL and incandescent bulbs
- Provide a CFL recycling delivery channel that is free for retailers

Data Tracking and Verification issues

The coupon program requires customers to fill out the coupon and provide their name and address. On average, approximately one of five processed and paid coupons (32%) do not contain customer information. Some retailers have a much higher proportion of incomplete coupons. For example, the retailer that sold the greatest number of units

through the coupon program (29,497 units, or 46% of the total coupon units), is missing customer information on about half of its units' coupons (49%).[38]

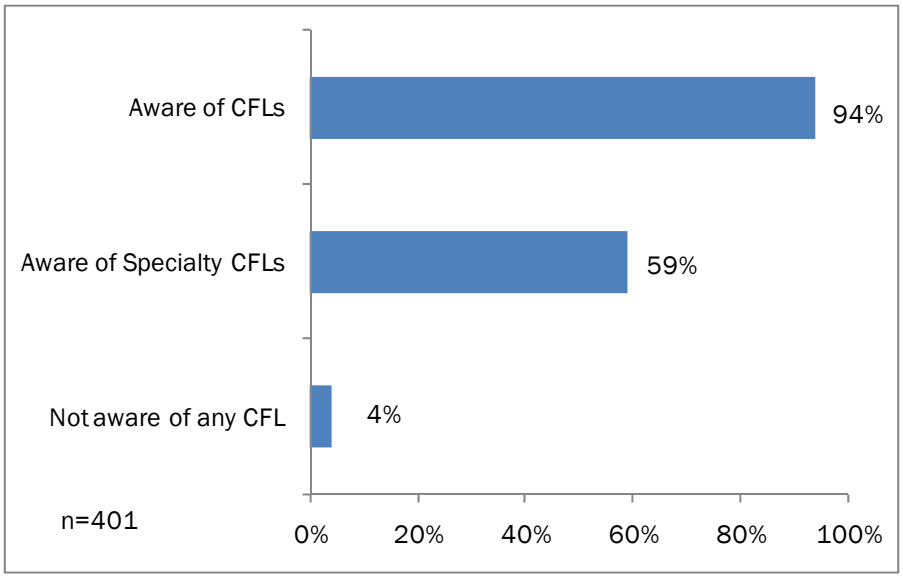
Additionally, other fields on coupons are incomplete. Nearly one-fifth of the units for which coupons were processed (18%) have "unknown," "other," or missing model names. Ten percent of the units processed through coupons have missing manufacturer information, and 9% have missing unit type (without model name or manufacturer name either) so we cannot deduce what type of product was rebated.

All three retailers we interviewed who participate in the coupon program report that it is not difficult to get customers to fill out the coupon information at the register—they explain that if customers do not fill out the coupons completely, they (the retailer) either fill them out themselves or destroy the coupons without collecting the incentive from LIPA. We made numerous attempts over several weeks to interview the top-selling coupon retailer mentioned above, but were unable to connect with this retailer. LIPA may want to remind coupon retailers with higher than average incomplete information rates about the program requirements. LIPA should also discuss this issue with APT and EFI.[39]

Potential of LIPA CFL Program

As shown in Figure 2-11, nearly all LIPA residential customers have heard of CFLs (94%), though fewer (59%) know that CFLs are available for light sockets that require a specialty bulb.

Figure 2-11: CFL Awareness



[38] Note that since the coupons were only about 4% of total program bulbs, the coupons with missing data represent less than 1% of all program bulbs.

[39] APT implements the appliance programs by negotiating contracts with retailers and managing the day-to-day operation of the program at the retail level. EFI is responsible for processing the rebate applications and payments.

Likewise, a large majority of LIPA residential customers have at least one CFL installed in their homes (83%). Far fewer have a specialty CFL installed (14%). Despite the relatively high penetration rate of standard CFLs, much potential remains for CFL growth within the residential market, as only 27% of standard light bulbs in use are CFLs, and only 5% of specialty light bulbs in use are CFLs.

Our interviews with 13 participating lighting retailers contained questions on CFL stocking practices, sales, and program impact. Unfortunately, many could not provide answers to our questions stating that they did not have that type of knowledge or corporate policies prevented them from answering. However, the answers we did receive suggest the LIPA program has influenced CFL sales and could continue to do so.

Seven of ten retailers who could answer questions about CFL sales, said that sales of spiral CFLs would be lower if the program did not exist. Five of nine felt their sales of specialty CFLs would be lower.

Seven of nine felt that LIPA discounted CFLs sell more quickly than non-discounted CFLs. Retailers have mixed views on the pace of sales of program-discounted CFLs compared to a comparable incandescent bulb. Four of thirteen said the CFLs sell more slowly; another four said the CFLs sell faster; while three said they sell at the same pace. The remaining two retailers do not sell incandescent bulbs.

As the Lighting program is particularly interested in promoting specialty CFLs, we made specific efforts to ask retailers about this program component. While many (8 of 11 who could answer) report that their sales of specialty CFLs are either "excellent" or "good" and only a few (3 of 11) said sales were "fair" or "poor," retailers explain that the high price of specialty CFLs still presents a barrier to selling more of specialty CFLs. This suggests that LIPA's discounts on specialty CFLs are important to the continued growth of specialty CFL adoption.

LIPA's discounts on specialty CFLs may benefit from additional promotion to retailers. Two of the thirteen retailers we spoke with were unaware that the LIPA program discounts specialty bulbs. One of these retailers does not sell specialty bulbs through the program and did not know if the store would be interested in doing so in the future as that is a corporate-level decision. The other retailer does sell program-discounted specialty bulbs but is unfamiliar with the specialty bulb program. He is actually the corporate buyer for all retail locations. However, a store manager for this particular retailer is aware of the program.

Dehumidifiers and Refrigerators

The 2010 process assessment of the Dehumidifier and Refrigerator programs included three data collection and analysis efforts:

- Participant telephone survey: We conducted a telephone survey with 70 Dehumidifier program participants.
- In-depth interviews with program staff and program implementation contractors: We conducted interviews with three LIPA staff members, one APT staff member, and one EFI staff member.

- **Review of program databases and materials**: We reviewed the program-tracking database and program promotional materials.

Program Participation

As shown in Table 2-15, the Dehumidifier and Refrigerator programs exceeded their participation goals.

Table 2-15. Appliance Rebate Goal versus Actual Units

Program Component	Unit Goals	Actual Units	Actual as Percentage of Goal
Appliance Rebates			
Dehumidifiers	1,500	3,669	245%
Refrigerators	12,000	25,597	213%

The appliance component of the EEP program works through 112 participating retail locations. While no memoranda of understanding (MOU) are prepared between LIPA and the retailers, participating retailers agree to place promotional signage in their stores and to have their sales staff members participate in training sessions on the program and ENERGY STAR appliances.

Customers who purchase a qualified appliance from a participating retailer need to fill out the rebate form and send it to LIPA along with a receipt that shows the appliance's model number, manufacturer, and price. Customers receive $10 for dehumidifier purchases and $75 for refrigerator purchases.[40]

Table 2-16 shows that appliance and big box stores sold the greatest number of program dehumidifiers and refrigerators. Customers purchased approximately half of the program dehumidifiers (48%) and nearly two-thirds of refrigerators (63%) from appliance stores. Most of the appliance dealers are local and independently owned. Big box retail chains and DIY stores are other popular locations for purchasing qualified dehumidifiers and refrigerators.

[40] LIPA increased the incentive for dehumidifiers to $20 in 2011.

Table 2-16. Total Stores and Appliance Sales by Retailer Type

Retailer Type	Dehumidifiers		Refrigerators	
	Number of Stores	Units Sold (n=3,669)	Number of Stores	Units Sold (n=25,447)
Appliance	62	48%	145	63%
Do-It-Yourself/Big Box	109	46%	110	17%
DIY	0	0%	44	19%
Online	24	2%	20	1%
Warehouse	18	3%	3	<1%
Wholesale	0	0%	6	< 1%
Electronics	2	< 1%	14	< 1%
Hardware	6	< 1%	1	0%
Other	2	< 1%	4	< 1%
Totals	**223**	**100%**	**303**	**100%**

LIPA customers are supposed to purchase eligible appliances only at participating retailers. However, the rebate instructions on the website and on the rebate application do not clearly specify that customers should purchase the appliances at participating retailers. Customers, do, in fact, download rebate forms from the LIPA website and purchase appliances at other retailers.

The program-tracking data show that LIPA customers received rebates for appliances purchased from a large number of non-participating retailers. Though 112 stores participate in the program, customers purchased dehumidifiers at 223 different retail locations, and they purchased refrigerators at 303 retail locations. Still, customers purchased nearly all refrigerators (97%) and most dehumidifiers (91%) from participating retailers.

While the program exceeded its goals in terms of unit sales, responses from the participant survey indicate that a majority of program participants would have purchased their dehumidifier without program support. The survey found that 13% of participants learned about the rebate *after* they had purchased the dehumidifier so the program could not have influenced their purchase decision. Participants who learned about the program *before* they selected their dehumidifier were asked the likelihood that they would have purchased the exact same one if the $10 rebate had not been available. Based on a 1 to 7 scale, where 1 is "not at all likely" and 7 is "extremely likely," 84% gave a 6 or 7, indicating it was highly likely they would have made the same purchase without the rebate. As a result, appliance program net savings are considerably lower than gross savings as discussed above in greater detail.

The participant survey results indicate that the program's training of sale's associates and in-store marketing materials plays an important role in attracting customers who would have purchased a less efficient dehumidifier if the program did not exist. Our comparison of program free riders to non-free riders shows that non-free riders were more likely to have seen program marketing materials and talked with a sales associate about the energy use of different dehumidifiers than free riders.

In addition, the low incentive level ($10) likely played a role in the high free ridership number, as the incentive may have represented a small percentage of the product cost for many customers (i.e., a $10 incentive may not be high enough to attract the attention of a customer that is spending over $200 to purchase a dehumidifier, and thus they continue to focus on the size/style that they want rather than the efficiency). Thus, raising the incentive in 2011 may help *lower* the free ridership rate.

Marketing and Outreach

An important aspect of the appliance program is training the retailer sales associates to promote ENERGY STAR appliances and educate customers about their benefits. APT staff conduct periodic trainings for retailers to teach them about the products, visit each store every one to four weeks, label products with signage, provide rebate forms, and replace POP materials. The program also offers a number of marketing materials, including:

- In-store signage that promotes rebate offerings
- Printed qualifying products lists for in-store usage
- Bill inserts (for dehumidifiers only)
- LIPA website advertisements and information
- Advertisements in *Newsday* and LIPA's newsletter and electronic newsletter

In addition, the program supports participating retailers through cooperative advertising. LIPA provides retailers with ENERGY STAR and LIPA logos, and provides supplemental funding towards the costs of the print advertising. LIPA must approve advertisements before retailers can use the collateral.

Results from the dehumidifier participant survey indicate the in-store marketing efforts reached many participants. Most participants learned about the Dehumidifier program while in the store: half of respondents (49%) learned about the program from a salesperson at the store, while a third of respondents (33%) learned about it from signage or other materials in the store. Accordingly, the majority (83%) of participants obtained the rebate application form from the retailer. Roughly three-quarters of participants (77%) spoke with a salesperson about their purchase, though less than half (41%) of these conversations dealt with the amount of energy that could be saved by purchasing different dehumidifiers.[41]

[41] We did not ask these questions of the 13 participants who learned about the program *after* they had already purchased their dehumidifier and the one participant who was using the dehumidifier outside LIPA territory.

Participant Satisfaction

The dehumidifier participant survey shows that participants are very satisfied with the Dehumidifier program, and they find it easy to participate.

Participants find the program processes to be straightforward. For example, about three-quarters of respondents (73%) say discerning what models qualify for the program was easy (rating it a 6 or 7 using a 1 to 7 scale, where 1 is "extremely difficult" and 7 is "extremely easy," n=52). Further, nearly all respondents (96%) say that filling out the rebate application form was easy (rating it a 6 or 7, n=68).

The Dehumidifier program seeks to issue incentives within four to six weeks of receiving rebate applications. The majority of respondents (95%) who could recall the amount of time it took to receive their check report receiving their rebate check in six weeks or less, and over half (57%) received it in four weeks or less (n=63). Three quarters of respondents (76%) are satisfied with the time they waited (rating 6 or 7 on a scale of 1 to 7, where 1 is "extremely dissatisfied" and 7 is "extremely satisfied," n=67), while only 2% are dissatisfied (rating 1 or 2).[42]

Overall, participants gave the Dehumidifier program an average rating of 6.4 on a scale of 1 to 7, where 1 is "extremely dissatisfied" and 7 is "extremely satisfied." The majority of participants (83%) gave the program a rating of 6 or 7 (n=69). The remaining respondents (17%) were neutral about the program (providing ratings of 3 to 5). We asked participants giving the program a rating of 3 or lower how the program could be improved. These participants suggested increasing the rebate amount, providing the rebate payment faster, and making the rebate available at more retailers.

Room Air Conditioners

The 2010 process assessment of the Room Air Conditioner (RAC) included three data collection and analysis efforts:

- **Participating retailer telephone interviews**: We conducted telephone interviews with 10 participating retailers.
- **In-depth interviews with program staff and program implementation contractors:** We conducted interviews with three LIPA staff members, one APT staff member, and one Energy Federation, Inc. (EFI) staff member.
- **Review of program databases and materials**: We reviewed the program-tracking database and program promotional materials.

Program Participation

The RAC program achieved its overall participation goals but did not achieve the program's desired distribution of units by size. The program's goal was for 60% of sales to be smaller

[42] The program does not appear to have a problem with timely receipt of rebate checks or participant dissatisfaction as a result. This 2% is only 1 person out of the 70 we interviewed. This respondent reported that it took over six weeks to receive his rebate check. One other participant said it took more than six weeks to receive his check while another respondent said he never received it. Six respondents could not recall how long it took.

units (6,000 Btu/h or less) and 40% to be larger (6,001 to 8,000 Btu/h). Actual sales were nearly the opposite (43% small and 57% large).[43]

Table 2-17. Room Air Conditioner Goal versus Actual Units

Unit Size	Unit Goals	Actual Units	Actual as Percentage of Goal
6,000 BTU/h or less	9,000	6,493	72%
6,001 to 8,000 BTU/h	6,000	8,528	142%
Totals	**15,000**	**15,021**	**100%**

Although the program promotes the purchase of ENERGY STAR room air conditioners that use up to 8,000 Btu/h, it has placed greater emphasis on air conditioners that use 6,000 Btu/h because the incremental cost of an ENERGY STAR RAC is greater for smaller RAC units than it is for larger RAC units. Therefore, the RAC program's standard offering for most retailers includes a greater discount for ENERGY STAR RAC models requiring 6,000 Btu/h or less, and a smaller discount for those requiring more than 6,000 Btu/h.

Nine retailers participate in the RAC program. Most are independently owned single-store retailers. One is a local chain with 18 separate locations that participate in the program. This retailer sold 89% of the units discounted through the program. Due to the large number of sales, the program allowed this retailer more flexibility in determining the size of program discounts. Rather than providing larger discounts for smaller units and smaller discounts for larger units, as was the case with all other retailers, this retailer could adjust the discounts so that more expensive units had a larger discount. This policy meant that some larger units carried a larger discount than smaller units did at this retailer.

The RAC program has recently changed its delivery approach to better control sales volume. In 2008, the RAC program was a downstream mail-in rebate style program. The program was extremely successful, selling twice as many units as what was in the program budget. To keep the program within the program goals and budget, the RAC program used an upstream retailer discount approach in 2009 and 2010 to limit participation. While the program in 2010 indeed limited the total number of units to match its goal, it was unable to manage the distribution of units by size to achieve its desired cost-effectiveness level.

Interviews with participating retailers suggest a reason why the program is struggling to meet its goals for smaller RAC units: the participating retailers are all local appliance dealers, and report that there is a lot of competition in the small RAC unit market, with drugstores and supermarkets selling the smaller units. These other retailers, however, do not sell the bigger units, leaving that market to the appliance dealers (i.e., the appliance

[43] The evaluation team found a discrepancy in LIPA's categorization of RACs of 6,000 BTUs as "small" or "large". In the LIPA sales and energy-tracking data sheet, RACS of 6,000 BTUs are included in the larger unit category. However, LIPA gives larger rebates for the purchase of units *at or below* 6,000 BTUs units and smaller rebates to units *above* 6,000 BTUs. For the evaluation, we followed the rebate definition and defined 6,000 BTU units as small. Therefore, LIPA's tracking sheet reports far fewer smaller unit sales than we do in both the process and impact evaluations.

dealers in the program sell more of the larger units because of competition from drug stores and supermarkets for sales of the 6,000 Btu/h or smaller units).

Marketing and Outreach

The in-store marketing of the program is strong. Similar to the Dehumidifier and Refrigerator programs, APT staff conducts periodic trainings for retailers to teach them about the products, visits each store every one to four weeks, labels products with signage, provides rebate forms, and replaces POP materials. The RAC program produces in-store signage that promotes LIPA's discounts. It does not appear that the RAC program produces other promotional materials as it does for other EEP products (e.g., bill inserts, *Newsday* advertisements, etc.).The LIPA website does promote ENERGY STAR RAC units and suggests the appropriate size units based on room size; however, in 2010 it did not mention the retailers who participate in the program or the discount program itself.

Retailers report that they almost always display LIPA-provided marketing materials, and nearly all retailers say they let customers know that LIPA provides the discounts. Overall, retailers feel the marketing materials the RAC program provides are useful and are satisfied with what the program provides. Nevertheless, one retailer mentioned that it would be helpful if the program provided more out-of-store advertising on their behalf.

Participant Satisfaction

Interviews with 10 participating retailers indicate that retailers are satisfied with the RAC program overall. On average, retailers gave the program a rating of 6 (using a scale of 1 to 7, where 1 is "extremely dissatisfied" and 7 is "extremely satisfied"). Retailers are also quite pleased with APT representatives—providing an average rating of 7. All interviewed retailers were satisfied with the incentive amount, and report that their payments on behalf of LIPA arrive on time.

An in-depth interview with the LIPA staff members indicates that some participants were unhappy that the program moved from customer rebates to upstream discounts. However, only one retailer believes that the store's sales have decreased because of the shift to upstream incentives, and four retailers say their sales *increased* due to the shift. Although, unprompted, four retailers recommend that the program shift back to the customer rebate channel instead of upstream discounts. These retailers say the upstream program requires more paperwork than the coupon program did.

In spite of the program's efforts to increase the market share of smaller ENERGY STAR RAC units that require 6,000 Btu/h or fewer, the dominant complaint among the retailers regarded the models that the program discounts. Half of respondents specifically recommended that the program include units requiring above 8,000 Btu/h; another retailer requested that the program increase the discount for the 6,001-8,000 Btu/h units. One retailer said he is less interested in carrying smaller units in general because there is greater competition in the market for these smaller units since more stores, like drugstores, carry them. One retailer suggested that LIPA should discount *any* ENERGY STAR unit instead of specifying which models should qualify. Despite this feedback, only three respondents (out of 10) stated they are not satisfied with the choice of models.

Program Impact on Stocking and Sales

The RAC program has had an impact on retailers' stocking decisions. While the majority of respondents (7 out of 10) are certain that their stores stocked RAC ENERGY STAR models that were not discounted by LIPA in 2010, four of the ten respondents say that their stores have changed the mix of RAC model types since they began participating in the program. All four carried fewer ENERGY STAR units overall and offered less variety in terms of models prior to participating in the RAC program. Specifically, two of the retailers report they have begun carrying more of the smaller ENERGY STAR units that require 5,000-6,000 Btu/h since they began participating in the program. Half of the respondents are certain that they would not stock as many ENERGY STAR RAC units without the program. A buyer for the largest participating chain store explains the program has a dramatic impact on his stocking decisions, and requests that the program provide information about what models it will discount earlier in the year to drive his purchasing decisions more accurately.

The program has had an impact on increasing sales of ENERGY STAR RAC models. Nearly all respondents (8 out of 10) are certain that their actual sales of ENERGY STAR RAC units have increased since they have begun participating in the RAC program. The majority of those who experienced an increase in ENERGY STAR RAC sales (7 out of 8) believe the program is a very important reason for this increase. Moreover, the majority of respondents (8 out of 10) are certain that their sales in non-ENERGY STAR RAC units have decreased since they have begun participating in the RAC program. On average, they estimate their sales have decreased by about 40%. However, respondents point out that other factors, like customers' increasing interests in energy and cost savings and changes in weather, play a somewhat important role as well.

Pool Pumps

The 2010 process assessment of the Pool Pump program included three data collection and analysis efforts:

- **In-depth interviews with program staff and program implementation contractors:** We conducted interviews with three LIPA staff members, one APT staff member, and one EFI staff member.
- **Review of program databases and materials:** We reviewed the program-tracking database and program promotional materials.
- **Residential baseline study:** As part of the residential baseline study, we conducted a phone survey and in-home audits with residential customers to characterize LIPA's market potential for energy saving programs.

Program Participation

As shown in Table 2-18, LIPA is struggling to meet its participation goals for pool pump rebates. Program staff is pleased with the number of pool pump installers who participate in the program; however, the staff notes that the activity level of the installers is inadequate to meet the program's goals.

Table 2-18. Pool Pump Rebate Goal versus Actual Units

Type	Unit Goals	Actual Units	Actual as Percentage of Goal
Two Speed	1,000	17	2%
Variable Speed	1,000	317	32%

Program staff suggests that end-user participation in the Pool Pump program might be limited because of the cost and effort required of participants. For customers, the costs of the program pumps outweigh the benefits, in part, because a participating contractor must install the pump. Program staff has received feedback that many customers would rather install the device on their own and forego the rebate because it is less costly and requires less effort in terms of coordination and paperwork.

Marketing and Outreach

The current program marketing campaign targets pool pump installers and dealers. APT conducts various activities to engage trade allies (pool pump installers) such as breakfast meetings where manufacturers demonstrate their products. In addition, the program also markets to end-use customers using the following materials:

- In-store signage that promotes rebate offerings
- LIPA website advertisements and information
- Lists of qualified products and participating dealers and installers
- Bill inserts
- Advertisements in *Newsday* and LIPA's newsletter and electronic newsletter

Program Potential and Recommendations

The program staff acknowledges the challenges of the Pool Pump program. The phone and on-site baseline surveys that we conducted for LIPA provide insight on the market potential for the pool pump program. Results from both surveys indicate that there is greater market potential for energy efficient pool pumps than the LIPA program is realizing.

According to the residential baseline on-site survey, 14% of LIPA residential customers living in single-family homes have a pool. Nearly all (90%) have a pool pump, which is likely to be a constant speed pump. As Table 2-19 shows, only 4% of pool pumps are variable speed and none are two-speed (note that we could not access nearly a fifth of pool pumps to determine type).

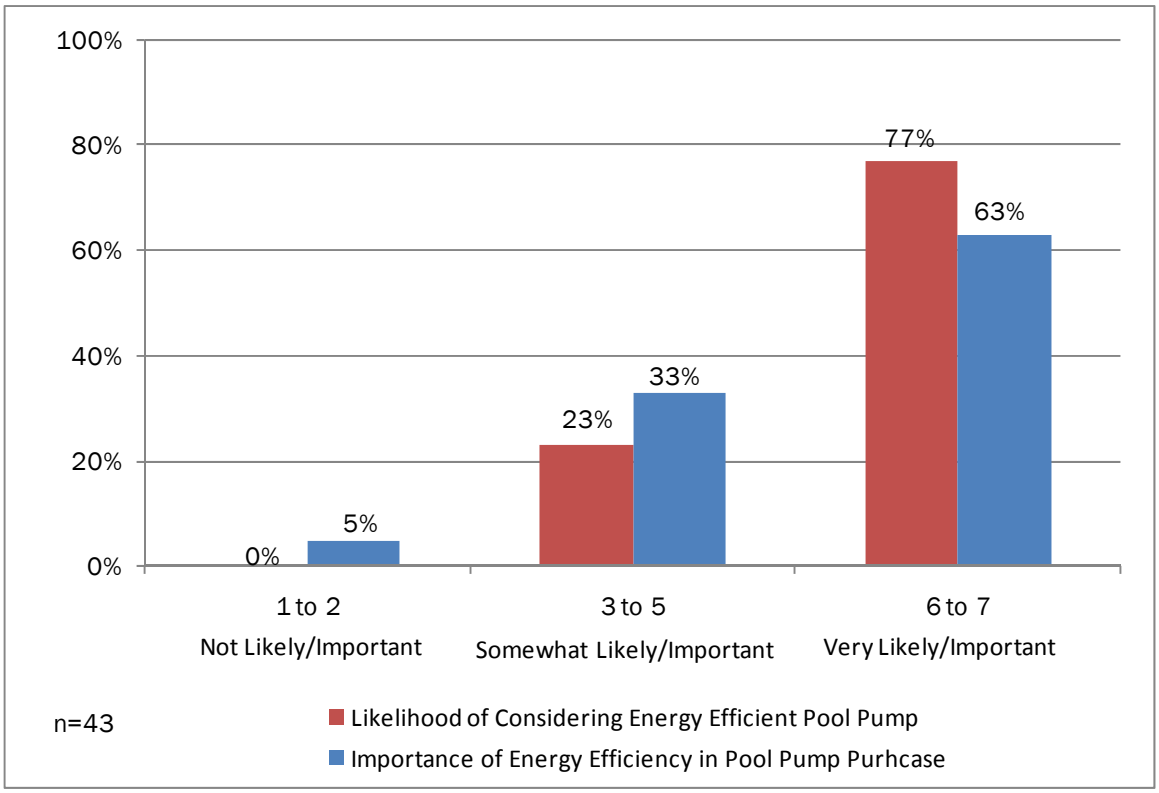
Table 2-19. Pool Pumps in Use among LIPA Residential Customers with Pools

Type of Pool Pump	Percentage of Pumps
Constant Speed	79%
Variable Speed	4%
Two Speed	0%
Cannot Assess	18%

The baseline phone survey suggests that the main barrier to program participation is that customers are unaware of the existence of energy efficient pool pumps and their benefits. Only 33% of pool owners have heard of a variable speed or energy efficient pool pump. Most pool owners do not plan to replace their pool pump in the next year, but if they did, most would do so because their existing pump broke or was not working well (95%). Only 3% said they would replace the pump to save money. Most pool owners do not know enough about early replacement of an inefficient pool pump to even consider it.

Despite this lack of knowledge, many are open to a more energy efficient option as shown in Figure 2-12. When asked how important saving energy would be compared to other factors when purchasing a future pool pump, nearly two-thirds of pool owners said energy savings would be very important. Three of four said they would be very likely to look for an energy efficient model the next time they purchase a pool pump.

Figure 2-12. Attitudes toward Energy Efficient Pool Pumps



Refrigerator Recycling Program

The 2010 process assessment of the Refrigerator Recycling program included four data collection and analysis efforts:

- **Participant telephone survey:** We conducted a telephone survey with 70 Refrigerator Recycling participants.
- **In-depth interviews with program staff and program implementation contractors:** We conducted interviews with three LIPA staff members, as well as three staff members from Appliance Recycling Centers of America (ARCA).
- **Review of program databases and materials:** We reviewed the program-tracking database and program promotional materials.
- **Residential baseline study:** As part of the residential baseline study, we conducted a phone survey and in-home audits with residential customers to characterize LIPA's market potential for energy saving programs.

Program Participation

LIPA began its Refrigerator Recycling program in 2010. The program got a late start with the first appliance pickup made in March. As shown in Table 2-20, the program achieved approximately half of the unit goals with 4,557 appliances recycled out of a goal of 9,000. A large majority of recycled appliances (83%) were refrigerators.

Table 2-20. Refrigerator Recycling Actual versus Unit Goals

Appliance	Unit Goals	Actual Units	Actual as Percentage of Goal
Refrigerators	NA	3,766	83%
Freezers	NA	791	17%
Total	**9,000**	**4,557**	**50%**

A total of 4,332 LIPA customers participated in the program, with 95% recycling a single appliance and 5% recycling two appliances.

Appliance and Participant Characteristics

The participant survey and the program-tracking database contain information about the appliances recycled through the program. The participant survey asked respondents where the appliance was located during the year prior to when LIPA picked it up (see Table 2-21). A slight majority of the refrigerators recycled (61%) were located somewhere other than the kitchen indicating that participants were using them as secondary refrigerators.

The program-tracking data also recorded appliance location. The locations were listed as a combination of room type and floor. A "kitchen" is not specified as a location but 1st, 2nd, and 3rd floors are listed. We assumed the floor locations indicated a kitchen because the data noted basements, garages, and porches. With these assumptions in place, a larger majority (80%) of the refrigerators recycled were secondary appliances. Nearly all freezers were standalone freezers and were located in either the basement or the garage.[44]

Table 2-21. Appliance Location of Survey Respondents versus All Participants

Location	Participant Survey		Program Database	
	Refrigerator (n=59)	Freezer (n=11)	Refrigerator (n=3,766)	Freezer (n=791)
Kitchen	39%	9%	20%	7%
Basement	29%	73%	30%	49%
Garage	25%	9%	49%	43%
Laundry Room	2%	9%	NA	NA
Porch/Patio	2%	0%	1%	1%
Other	3%	0%	2%	0%

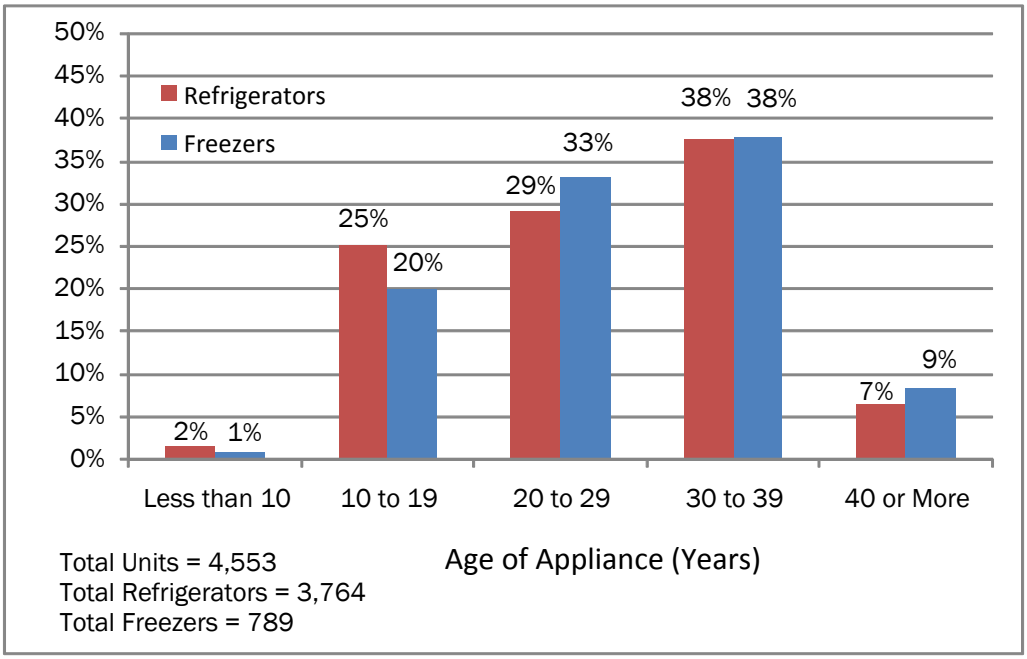
Due to market forces, as well as the adoption of federal standards, appliance efficiency has improved significantly over the past three decades. As a result, an appliance's age is an excellent proxy for its efficiency and relative energy consumption and, therefore, of significant interest to evaluators. As with appliance location, both the participant survey and the program-tracking data provide information on the age of the appliances recycled through the LIPA program and produce slightly different results. On average, program participants estimated their appliances to be younger than the estimates of the ARCA team that picked up the appliances. The average age provided by participants was 17 years old while the average age of the same appliances according to ARCA was 26 years old. Such discrepancies are not unusual since it can be difficult to estimate the age of appliances. Because the program database contains more appliances from which to draw the data, the tables and figures below report age estimates from the program-tracking data.

The program is recycling old and inefficient appliances. According to the program database, the average age of refrigerators and freezers recycled through the program was 26 and 27 years, respectively. As Figure 2-13 shows, a small number of appliances were manufactured since 2000 and should have been ineligible for the program but were still picked up by ARCA (7 freezers and 62 refrigerators). Most appliances were much older. Forty-five percent were at least 30 years old. Moreover, 77% were manufactured prior to

[44] Some caution should be used in interpreting the program-tracking location numbers because this data indicates the location of the appliance when it was picked up. Participants may have already moved their appliance from their kitchen to another location, such as a garage, in anticipation of the pickup. Regardless, the program did keep refrigerators that had been used as primary appliances from being used as secondary appliances.

1994 when federal appliance standards went into effect with higher efficiency requirements.

Figure 2-13. Age Distribution by Type of Appliances Recycled



Refrigerator Recycling program participants tend to be white, educated, homeowners around 60 years of age who have an income of over $75,000 per year. All Refrigerator Recycling program participants are homeowners, and nearly all of them (94%) live in single-family homes. Most participants' homes (77%) were built before 1970 (n=69), and over half of respondents (58%) have lived in their homes for more than 20 years (n=67). The median age of participants is 63. The majority of participants (69%) have either a college degree or more education. Of those respondents who are willing to provide their income range (n=40), the majority (80%) makes $75,000 or more per year before taxes. The most common income bracket given (25%) is between $100,000-$149,000/year. Nearly all participants (92%) are white (non-Hispanic).

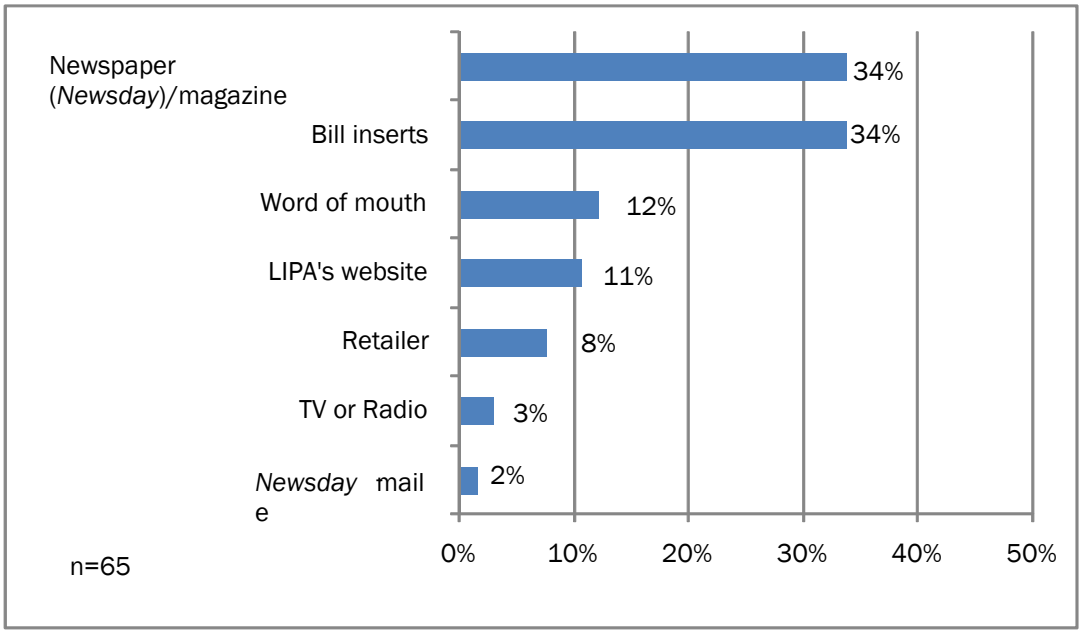
Marketing and Outreach

As a new element of the EEP program, the Refrigerator Recycling program receives the most extensive advertising of all of the EEP components. The program uses the following marketing channels:

- Television commercials
- Radio spots
- Bill inserts
- LIPA website advertisements and information
- Advertisements in *Newsday* and LIPA's newsletter and electronic newsletter

As shown in Figure 2-14, most participants learned of the Refrigerator Recycling program through print media or bill inserts. Approximately one-third of respondents (34%) learned of the program through newspaper or magazine advertisements, and an equal share (34%) learned of the program through bill inserts. Though the program does not partner with appliance retailers, 8% said they learned of the program from a retailer. Few learned of the program from TV or radio advertisements (3%).

Figure 2-14. How Participants Learned about Refrigerator Recycling Program (Multiple Response)



The Refrigerator Recycling program's incentive is the biggest motivator for participants. Over a third (40%) of participants say the main reason they chose to recycle their appliance through LIPA's program was the incentive. A fifth of respondents (19%) cite that they participated because they are no longer using their appliance (either because it was old, defective, or otherwise). Less commonly, respondents mention other motivations: convenience (9%), lack of awareness of other methods (9%), and helping the environment (7%).

Participant Satisfaction

In a survey with 70 participants of the Refrigerator Recycling program, we learned that participants are happy with the program and that program processes are functioning well.

The majority of respondents (87%) are satisfied with the program overall (rating the program a 6 or 7, where 1 is "extremely dissatisfied" and 7 is "extremely satisfied"). In addition, most respondents (94%) would recommend the Refrigerator Recycling program to a friend or family member (rating a 6 or 7 on a scale of 1 to 7, where 1 is "extremely unlikely" and 7 is "extremely likely).

Participants find the processes involved with signing up for the Refrigerator Recycling program to be easy and are satisfied with them. Nearly all (91%) participants who signed up for the Refrigerator Recycling program online say the sign-up screen was easy to find and all (100%) say the website answered all of their questions about the program (n=11). All of those who signed up on the telephone report that the representative they spoke with was polite and courteous and say the representative was able to answer all of their questions (n=42). Moreover, nearly all respondents (93%) found it easy to understand the program requirements (using a 1 to 7 scale where 1 is "extremely difficult" and 7 is "extremely easy," respondents gave a rating of 6 or 7).

The processes involved in the administration of the program are working well. For example, the program uses an automated telephone service to confirm participants' appointment times. Only 4% are certain they had not received a confirmation call, another 4% are unsure whether they did, and the remaining majority (91%) report receiving a call. Additionally, the program seeks to send out incentive checks within four to six weeks of appliance pickup. Of the respondents who can recall when they received their incentive checks (n=59), almost all (95%) received their checks within six weeks. Moreover, about two thirds (68%) of those who can recall when they received their checks say it came in less than four weeks. The majority (80%) of respondents (who had an opinion about the length of time they waited for their check) are satisfied with the length of time they waited (n=64).

Respondents are satisfied with the collection team that picks up the appliances, as well. All (100%) say they were polite and courteous; nearly all say that they arrived on time (94%). Accordingly, nearly all respondents (93%) are satisfied with the collection team. Respondents who gave the team lower ratings are the few who said the team did not arrive on time.

Program Potential

Though the program struggled to meet its participation goals during the first year of the program, our residential baseline on-site survey suggests that there is great potential for the program to increase participation in the future.

Forty-two percent of LIPA residential customers have more than one refrigerator in their home. These secondary refrigerators are much older on average than primary refrigerators. The average age of a refrigerator in a kitchen is 11 years compared to 25 years for refrigerators in other rooms. Slightly over one-half of secondary refrigerators are kept in the basement (52%), with one-quarter in the garage.

Data Tracking

Overall, the EEP program collects data necessary for program tracking and management, as well as to support the evaluation process. APT, EFI, and ARCA are responsible for tracking program participation and providing LIPA with updates on a regular basis. Our review of the measure-level program databases shows that data fields are populated and only a few entries are outside plausible data ranges.[45]

However, we did find that our final program participation counts did not always match LIPA's own program counts. We worked closely with LIPA to resolve these differences, and we were able to either eliminate or reduce our differences in program counts to the point that they are very small and should have a negligible impact on EEP savings.. Overall, we found that the program sold 1% more CFLs than LIPA reported in the program-tracking spreadsheet. We also found the program sold more standard CFLs and fewer specialty CFLs than LIPA reported (see Table 2-22).

Table 2-22. Program Reported Participation Compared to Evaluated Participation

Program Component	2010 EEP Reported Participation	2010 Evaluated Participation	Evaluated - Reported
Lighting			
CFLs - common	937,808	988,087	50,279
CFLs – specialty	691,515	654,263	-37,252
SSL	3,431	3,438	7
Fixtures	9,071	9,073	2
Pool Pumps			
Two speed	19	17	-2
Variable speed	313	317	4

[45] We found a few appliances in the refrigerator recycling database that were so old that they were likely data entry errors. For example, the database showed the manufacture date of one refrigerator as 1918.

Another area of uncertainty has to do with the formulas LIPA uses to calculate demand and energy savings. These formulas are not entirely transparent, and were unable to replicate LIPA's reported savings using LIPA's final participation counts and the TRM.

Both these issues—different program participation counts and lack of transparent energy saving formulas—can produce low program realization rates. Implementing Seibel may help LIPA maintain more accurate program participation counts. For the energy saving calculations, LIPA should review the formulas it uses to calculate savings to ensure they are consistent with the TRM.

Conclusions and Recommendations

The LIPA EEP program exceeded its annual demand savings goal but fell short of the annual energy saving goals (achieving 87% of goal). The program exceeded its unit sales goals for ENERGY STAR spiral and specialty CFLs, dehumidifiers, refrigerators, and room air conditioners. The program fell short of unit goals for pool pumps and refrigerator recycling.

Overall, the program processes work well, and participating customers and retailers are satisfied with the program. However, we have identified a few areas the program may want to consider addressing in the future.

Our key recommendations related to the program processes are:

Lighting

- **Retailer Marketing and Outreach:** The program was very successful at selling specialty CFLs in 2010, but there may still be opportunities to expand the program to more retailers. Two of the thirteen retailers we spoke with were unaware that the LIPA program discounts specialty bulbs. LIPA's discounts on specialty CFLs may benefit from additional promotion to retailers.
- **QA/QC:** LIPA has a coupon option for retailers who cannot participate in the markdown program due to its electronic data-tracking requirements. This allows more independent retailers to participate and gets the program into a wide variety of store types. Processing the coupons and verifying that all purchases meet program requirements is more time consuming for the program. We found that a sizable number of coupons (32%) were not filled out completely but were still paid by the program. Moreover, the percentage of incomplete coupons was higher for some retailers than others, with the largest coupon participant having a particularly high percentage of incomplete coupons. LIPA should work with its implementation contractors to ensure they are following all program eligibility requirements.

Appliances

- **Retailer Participation**: LIPA lists 112 participating retail locations for dehumidifiers and refrigerators, but rebated dehumidifiers sold at 223 stores and refrigerators sold at 303 stores. It is not necessarily a problem that LIPA customers are purchasing otherwise eligible appliances from non-participating retailers, and these purchases are likely increasing program participation. LIPA may also want to consider making it clear on the program materials that customers do not need to purchase appliances at participating retailers, but that they can find eligible appliances at the participating retailers listed on the LIPA website.

  Not restricting the sales to participating retailers may also impact the program net-to-gross ratio. Retailer and customer education are key aspects of the program. Participating retailers undergo training and agree to promote program-marketing materials that explain the benefits of ENERGY STAR appliances. These efforts help the program reach customers who may not have considered a high efficiency appliance. The customers who purchase from non-participating retailers may be more likely to know they want an ENERGY STAR appliance and then shop to find the lowest price retailer.

- **Program Participation**: LIPA far exceeded the unit sales goals for each appliance type. With a customer rebate program, LIPA has less control over total sales. LIPA changed the room air conditioner program from customer rebates to in-store markdowns for this reason. If exceeding the sales goal is considered acceptable (or even favorable), the current program design with end-use customer rebates can stay as it is; however, if LIPA wants to limit or cap sales at closer to the targeted goals, LIPA may want to consider an upstream rebate as implemented for room air conditioners.

- **Free Riders:** Opinion Dynamics estimated a new net-to-gross number for the dehumidifier portion of the program and found it to be considerably lower than the deemed value the program had used in planning. LIPA has already increased the incentive from $10 to $20 for 2011. This could help reduce the free ridership value as the higher incentive could induce more people who would not otherwise purchase an ENERGY STAR model because of the higher price to make the purchase. LIPA may want to estimate net-to-gross in 2011 for both appliances to ensure the program remains cost effective.

Room Air Conditioners

- **Retailer Participation:** Nine retailers participate in the RAC program. Most are independently owned single-store appliance retailers. One is a local chain with 18 separate locations that participate in the program. While this strategy promotes local businesses, it appears that it may conflict with the program's goal of influencing the smaller RAC market. The participating appliance dealers we interviewed said that they face a lot more competition for the smaller units than the larger units because a large number of stores, including drugstores and supermarkets, sell small RACs. LIPA may need to consider expanding the program to additional retailers to reach more of the small RAC market.
- **Program Incentives:** To influence the small RAC market, the RAC program's standard incentive for most retailers includes a greater discount for ENERGY STAR RAC models requiring up to 6,000 BTUs/hr, and a smaller discount for those requiring more than 6,000 BTUs/hr. LIPA allows the local retail chain with the largest number of sales more flexibility in determining the size of program discounts. This retail chain's largest discount is on a few units that are greater than 6,000 BTUs/hr. Since the program met its overall unit sales goals but not the size distribution goals, LIPA may want to consider standardizing rebate levels across all retailers.

Pool Pumps

- **Marketing and Outreach:** LIPA is aware that the pool pump program has struggled to meets its participation goals. LIPA already conducts a fairly large marketing campaign having promoted the program through bill inserts, LIPA E-News, and *Newsday*. LIPA also promotes the program to contractors. Despite these efforts, our residential baseline survey found that most pool owners were unaware that more efficient pool pumps existed. We encourage LIPA to continue its marketing efforts but consider more targeted marketing of pool owners. LIPA may be able to work with its network of installers to identify potential participants.
- LIPA also reports that customers find the program design to be difficult and expensive due to the contractor requirements. Customers appear to focus more on the initial costs than the long-term cost savings. LIPA may need to be explicit in its marketing materials about exactly how much the average pool owner would save in a year with a more efficient pool pump and how long it will take to realize a return on their investment.

Refrigerator Recycling

- **Marketing and Outreach:** LIPA started its Refrigerator Recycling program in 2010. The program got a somewhat late start (in March) and did not meet its participation goals. The program has an even higher goal for 2011, so LIPA will need to work even harder to meet this goal. LIPA did heavily promote the program in 2010 through a bill insert, *Newsday* advertisements, and radio and television ads. The participant survey results combined suggests that the bill insert and *Newsday* ads

were more effective than the radio and television ads. LIPA may want to shift some of its advertising budget away from radio and television to bill inserts and print ads.

2.2.2 Cool Homes

The Cool Homes program seeks to improve the energy efficiency of residential heating, ventilation, and air conditioning (HVAC) systems throughout Long Island. Through the assistance of a LIPA-approved contractor, residential account holders can apply for incentives associated with the installation of higher-efficiency HVAC equipment. In 2010, the program discontinued rebates for the tune-up of central air conditioning equipment, but continued to offer rebates for central air conditioners, furnace fans, and geothermal and air source heat pumps, as well as ductless mini-split systems. Further, the program offers a rebate for the early retirement of central air conditioning systems.

Net Impacts

Table 2-23 shows a categorical breakdown of evaluated savings compared with tracked program savings for air conditioners, heat pumps, ductless systems, and furnace fans rebated by the program.

Table 2-23. Cool Homes Net Impacts Summary

Measure Category	N	Net Ex Ante Impacts		Net Ex Post Impacts		Realization Rate	
		kW	kWh	kW	kWh	kW	kWh
Central A/C	3,216	4,378.3	2,487,395	3,024	1,320,045	69%	53%
Air source heat pump	444	507.8	722,205	347	849,283	68%	118%
Ductless Mini split	811	154.5	542,666	141	173,239	91%	32%
Geothermal heat pump	220	465.8	539,943	254	1,163,025	54%	215%
Furnace fans	411	74.3	188,545	132	191,456	177%	102%
Total	**5,102**	**5,580.7**	**4,480,754**	**3,898**	**3,697,048**	**70%**	**83%**

Line loss factors and program provided net-to-gross factors have been included in both ex ante and ex post savings.

The Cool Homes program updated savings algorithms for a number of categories in 2010. The evaluation team discussed these updated algorithms with the implementation team and used the updated algorithms. See Appendix E for a discussion of the evaluation algorithms.

The deemed savings values in Appendix E were normalized with average installed size and efficiency for each measure. These normalized savings values were multiplied with total installed size in 2010 to ensure an "apples-to-apples" total savings comparison with ex

ante values. Based on the measure-specific evaluations and the total savings outlined in Table 2-23, the evaluation team has a number of general recommendations:

- Central AC and Air Source Heat Pump: For Central AC and Air Source Heat Pump measures, the program's savings algorithms have been updated to include savings based on quality installation practices of installed equipment.

  For the Central AC category, the program currently calculates demand savings using a baseline EER that we believe is too low. We recommend adherence to efficiency standards set forth by ASHRAE 90.1 2004 or later.

- For both Air Source Heat Pump and Geothermal Heat Pump measures, discrepancies in energy realization rates can be attributed to adjustments to the equivalent full-load heating hours (EFLHs). Program documentation did not contain data for heating hours for Air Source Heat Pump measures, although there was information for the geothermal heat pumps. There are a variety of sources that cite residential EFLHs, and for this evaluation, we selected ENERGY STAR EFLHs for New York City for both heating and cooling. These values are higher than what was being used by LIPA for geothermal heat pumps (and we assume air source heat pumps). The geothermal cooling hours in this analysis is 41% higher and geothermal heating hours are 65% higher. We recommend that future evaluation efforts collect primary data on EFLHs.

- No additional information was available for Ductless systems in 2010; the evaluation of these measures is identical to last year's evaluation. The evaluation team agreed with the algorithms and assumptions outlined in program files. However, a mismatch was discovered between tracked savings values and the values determined through program algorithms. The evaluation team recommends a thorough review of the savings calculation and tracking process to ensure consistency among all program files.

In general, though realization rates are low for certain categories, the Cool Homes program has made improvements on document transparency and tracking capabilities. The evaluation team recommends a systemic effort to determine operating conditions such as equivalent full-load cooling and heating hours for Long Island. Studies that incorporate metered data would not only be useful to the Cool Homes program, but all LIPA programs that feature HVAC incentives.

Net-to-Gross Estimation

LIPA used deemed NTG values for planning and evaluation and as part of the 2010 Cool Homes evaluation. The evaluation team began to collect data to update the NTG values for the Cool Homes program. As an initial step, we used a participant self-report method to collect information for estimating NTG. In particular, the participant survey contained a battery of questions designed to measure free ridership and spillover. This approach produced significantly higher free ridership values than are currently used in program planning. However, due to the presence of unique market conditions over the program year, including federal tax incentives, the evaluation team plans to use these data in conjunction with data being collected for the Residential HVAC Market Characterization Study to calculate a new NTG value for the cool homes program.[46]

Given that this research is not yet fully complete, the team used LIPA's deemed values for the 2010 evaluation effort.

Table 2-24. Cool Homes Net-to-Gross Values

Components	Program Deemed	2010 Evaluation
All but fans Free Ridership (FR)	0.02	0.02
Fans Free Ridership (FR)	0.10	0.10
Spillover (SO)	0.00	0.00
All but fans Net-to-Gross (1-FR+SO)	0.98	0.98
Fans Net-to-Gross (1-FR+SO)	0.90	0.90

Process Findings

We based our 2010 process assessment of the Cool Homes program on data from four data collection and analysis efforts, including:

- **Review of program databases and materials**: We reviewed the program-tracking database and program promotional materials.
- **Participant telephone survey**: We conducted a telephone survey with 141 participating Cool Homes customers.
- **In-depth interviews with program staff**: We conducted interviews with two LIPA staff members.
- **Participating contractor telephone survey**: We conducted a telephone survey with 28 participating Cool Homes contractors.

[46] Research efforts include focus groups with participating and non-participating contractors and in-depth interviews with HVAC distributors.

Participant Profile

Program Participants

In 2010, 4,569 LIPA residential customers participated in the Cool Homes program, which encourages customers to purchase and install energy efficient central air conditioning (A/C), heat pumps, and efficient furnace fan motors by providing financial rebates and incentives to offset a portion of the equipment's higher initial cost.[47] The Cool Homes program includes a variety of packaged and split A/C units and heat pumps.

Cool Homes participants tend to be middle-aged or older. In fact, 35% of survey respondents are 65 years of age or older and 34% are between 55 and 64 years of age. In addition, all participants own their homes, and most participants (89%) live in single-family residences. Further, income levels among participants are high. Nearly half of participant households (46%) have an income over $100,000 a year and 22% earn between $75,000 and $99,999 a year.

Program Contractors

According to the program-tracking database, 120 contractors participated in LIPA's Cool Homes program in 2010. The mean number of rebated projects per contractor is 40 and the median is 7. The number of projects per contractor ranges from 1 to 334 projects. Sixteen contractors (13%) performed at least 100 installations receiving rebates in 2010 and 65 (54%) performed less than 10 rebated installations.

Projects completed on Long Island comprise virtually all of participating contractors' 2010 revenue: 74% of participating contractors report that Long Island projects account for all of their revenue. In addition, participating contractors primarily serve residential customers, as 79% claim that 70% or more of their customers are residential.

To participate in the Cool Homes program, contractors must attend an Airflow and System Charging training class offered by the implementation contractor, Conservation Services Group (CSG). This hands-on training presents technicians with proper quality installation techniques. These consist of measuring the system airflow and refrigerant charge and verifying that they are within an acceptable range. While these techniques are also used in tuneups, the program does not specifically focus on tuneups in the training. In addition, CSG sends out regular communications to contractors alerting them to the next scheduled training class for new technicians or those needing retraining. High turnover among technicians is not a problem for the program, as most technicians simply move from one contractor to another, and the skills and training carry over.

Marketing and Outreach

In general, contractors conduct much of the marketing and outreach for the Cool Homes program. When promoting the Cool Homes program, 62% of contractors use a combination of Cool Homes program materials (such as prepaid postcards provided by LIPA) and their own materials. As a result, it is not surprising that contractors are the most important source of information about the Cool Homes program for participating

[47] Based on the combination of unique participant names and addresses in the 2010 tracking database.

customers. In addition to serving as the most common information source, 72% of participants report that their contractor recommended that they participate in the program. These findings mirror contractor reports that nearly all (95%) promote the Cool Homes program to "virtually every customer."

Table 2-25. How Participants Learned about Cool Homes
(Multiple Response)

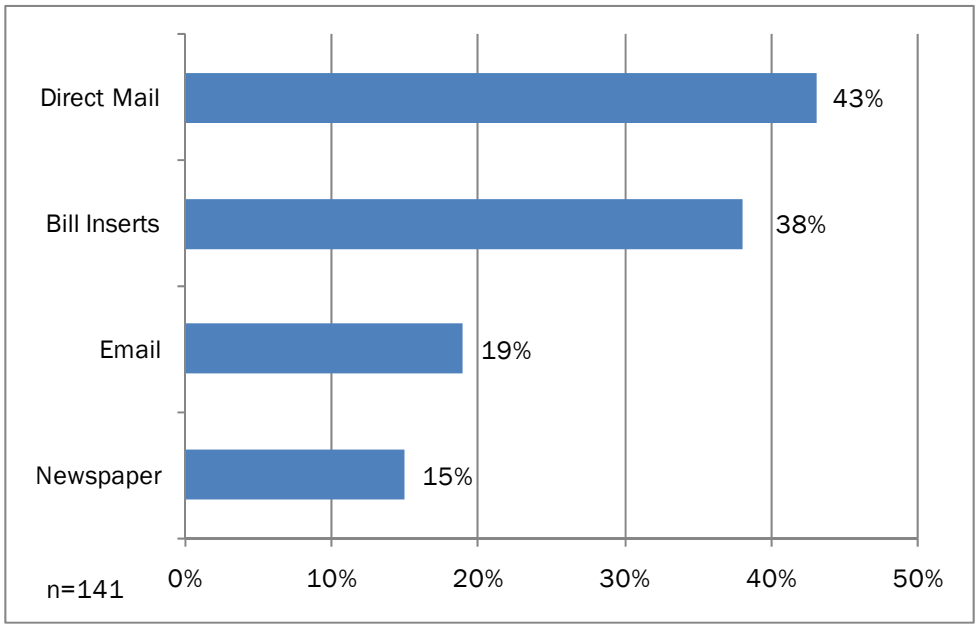
Information Source	Participants (n=141)
Contractor	68%
LIPA website	9%
Word of mouth	6%
Retail store	4%
Bill Insert	3%

*Note: Percentages presented here include participants responding, "don't know."

In addition to supporting contractors, LIPA promotes the program through a number of other methods. These include bill inserts, TV and radio spots, and outreach at relevant shows and events with brochures and information about the program. The Cool Homes program also performs more targeted outreach, such as leveraging the Home Performance program's participant list to send targeted mailings. Finally, LIPA has worked with AEG in a limited number of cases to perform data mining to identify communities or subdivisions with houses that have participated in the program with the assumption that other houses in the subdivision have central A/C systems installed at similar times. While effective, these targeted marketing initiatives are very focused and only reach a small number of potential participants.

Beyond the Cool Homes program, the majority of participants report that direct mail (43%) and bill inserts (38%) are the best ways to reach them about future energy efficiency program offerings offered by LIPA (Figure 2-15). Participants also mentioned email (19%) and the newspaper (15%) as somewhat preferable ways to inform customers about energy efficiency programs.

Figure 2-15. Best Ways to Reach Customers about Other LIPA-Sponsored Energy Efficiency Programs
(Multiple Response)



*Note: Percentages presented are non-valid, which means that don't know and refused responses are included in this analysis.

Program Processes

Application Process

According to the Program Manager, the contractor typically fills out most of the rebate application and then brings it to the customer to add their account information and signature before submission. The application is then sent to LIPA and National Grid enters the data into a website designed by the program implementer, CSG, using Air-Conditioning, Heating, and Refrigeration Institute (AHRI) equipment data.[48] Assuming the application and related documents (such as Manual J calculations and sales receipt) are complete and correct, and the application is not selected for QA inspection (described below), the application is approved and the payment is processed for the participant and the contractor. In rare cases, LIPA or CSG will work with the participant directly to complete the rebate application, and the contractor will not receive an incentive.

The participation process is slightly different for early retirement (ER) projects. In those cases, the contractor calls the CSG Customer Contact Center and provides information about the old unit that is being replaced and the new, planned equipment. If the ER unit is deemed eligible and is not selected for a field verification visit, the Contact Center issues a reservation number. If the unit is selected for and passes the field verification, the contractor is issued a reservation number. Once the reservation number is issued, the contractor and customer may proceed in removing the old equipment and installing the

[48] AHRI is an independent group that certifies HVAC equipment that meets manufacturers' performance claims to enable fair comparison of different equipment.

new equipment. Applications without an ER reservation number are treated as Replacement applications.

Participation Process

Participating customers indicate that it was easy to learn about and participate in the Cool Homes program. Nearly all participants (93%) report that contractors clearly explained the process for participating in the program, which illustrates the effectiveness of program contractors who play a role in explaining the program to 91% of participants. Further, most participants (66%) report that it is easy to access information about how to participate in the Cool Homes program (a rating of 6-7 on a scale from 1 to 7 where 1 is "very difficult" and 7 is "very easy").

In contrast, contractors are less satisfied with the participation process, specifically the application process. Half of all participating contractors rate the ease of the application process as a 5 or less on a 0 to 10 scale, where 0 is very difficult and 10 is very easy. Those giving very low ratings (less than 4) cite too much paperwork and lengthy process as their reasoning.

In terms of customer engagement with contractors, those who have a pleasant experience working with contractors on previous home improvements are more likely to hire those contractors for future work. Because contractors play an integral role in marketing and outreach for the Cool Homes program, maintaining the customer-contractor relationship is vital. Thirty-one percent of respondents used a contractor for the Cool Homes program because they had previously worked with that contractor, and 32% heard about their contractor from a friend or family member.

Measure Verification

Program staff may select applications for a QA visit based on suspect information or according to the normal QA selection protocol. Based on this protocol, the program implementer performs post-inspection to verify installed equipment on the first five rebated projects for each contractor. If these five projects are verified without problems, then the program randomly inspects 10% of future applications from that contractor.

In addition to the standard QA protocol, customers applying for the ER incentive are also subject to similar pre-inspection to verify that the existing equipment is still operational. The program pre-inspects the first five ER applications and then reduces the inspection rate to 10% of applications.

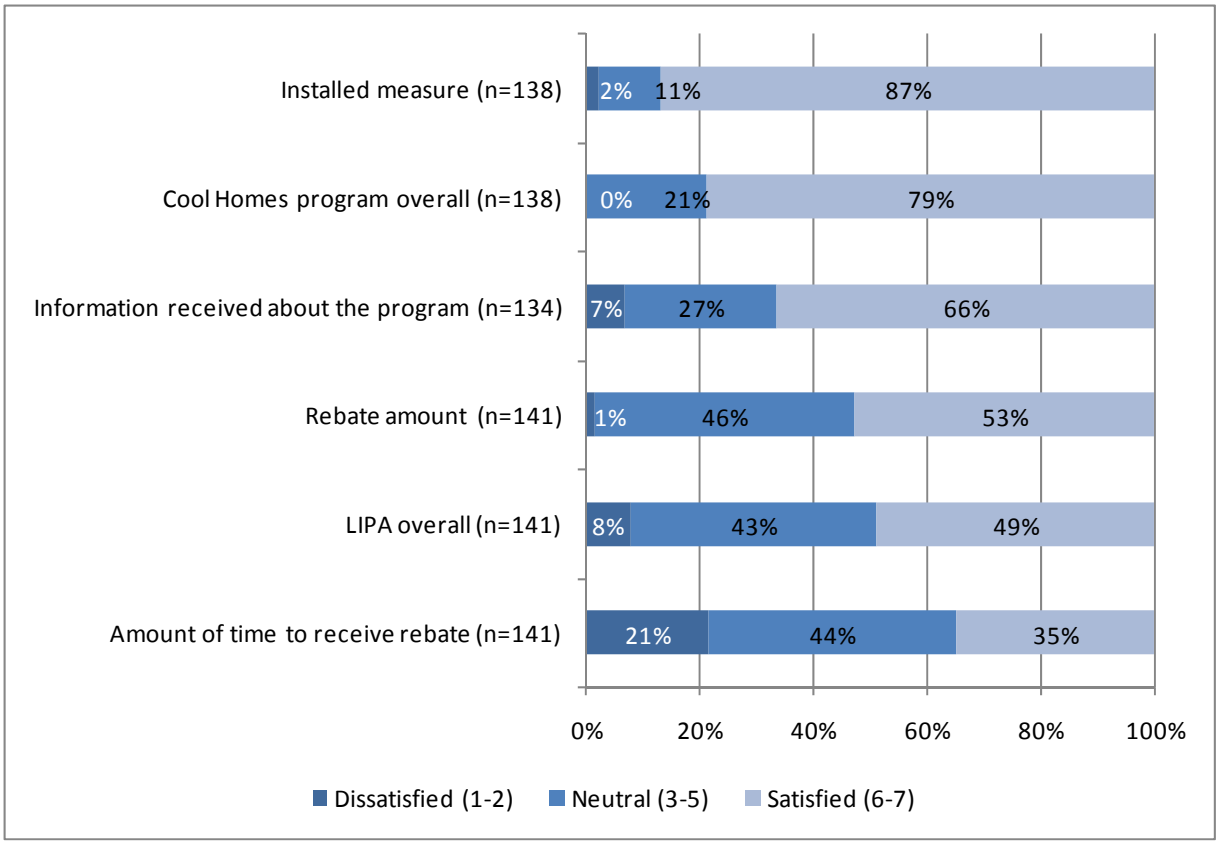
Program staff believes the inspection and verification process works well and the program has experienced no instances of fraud. With that said, the current tracking database has a number of verification fields, but it is unclear how well these fields are updated. For example, the database only lists 131 records with inspection dates, and only one application that was flagged as requiring an inspection had an inspection result. Additionally, there is no clear field in the database to identify applications that have received post-inspection or to tally the inspections by contractor, making it difficult to evaluate if the program is meeting its QA quotas.

Program Satisfaction

Participant Satisfaction

In general, satisfaction with the Cool Homes program is high—79% of participants are satisfied with the Cool Homes program overall (a rating of 6 or 7 on a scale from 1 to 7, where 1 is "extremely dissatisfied" and 7 is extremely satisfied"). Large shares of participants also report satisfaction with the installed measures and the information received about the program. They provide the least favorable ratings for the amount of time required to receive the rebate.

Figure 2-16. Participant Satisfaction with Elements of the Cool Homes Program



*Note: Based on a scale from 1 to 7 where 1 is "extremely dissatisfied" and 7 is extremely satisfied".

In addition, most participants are very satisfied with their contractor. Ninety-two percent of participants are satisfied with the ease of scheduling their appointments (a rating of 6-7 on a scale from 1 to 7, where 1 is "very difficult" and 7 is "very easy")—providing a mean satisfaction rating of 6.4. Participants are also satisfied with the overall quality of work performed by their contractor for the Cool Homes program (91%) and the professionalism of the contractor (93%). Overall, 91% of participants will recommend their contractor to others, suggesting the program has a strong and valuable network of contractors.

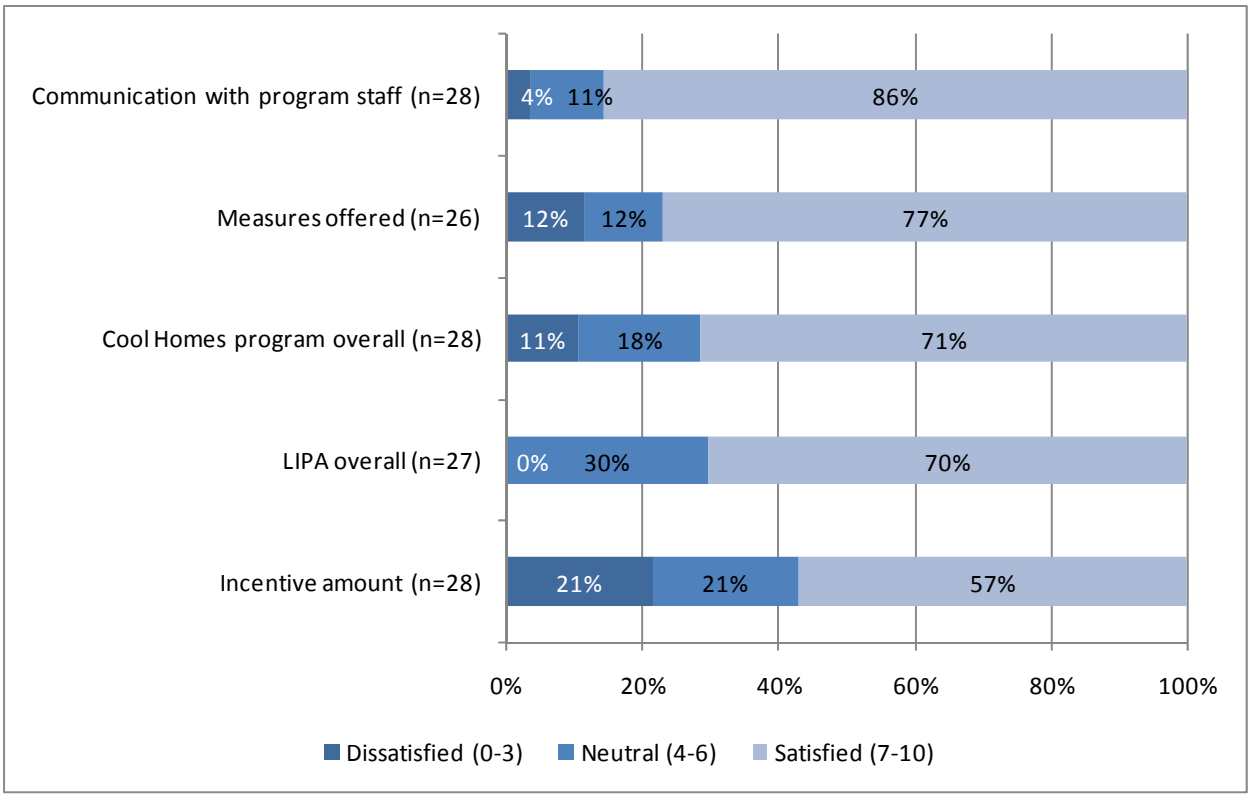
Participant Suggestions for Improvement

When asked what could be done to improve the Cool Homes program, 27% of participants said that no changes were needed. Among the suggestions, the most common ideas include increasing the rebate amount (18%), increasing program marketing (13%), shortening rebate-processing time (13%), and offering more education to customers about LIPA-sponsored energy efficiency programs and how to save energy in their homes (5%).

Contractor Satisfaction

Participating contractors are generally satisfied with the Cool Homes program, as 71% give a satisfaction rating of 7 to 10 on a scale of 0 to 10, with 0 meaning "very dissatisfied" and 10 meaning "very satisfied." Satisfaction appears highest with communication with program staff. Only 57% of contractors report satisfaction with the incentive amount, which is typical of contractor-focused programs.

Figure 2-17. Contractor Satisfaction with the Cool Homes Program Elements



*Note: Based on a scale from 0 to 10, where 0 is "extremely dissatisfied" and 10 is extremely satisfied."

Although still satisfied, contractors rate their satisfaction with the incentive amounts offered by the program lower than other elements of the program. When asked to explain their low ratings, contractors state that the rebates are either too small or are small in comparison to programs in other markets.

Sixty-eight percent of contractors report that since joining the program, it has met their expectations. Of the nine contractors for whom the program did not meet expectations, the primary reasons are the length of time to process rebates (identified by four contractors) and the amount of paperwork involved (identified by two).

Barriers to Participation

The nature of heating and cooling investment decisions make the market served by the Cool Homes program particularly challenging to serve. For example, most customers do not think of their air-conditioning systems until they fail or have problems, making the early retirement of systems especially difficult. As a result, although LIPA regularly promotes the program, customers may not even think about participating until it applies to them due to equipment failure.

On the contractor side, potential barriers to participation include the various program requirements, such as purchasing Manual J software and recommended diagnostic tools, securing Early Retirement reservation numbers, and attending training. However, contractors report minimal problems meeting these requirements, but do have difficulty completing a minimum of 20 applications in the program year to qualify for reimbursement for the cost of their diagnostic tools. Almost half of participating contractors (48%) identified this issue, which is likely attributable to the small size of some of the participating firms.

In-depth interviews indicate that some contractors also view the application as burdensome. In particular, some contractors report that, in order to bypass the application, they will discount the equipment/installation to match the price of participating contractors to avoid having to go through the program. We will assess the prevalence of this practice based on findings from contractor focus groups conducted as part of the HVAC Market Characterization Study.

Additional Energy Saving Actions

Since participating in the program, 24% of participants have made additional improvements to their homes, for which they did not receive a rebate[49]. In particular, this group of participants mentioned installing insulation or weather stripping (32%), installing other energy efficient appliances (31%), and installing high efficiency lighting options (16%) (e.g., CFLs or other lighting fixtures).

[49] Note that 24% of participants taking additional actions were influenced by their participation to some degree. The evaluation team did not estimate spillover associated with these participants as we used LIPA's deemed NTG value to estimate net program savings.

In addition, the Cool Homes program is not the first experience many LIPA customers have with their energy efficiency program offerings. For example, 27% of Cool Homes participants report taking part in other LIPA-sponsored energy efficiency programs—among this group, the most common is LIPA's Home Performance with ENERGY STAR program (10% of all participants). This finding suggests that the Home Performance program is a valuable venue for educating customers about additional energy efficiency program opportunities.

Data Tracking

The program-tracking database is generally effective in collecting the data needed for tracking and evaluation. It contains the appropriate project, customer, contractor, and equipment information, including the fields on the application materials. All sheets are linked by unique Application IDs. Overall, while there were some missing fields throughout the database, they generally appear to be random and do not significantly affect the implementation or evaluation of the program.

One exception is customer contact information and the lack of customer phone numbers. Of the 4,569 unique customers in the database, only 2,280 had phone numbers listed and only 105 had phone numbers with area codes. This presented a significant problem when fielding the survey of participating customers. While it is our understanding that the new Siebel tracking system will capture this information, we recommend that CSG collect and enter this information into their tracking system consistently so that they can reach participants in a timely manner if needed.

In addition, while it does not pose a significant issue at this time, many contractors are listed in the database with different contractor identification numbers. For example, Pelto Inc. is listed as CY0000000471, CY0000000923, and CY0000001328. As a result, in some cases, it is difficult to discern unique companies, which inhibits the ability of program staff to track the number of projects completed by each contractor as needed to follow the QA protocol.

The evaluation team also identified inaccuracies in the tracked deemed savings values for some measures. Specifically, we determined that for some measures included in the program-tracking database, the reported ex ante savings value did not equal the savings value calculated using the deemed savings algorithm for the measure. We identified no specific pattern in this discrepancy as we identified reported ex ante savings values that were both higher and lower than the savings values we derived using the measure's savings algorithm. These discrepancies are limited to a subset of program measures and more often affect the tracked savings demand savings values. The table below shows the specific measures for which we identified this discrepancy.

Table 2-26. Cool Homes Measures with Inconsistency in Ex Ante Value and Expected Value

Measure	kW	kWh
ECMs on Furnace Fans	X	
Ductless Mini Split System		X
Geothermal Heat Pump	X	

Conclusions and Recommendations

The Cool Homes program exceeded its 2010 energy savings goal, but did not meet the 2010 demand goal. The program relies heavily on contractors as the primary method of outreach and has done well in its recruitment efforts. In addition, participants are extremely satisfied with the program and the contractors.

Our key recommendations related to the program processes are:

- **Marketing and outreach:** While LIPA seems to be effectively reaching certain customer segments within the market, early retirement candidates have a low awareness of the program. Program staff should continue to target this segment through bill inserts, leveraging data from other programs and additional data mining with AEG.
- **Data tracking**: LIPA and CSG should prioritize the entry of customer contact information, particularly telephone numbers, into the program database. As part of this process, program staff should work with contractors to stress the importance of submitting completed applications and the program should not accept those without all required fields populated. In addition, LIPA should continue its efforts to add telephone numbers (where available) into their monthly tracking file, which is output from their customer tracking system.
- **Rebate processing**: Participants are less satisfied with the amount of time it takes to receive their rebate compared to other components of the program. This is likely due to limited rebate processing resources and the resulting backlog of applications that occurred at the end of the 2009 program year. LIPA should consider implementing application deadlines (such as 60 days from installation of the equipment) to better space out the incoming applications and manage rebate processing. If feasible, additional resources in the rebate-processing department would help to address this issue.
- **Measure verification**: The design of the program's measure verification process is adequate for this type of program. However, LIPA should consider updating the program-tracking database to include more information about pre- and post-inspections by flagging those applications that received an inspection. In addition, LIPA could consider developing a system that tallies the number of jobs inspected for each contractor, allowing more transparency into whether the QA guidelines and quotas are being met.

2.2.3 HPD and HPwES

The Home Performance with ENERGY STAR® (HPwES) and Home Performance Direct (HPD) programs work in concert to provide homeowners with free and low-cost measures, and information to encourage greater energy savings. Together, the programs consist of a full-home audit, home energy rating score, and possible incentives for new, efficient equipment. The HPD program conducts free, full-home audits with a LIPA-certified home energy rater for (1) electric heat homes and (2) non-electric heat homes with central air conditioning and high electricity usage. The HPD program provides free air and duct sealing measures and compact fluorescent light bulbs.[50] Home Performance with ENERGY STAR encourages installation of weatherization, insulation, and other building shell measures through incentives for residential account holders. Incentives vary based on the heating type, with higher incentives for electric heat homes than homes with oil or propane systems with central air conditioning.[51]

Throughout this report we refer to HPD Only participants as those who participated in HPD alone, while Follow-Up HPwES participants are those who participated in both HPD and HPwES. Free Market HPwES participants only participated in HPwES.

Net Impacts

The Home Performance (HP) programs did not meet demand or energy targets in 2010. This is due in part to lower than expected energy and demand savings among participants, as well as lower than expected free-market HPwES jobs, which produce a higher amount of savings than HPD follow-on projects. Inputs to the final 2010 savings figures, including the engineering review, NTG adjustments, and billing analysis, are discussed in detail below.

Engineering Review

The evaluation team conducted an engineering review of the savings algorithms and deemed savings values for each program measure. For two measure categories—air sealing and HVAC—no information was available on algorithm inputs. For hot water measures, the engineering review determined that the savings values were significantly underestimating both energy and demand savings.[52] For CFLs, we determined that the planning estimates had calculated the demand savings by dividing the energy savings by the assumed hours of use, those inherently assuming a coincidence factor of 1.0. We applied the 0.11 coincidence factor (as discussed in the EEP evaluation section), significantly reducing the ex post demand savings. All recommendations for adjusting the engineering algorithms for the HPD and HPwES programs are presented in the Technical Resource Manual (TRM) (see Appendix F).

[50] The type and extent of HPD measure installation depends on which measures will have the greatest savings impact, as determined by household attributes and program software. Air and duct sealing work is limited by the amount of time contractors can spend installing measures during their HPD visit.

[51] Homes with non-electric heat and without central air conditioning do not qualify for either program.

[52] Hot water measures account for 1% of evaluated program energy and demand savings.

NTG Adjustments

As part of the 2010 Home Performance evaluation, the evaluation team also collected data to update the NTG factors applied to gross savings associated with CFLs and air sealing measures installed through the HPD program, as well as for the HPwES program overall.

As discussed in the methodology section, we used a participant self-report method to estimate free ridership and spillover among participants in the two programs. The HPD and HPwES participant surveys contained a battery of questions designed to measure free ridership and spillover. The new estimates from the surveys are presented in Table 2-27 along with the LIPA deemed values used to develop the ex ante savings estimates.

Table 2-27. Home Performance Net-to-Gross Values

Program	Components	Free Ridership		Spillover		Net-to-Gross (1-(FR+SO))	
		Program Deemed	2010 Evaluation	Program Deemed	2010 Evaluation	Program Deemed	2010 Evaluation
HPD	Air Sealing	0	0.09	0	0.07	1	0.98
	Hot Water	0	0	0	0.07	1	1.07
	HVAC	0	0	0	0.07	1	1.07
	Lighting	0	0.54	0	0.07	1	0.53
HPwES	Overall Program	0	0.26	0	0.004	1	0.74

The net-to-gross factors derived from participant survey data are lower than the program deemed values. Among HPD participants, a large percentage indicated they would have purchased some CFLs on their own, which contributed to the overall high free ridership rate for this measure and the reduction in the evaluated NTG factor for the program. In addition, we found some evidence of spillover resulting from the both programs.

As described in Section 2, Detailed Methods, we also examined spillover using responses to the participant telephone survey and found that there were seven HPwES and seven HPD decision-makers that took action and attributed it to the Home Performance program. Within both program components, the respondents performed HVAC tuneups; installed insulation, new windows, or weather stripping; and purchased energy efficient appliances among other actions. These findings demonstrate that there is the potential for HPD and HPwES participants to take similar action outside of the program. However, only spillover associated with the HPD program existed in large enough quantities to influence the NTG ratio.

Table 2-28 provides a categorical breakdown of evaluated savings, based on the engineering estimates and NTG adjustments, compared with tracked savings for the combined HP programs by measure.

Table 2-28. Home Performance Net Impacts Summary Based on Engineering Review and NTG Adjustments

Measure Category	N	Net Ex Ante Impacts		Net Ex Post Impacts		Realization Rate	
		kW	kWh	kW	kWh	kW	kWh
Insulation	1,129,488	105.7	1,455,350	78.2	1,076,959	74%	74%
Lighting	33,885	1312.4	1,279.195	67.3	596,132	5%	47%
HVAC	79,113	343.9	921,390	296.5	806,533	86%	88%
Air Sealing	5,453	30.7	533,495	24.3	426,598	79%	80%
Hot Water	395	13.8	27,666	21.0	45,376	152%	164%
Door/Window	22	0.1	176	0	130	74%	74%
Spillover Measures		NA	NA	27.7	169,840	NA	NA
Total Engineering	**1,248,357**	**1,806.5**	**4,217,271**	**514.9**	**3,121,569**	**29%**	**74%**

Billing Analysis

We also conducted a billing analysis to determine program savings. We evaluated a number of possible models, including statistically adjusted engineering estimates (SAE model), as well as fully specified conditional demand analysis (CDA) models (utilizing individual "dummy" variables to indicate the presence of a measure installation).

Because of the nature of the program, with most measures being installed by most participants, the variables indicating measure installation were highly correlated (i.e., multicollinearity), leading to instability in the coefficient estimates. We decided instead to use a model that includes variables for weather, as well as a variable indicating the pre- or post-measure installation period. The final model, run for both all HP participants combined, as well as separately for HPD, HPwES, and HPwES only, is:

$$y_{it} = \alpha_i + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_{3it} X_{3it}, + \varepsilon_{it}$$

where:

y_{it}	=	Average energy consumption per day for home *i* during month *t (ADC)*
α_i	=	Constant term for home *i*
β_1	=	Coefficient for heating degree days (base 65)
β_2	=	Coefficient for cooling degree days
β_3	=	Coefficient for program participation
X_1	=	Heating degree days (base 65) for home *i* during month *t*
X_2	=	Cooling degree days* for home *i* during month *t*
X_3	=	Participation variable** for home *i* during month *t*
ε	=	Error term

*Cooling degree days are based on the temperature humidity index (THI), base 65 as follows:

CDD (based on THI) = Mean Hourly THI for the day, base 65 THI;
THI = (.55 x Temp) + (.2 x Dew Point) + 17.5
CDD = max (THI - 65, 0)

** X_3 (the participation variable) took the value of 1 during the period after which a home participated —after their last installation date. It was 0 during the pre-participation months of 2009 participants, and for 2010 participants prior to their first installation date The records for billing periods between installation months were dropped during the analysis

Note that the billing analysis, being based on actual customer usage and including 2010 participants as a comparison group, incorporates the effects of both free ridership and spillover. For example, the 2009 energy use for the 2010 participant homes would reflect measures installed that program participants would have installed in the absence of the program, and any additional measures participants installed would be picked up by an increased coefficient for the participation variable.

The final energy realization rate for energy for all HP participants combined was approximately 63%, somewhat below the engineering and NTG estimates. Because the final model did not differentiate realization rates by measure, and the billing data do not contain demand values, the realization rate for the demand savings is calibrated based on the engineering estimates (i.e., the proportion of the demand/energy realization rates is extrapolated for the billing analysis based on the engineering analysis).

Because the billing analysis is based on actual customer usage, and thus are more robust than engineering estimates, we elected to base the final savings estimates for the program on this analysis. The ex post realization rate for the combined Home Performance programs, therefore, is 24% for kW and 63% for kWh. The standard error for the kWh estimate of 63% was 5.5%, with a 90% confidence interval of 54% to 72%, and a relative precision of 0.14.

Variation in kWh savings by participant types may be of interest to program planners since there were very substantial differences. The program model was evaluated separately for HPD-only, HPD plus HPwES, and HPwES-only (Free Market) participants. The differences across these groups were striking. The highest savings were found in the HPD plus HPwES group, at an annual 2,186 kWh in savings, which constituted a 19.5% reduction compared to the pre-participation period. The smallest savings came from the Free Market group at 178 kWh annually, representing only a 1.6% drop in consumption. In between these groups were the HPD-only participants, who saved an average of 640 kWh annually, indicating a 5.7% decrease in electricity consumption.

Process Findings

We based our 2010 process assessment of the Home Performance program on data from four data collection and analysis efforts, including:

- **Review of program databases and materials**: We reviewed the program-tracking database and program promotional materials.
- **Participant telephone survey**: We conducted a telephone survey with 176 participating Home Performance customers: 70 in the HPD program and 106 in the HPwES program.
- **In-depth interviews with program staff**: We conducted interviews with the LIPA program manager and program implementer, CSG.
- **Participating contractor in-depth interviews**: We conducted interviews with nine participating Home Performance contractors providing services through both the HPD and HPwES programs.

Participant Profile

Program Participants

We found notable differences between the participant groups included in this evaluation effort. While HPD Only and Follow-Up HPwES participants share similar household and housing characteristics, Free Market HPwES participants are notably different on household and housing dimensions that have implications for program design and delivery, particularly marketing.

As illustrated in Table 2-29, HPD Only and Follow-UP HPwES participants are markedly older than Free Market HPwES participants, with only 11% of HPD Only and 13% of Follow-Up HPwES under age 50, compared with 53% of Free Market HPwES. In addition, Free Market HPwES participants have about one more person per household than HPD Only and Follow-Up groups, and are more likely to have children at home. They are also more likely to live in single-family homes than HPD participants are, and their homes were generally built earlier.

Table 2-29. Participant Demographic and Household Characteristics

Characteristics	HPD Only (n=70)	HPwES	
		Follow-Up HPwES (n=70)	Free Market HPwES (n=36)
Age			
Less than 50	11%	13%	53%
50-69 years old	41%	38%	32%
70 years or older	48%	49%	15%
Household Size			
Average number of residents	2.0	1.8	3.2
Homes with children <18	27%	16%	56%
Household Income			
Less than 100K	69%	66%	22%
100K - 200K	14%	23%	44%
200K or more	16%	11%	33%
Housing Type			
Single-Family	36%	28%	97%
Apt/Condo/Townhouse (2+ units)	59%	70%	3%
Year Home Built			
Before 1970	11%	10%	72%
Between 1970-1988	77%	84%	14%
Between 1989-2001	12%	6%	3%
2002 or later	0%	0%	11%

The differences in age, household composition, and housing among these groups likely reflect a high number of senior housing communities in the HPD program. The HPD program targets electric heat homes, and many eligible homes happen to be located in senior housing communities (e.g., condominium communities or planned developments). HPD contractors also target senior housing communities for direct outreach, due to the concentration of eligible homes in these communities given their heating fuel. Contractors who are not enrolled in HPD—defined here as HPwES firms—target customers without electric heat (but with central air conditioning), as otherwise the customer would be eligible for HPD and unlikely to pay the HPwES contractor for an audit. We will discuss implications of these differences in later sections of the report.

Program Contractors

Firms that conduct both HPD and HPwES work—defined here as "HPD firms"—are more reliant on LIPA residential programs for their business than those who only participate in the HPwES program. For these HPD firms, HPD and HPwES projects now comprise about 30-35% of their work (but up to 75% for some contractors). All of the HPD firms have been involved in the LIPA Home Performance programs since the programs' inception. Firms that conduct only HPwES work—defined here as "HPwES firms"—are less reliant on LIPA's program, with LIPA HPwES work comprising 5-30% of their business. They have also been involved in the program for a shorter period.

All the firms we spoke with are involved in other utility and municipal home energy efficiency programs on Long Island, such as National Grid's gas home sealing and insulation programs, the state Green Jobs-Green NY (GJ-GNY) free home audit program, and municipal programs in the towns of Babylon and Brookhaven. HPwES contractors get a larger proportion of their work from other utility and municipal programs than from LIPA. Some HPwES contractors expect to see an uptick in the number of HPwES jobs due to their ability to offer free or reduced-cost audits to non-electric heat customers through GJ-GNY.

The following summary table illustrates how the contractor experience differs for HPD and HPwES contractors. While program processes, quality assurance and quality control (QA/QC) procedures, and program communication is similar, there are differences in what type of customers each group targets, whether contractors receive referrals from LIPA/CSG (Conservation Services Group), how much customers pay for audits, and what activities are conducted during a home assessment. These differences are related to contractors' ability to perform audits for HPD-eligible customers, which are primarily electric heat homes. Since electric heat customers are eligible for the HPD program, which offers free audits and direct install measures, and only contractors enrolled in HPD can provide these audits, HPwES contractors generally target non-electric heat customers with high usage and CAC, and provide fee-based audits. As part of these audits, contractors recommend (and perform) HPwES follow-up measures. Differences between contractors and targeted customer groups provide context for process findings.

Table 2-30. Similarities and Differences in 2010 Home Performance Contractor Experience

	Criteria	HPD Firms (Enrolled in HPD and HPwES)	HPwES Firms (Enrolled in HPwES only)
Similarities	Contractor Certification Requirement	Building Performance Institute (BPI)	Building Performance Institute (BPI)
	Conduct independent marketing to find customers	Yes	Yes
	Educational materials for customers	Verbal education Company materials LIPA materials	Verbal education Company materials LIPA materials
	Energy modeling software	Real Home Analyzer (Homecheck replaced Real Home Analyzer; underlying assumptions similar)	Real Home Analyzer
	Follow-Up measure pricing	Contractor estimate including rebates, incentives	Contractor estimate including rebates, incentives
	Program implementation support	Call or email CSG directly	Call or email CSG directly
	QA/QC procedures	Aim for 15% of jobs	Aim for 15% of jobs

	Criteria	HPD Firms (Enrolled in HPD and HPwES)	HPwES Firms (Enrolled in HPwES only)
Differences	Number of approved contractors (2010)	6	33
	Relationship with LIPA	Contractual arrangement; paid directly by LIPA for HPD jobs	Open enrollment into LIPA program; not paid by LIPA for home audits
	Primary customer target	Electric heat and/or high usage with central air conditioning (eligible for HPD)	Non-electric heat with central air conditioning (ineligible for HPD)
	Receive referrals from LIPA	Yes[53]	No
	Audit procedures	Building Performance Institute (BPI) standards; Additional HPD procedures	Building Performance Institute (BPI) standards
	Audit direct install	Yes	No
	Audit pricing	Free to customer; LIPA pays set fee to contractor	Customer pays, unless free through non-LIPA program such as Green Jobs-Green New York[54]
	Training	Initial 4-week training for crew of 2 from CSG—processes, installation, sales	BPI certification, Brief training on Home Analyzer software

Program Outreach

Marketing and Outreach Activities

HPD and HPwES use different marketing strategies. For HPD, LIPA's current marketing and outreach consists of program materials, outbound calls to qualified customers, and outreach efforts from its implementation contractor, Conservation Services Group (CSG). CSG staff conducts outreach to towns and housing communities with electric heat, where they may give presentations (sometimes in conjunction with contractors), leave door hangers, or distribute flyers.

In contrast, CSG does not conduct any marketing for HPwES. One reason why marketing is less essential for HPwES is that HPD is expected to serve as a "feeder" program for

[53] The HPD contractors we spoke with reported receiving up to 75% of their HPD jobs from LIPA referrals.

[54] Income-eligible LIPA customers are eligible for free or reduced-cost home energy audits through NYSERDA's Green Jobs-Green New York program, which could be performed by a BPI-certified contractor (i.e., HPwES free market contractor).

HPwES. This model is working well as the majority of 2010 HPwES projects (83%) came from the HPD program, and nearly half (49%) of HPD participants select to continue to HPwES.[55] However, as discussed in the impact section of this report, program staff would like to see at least 20% of HPwES jobs come from free-market customers. As a result, additional marketing for HPwES may be warranted.

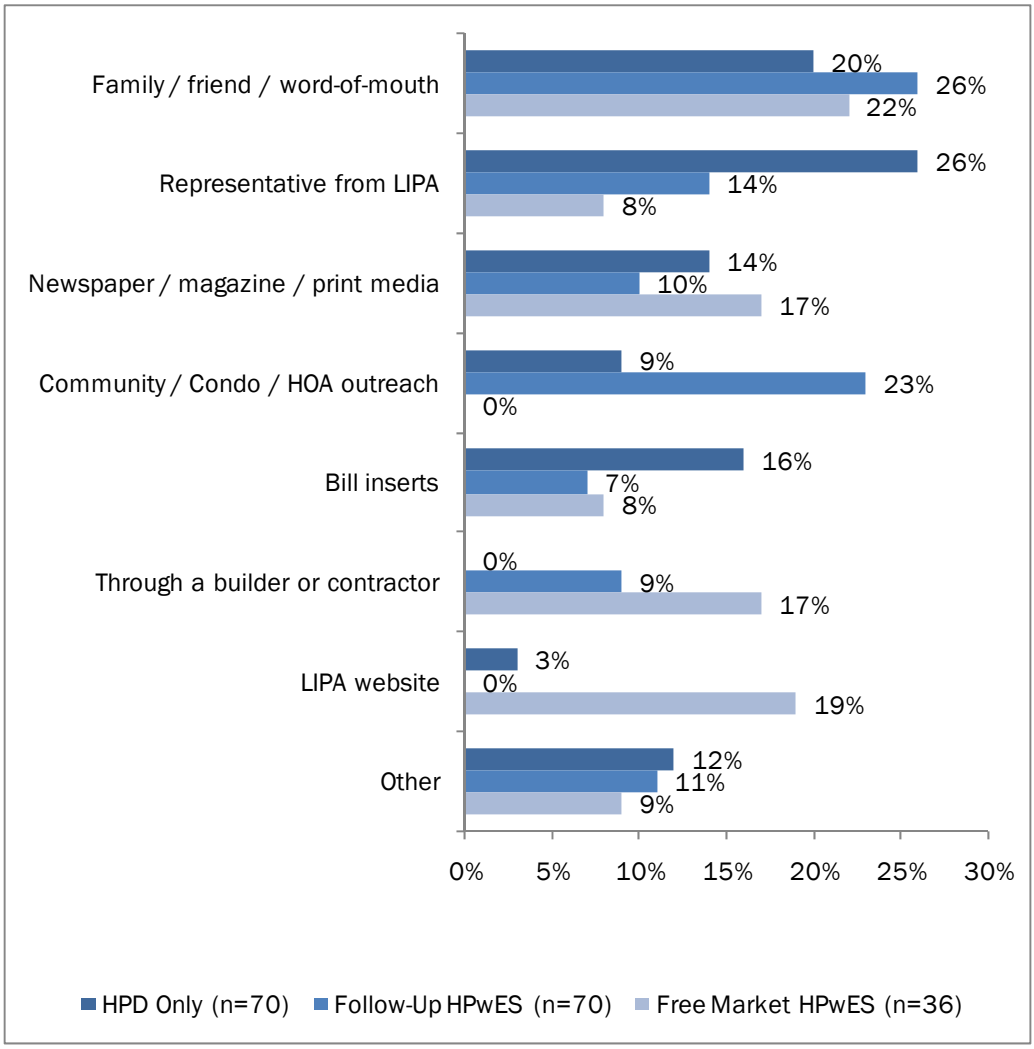
For both programs, contractors also play a major role in promoting program offerings, conducting their own advertising and marketing their home energy services. Contractor advertising and marketing activities include TV, newspaper/print, and Internet ads, direct mail, pamphlets, and door hangers, as well as community presentations. In addition to general advertising, most contractor firms conduct targeted outreach, such as promoting the program among prior customers, distributing their marketing materials to program participants to give to friends, and distributing materials or giving presentations in communities with a large proportion of housing that would qualify for the program.

Recall and Influence of Marketing Materials

As shown in Figure 2-18, LIPA representatives are the leading channel through which HPD Only participants learned about HPD, while word-of-mouth referrals are the leading channel through which HPwES participants learned about the program. Outreach or presentations at condominium communities, housing developments, or homeowners associations are also influential, with 9% of HPD Only and 23% of Follow-Up HPwES participants learning about the program through housing community outreach efforts (as noted above, contractor outreach to housing communities is likely related to known concentration of electric heat homes in these communities).

[55] Conversion to HPwES from the 2010 HPD program based on the number of completed HPwES Follow-Up jobs as of the 12/31/2010 conversion rate for 2010 HPD program participants will likely increase as more HPwES jobs are completed in early 2011.

Figure 2-18. How Participants Learned of HPD or HPwES Program (Multiple Response)



Participants consider direct mail—separate from their bills—to be the best way for LIPA to inform them about energy efficiency programs (43% of all respondents), followed by bill inserts (33%) and email (20%).

The differences in demographics and household characteristics between Free Market HPwES and HPD-eligible customers (illustrated in Figure 2-19), as well as differences in communication preferences suggest an opportunity to customize marketing tactics and messages, and follow-up measure encouragement tactics for each group. For example, over half of Free Market HPwES participants (54%) think direct mail is the best way to contact them about energy efficiency, significantly more than Follow-Up HPD (30%). No HPwES Free Market customers would like to be informed about energy efficiency programs by phone, compared with 16% of HPD Only customers and 9% of Follow-Up HPwES.

While there are no significant differences in preference to be informed about programs via email or online, Free Market HPwES customers may be more receptive to information communicated through the LIPA website, with 20% learning about the program through the website compared with 3% of HPD Only customers and 0% of Follow-Up HPwES.

Program Awareness

While the evaluation team did not conduct research with non-participants, interviews with participating Home Performance contractors suggest that program awareness is low. Nearly all Home Performance contractors we spoke with believe that program awareness is low even among eligible customers, with many learning about HPD or HPwES only after contact with their contractor. In addition, contractors do not think the general public understands the benefits and value of energy audits and comprehensive home assessments. Here, LIPA may be able to play a larger role in raising awareness and creating name recognition for the program through general advertising or increasing the quantity and intensity of targeted outreach.

Contractors also indicated that customers may have some initial misperceptions about the program stemming from the fact that they may not understand why LIPA is helping them, and therefore may distrust contractors. Some contractors expressed concern that their role in conducting marketing and outreach, performing the home assessment, and selling follow-up work may appear to be a conflict of interest to customers. Here, LIPA may also be able to play a larger role in explaining the program.

Once customers are aware of the program (i.e., customers who are on the website or call customer service), LIPA could also provide more robust messaging to explain the program's goals and offerings. Such messaging could help separate contractor sales pitches from program-sponsored installation work, which may engender greater trust among customers. Any information that LIPA could provide explaining this process could help deepen trust in program recommendations.

Participation Process

Nearly all HPD and HPwES participants (96% and 98%, respectively) feel that the process for participating in the program was clearly explained. In addition, most consider it extremely or very easy to access information about how to participate in the programs (73% HPD Only and 76% HPwES).[56] However, based on contractor interviews, there may be some confusion regarding the process, as some HPD contractors mentioned having to explain the process to customers at each visit (despite LIPA's "what to expect" letter).

In terms of program enrollment, nearly three-quarters of HPD Only participants signed up for the program by phone, either by calling the LIPA 800 number (62%) or receiving a phone call from someone in the program (10%). Given that the signup and scheduling process can involve additional communication with CSG, HPD contractors feel that the

[56] A rating of 6 or 7 on a scale from 1 to 7, where 1 is "extremely difficult" and 7 is "extremely easy."

lead tracking and referral system could be improved or streamlined to ensure that leads do not lose interest between the multiple scheduling calls they may receive.[57]

Measure Verification

In general, the Home Performance programs have sufficient quality assurance (QA) procedures to ensure high quality projects. Program staff reviews project documentation to ensure that the measures installed are eligible (based on the program guidelines) and that the project is complete. In addition, implementation staff conducts a field inspection for at least 15% of the jobs completed by each contractor, although the inspection rate is higher for new contractors entering the program and contractors who fail an inspection.[58] The inspection is not an instrumented survey, but a physical observation survey to verify that the proper measures were installed.

It is unclear how the program staff selects which projects to inspect. However, contractors can request that specific projects receive an inspection. In order to enhance this process, LIPA and CSG should document the field inspection process so that it is clear to internal audiences whether projects are randomly selected for the visits or some criteria is used to determine which projects receive a field inspection.

Follow-Up Measure Adoption

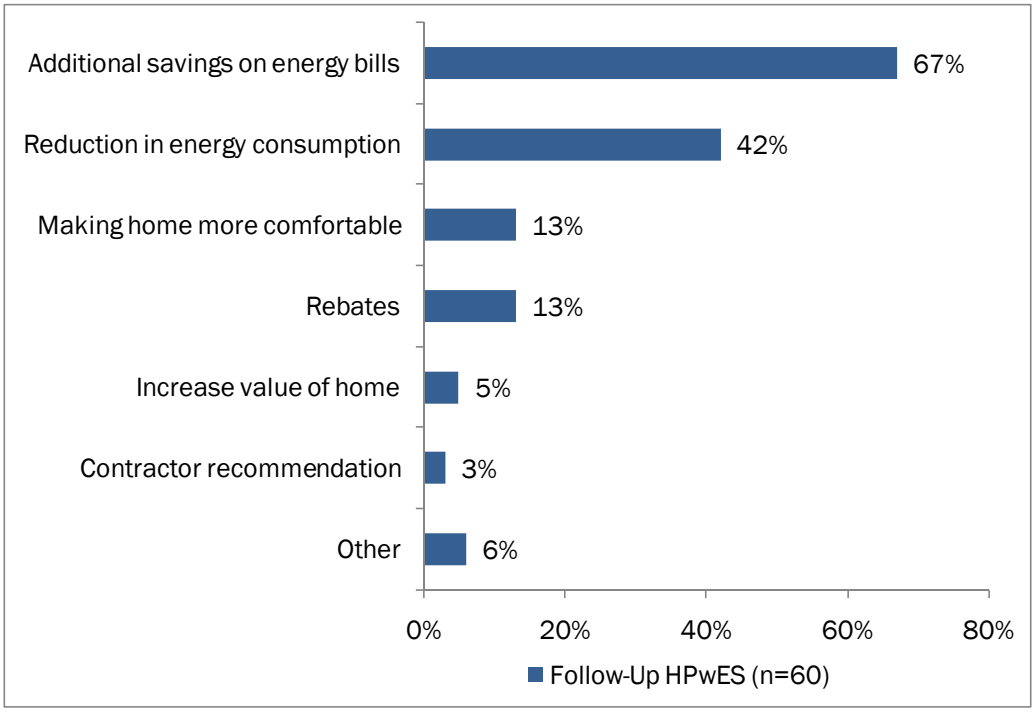
Motivation to Continue from HPD to HPwES

HPD participants who go on to participate in HPwES are motivated primarily by additional savings on their energy bills (67%) followed by a desire to reduce energy consumption (42%) (see Figure 2-19). Only 13% of HPD participants who go on to participate in HPwES mentioned making their home more comfortable as a motivating factor, whereas contractors consider improved comfort to be the main reason customers take follow-up actions. This gap between customer levers and contractor perceptions points to an opportunity for contractors to not lose focus of the customer cost and energy savings in their messaging.

[57] To determine whether streamlining the referral system is a priority, we recommend further analysis of the lead-tracking database to determine how many leads and which leads fall out of the process after an initial inquiry.

[58] Though the program requires that 15% of jobs be inspected, the implementation contractor estimates that over 20% of jobs are usually inspected.

Figure 2-19. Motivation to Continue from HPD to HPwES

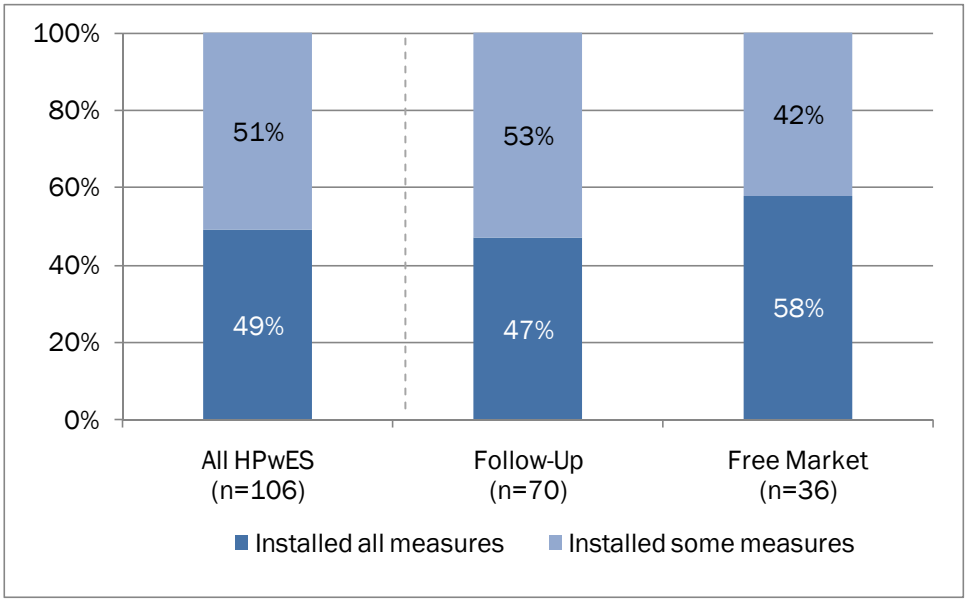


Opportunities to Improve Follow-Up Measure Adoption

Among HPwES participants, nearly half (49%) installed all the recommended measures (Figure 2-20). The proportion of participants reporting to have installed all the recommended measures was slightly higher among Free Market participants (58%) than Follow-Up HPwES participants (47%), though this difference is not statistically significant.[59]

[59] Customer interest in follow-up measures (which some contractors felt may be higher for Free Market participants compared with HPD) and significant differences in demographic and housing characteristics may also explain differences in uptake of follow-up work.

Figure 2-20. Degree of HPwES Recommended Measure Installation



The most significant barrier to installing all recommended measures is cost: 39% of HPD participants and 36% of Free Market participants said the cost of the recommended measures was too high. Information availability and comprehension may also affect a customer's decision to complete additional work. Nearly one-third (31%) of HPD Only participants did not recall receiving information about rebates and incentives available through LIPA to install additional measures. Similarly, lack of awareness or receipt of recommendations was the leading reason why HPD Only participants did not install recommended measures after their home assessment—32% of HPD Only participants who did not install anything after their home assessment did not recall receiving recommendations.

Since the program is designed to provide all HPD customers with a list of rebates and incentives, this limited recall of applicable incentives indicates a potential communication gap, and opportunity to improve communication. LIPA may want to investigate how these materials are presented to customers compared with other contractor materials. Improving the recommendations and sales process may be an opportunity to improve follow-up measure conversion through communication and program materials.

It is also evident that some participants have gone on to take other energy saving actions. . For example, some HPD Only participants have made additional improvements without using a LIPA rebate (16%), including insulation, new windows, weather stripping, appliances, CFLs, or tuneup of their central air-conditioning—many of which are rebate-eligible. Similarly, HPwES participants (20%) have taken additional actions without using a utility incentive or rebate—including installation of new windows or doors, energy efficiency appliances, heating equipment, and even insulation or weather stripping.

However, to classify these actions as spillover, a participant's home improvements, for example, must be influenced by the program in which they participated. For the Home Performance programs, seven individuals in each program attributed their decision to take

these additional actions to their participation in the Home Performance program. These findings are reflected in our impact analysis for this program.

In general, among HPwES participants, the leading reason why customers did not apply for LIPA rebates for qualifying measures was that they did not know the measures qualified. This indicates an opportunity to improve program measure uptake through communication.

Customer Satisfaction

Participant Satisfaction

In general, satisfaction with the program is high. More than three quarters of participants are generally satisfied with the program, with 78% of HPD and 79% of HPwES either extremely or highly satisfied. Table 2-31 shows that mean satisfaction ratings were generally high for program elements shared by HPD and HPwES.

Table 2-31. Participant Mean Satisfaction Ratings for Program Elements

How would you rate your satisfaction with...?	Mean Score*		
	HPD Only	HPwES Follow-Up	HPwES Free Market
Professionalism of Energy Advisor	6.4	6.4	6.4
Quality of work performed	6.3	6.3	6.1
Recommendation for additional measures	6.1	6.2	5.9
Program overall	6.1	6.2	6.0
LIPA overall	5.7	5.4	5.6

*Note: Scale is from 1 to 7, where 1 is "extremely dissatisfied" and 7 is "extremely satisfied."

Participants were most satisfied with the time it takes between signing up for and completing a home assessment (85% very or extremely satisfied), and the length of time the assessment lasts (83% very or extremely satisfied). Only 23% of HPwES participants expressed dissatisfaction over any program components—the leading dissatisfiers were speed of rebate processing (18% dissatisfied) and information on the rebate process (8%).[60] Only 11% of HPD Only participants expressed any dissatisfaction, and there were few patterns in their dissatisfaction (recommendations, quality of work, and information regarding the home assessment each dissatisfied 3% of respondents).

Participant Suggestions for Improvement

Over half of HPD Only participants (55%) and HPwES participants (62%) offered suggestions for improving the program. Leading suggestions for improvements among HPwES participants include bigger or higher rebates (15%), improving contractor quality (12%), better communication and follow-up from contractors and LIPA (12%), and increasing program awareness (9%). Leading suggestions for improvements among HPD Only participants include increasing program awareness (12%), explaining the assessment

[60] Dissatisfaction defined as a rating of 1 or 2 on a scale from 1 to 7, where 1 is "extremely difficult" and 7 is "extremely easy."

and direct install process (9%), explaining rebates and payment options (9%), and including other measures (7%).

Contractor Satisfaction

Overall, contractors offer somewhat mixed reviews of the HPD and HPwES program processes. The majority is highly satisfied with the program design and communication processes, including the QA/QC process. However, some contractors expressed frustration with the referral system, administrative components, and rebate processing time. In particular, contractors view QA/QC as essential to the program and appreciate having these processes in place as a way to validate their work and give legitimacy to the program—which can improve customer satisfaction, trust, and conversion to follow-up work.

While there is general agreement that the HPD referral process works, some contractors are concerned with the time lag between when a customer requests a change in the schedule through CSG and when CSG notifies the contractor of the change. In addition, despite frequent connectivity problems, contractors are generally satisfied with the software used by the program and the technical support from CSG, though some would like a refresher course to review changes in software functionality.

One perception mentioned frequently is that the administrative burden of the program is high, particularly the reporting requirements, customer paperwork, and approvals process. HPwES firms were relatively less satisfied with administrative requirements, given the overlap between program requirements of the multiple utility and municipal programs that each of their customers is likely eligible for. The need for greater integration across programs on Long Island is also clear from comments about the lack of integration between the Real Home Analyzer software for LIPA Home Performance programs, NYSERDA, and National Grid programs. This was a near-universal issue among contractors, who view this as duplicative paperwork and data entry into a similar software platform.

Data Tracking

The Home Performance tracking data pulls from both the Home Performance Direct and Home Performance with Energy Star components. While the program data appears to be functioning well for the program manager, our evaluation needs are somewhat different.

For example, to enable the evaluation team to survey participants, telephone numbers are needed. This is not a field that the program manager would typically require. In addition, phone surveys are better accepted if we can ask for a specific person. Customer names are present as a variable in the current dataset, but not always filled in. Another example is for our impact analysis which this year uses the program specific values in conjunction with billing data to assess savings in the home. The program tracking data keeps close track of site IDs, but has no need to include account numbers, so this variable was not present. We believe the account number associated with each site ID would be a valuable variable to add to the tracking dataset.

We recommend adding in two variables to the program-tracking database (a) telephone number of the participant and (b) billing account number of the participant. These variables would help future evaluation activities. We note that in Siebel, this data may already be included for each participant.

Conclusions and Recommendations

Overall, the Home Performance programs are functioning well—conversion to follow-up measures is high compared with the goals of the program, customer satisfaction is high, and customers find it easy to participate. Contractors are also satisfied with the program, the training they receive related to HPD, and the QA/QC process. Contractors look forward to getting more business through HPD and HPwES in the future, and participants wish more customers knew about the program.

Still, the program should work to increase program participation, uptake of follow-up measures (extent of measure uptake as well as conversion), participant satisfaction, and contractor satisfaction by addressing the challenges discussed above. Our key recommendations for program processes relate to marketing, customer communications, program integration, and the contractor experience.

Our key recommendations related to the program processes are as follows:

- Marketing: Marketing recommendations center on increasing program participation by improving name recognition and trust in the program. Both contractors and customers believe program awareness is low. In light of consistent contractor feedback, LIPA may want to reassess its approach to program advertising to include more general or mass advertising, even if this exposes customers who are ineligible for the programs (based on heating fuel, presence of CAC, and electricity usage) to program messages.

  We also recommend that LIPA consider expanding advertising to general or mass channels to increase HPD and HPwES program awareness. The benefit of increased awareness and reputation may outweigh the risk of dissatisfaction of customers being ineligible for the program, and targeted messaging would likely reduce these risks. General advertising should address, in part, why LIPA is offering free services and incentives for electric heat and high-use Central Air Conditioning (CAC) customers so that they understand the purpose of the program and have trust in the program offerings. In addition, program staff should consider whether this general advertising could help to explain the relationship between the LIPA programs and free audits offered through Green Jobs–Green New York.

  LIPA could tailor advertising to the distinct groups of HPD-eligible customers (more likely to be older and live in multi-family housing or condominium developments; more receptive to phone calls) and Free Market HPwES customers (more likely to be younger, have children, and live in single-family homes; more receptive to direct mail and Internet-based messaging).

- **Customer communication:** While customer communication related to program participation is strong, there are opportunities to improve follow-up measure uptake —conversion and depth or extent of uptake—through enhanced communication efforts. Our recommendations focus on ensuring that people understand the information they receive—particularly what rebates and incentives are available—and using customer communication to improve satisfaction levels.

  The conversion rate between HPD and HPwES is currently high. Still, program conversion could be improved. Given the partial recall of contractor recommendations and applicable rebates or incentives (by about one-quarter and one-third of HPD Only participants, respectively), modifying the recommendations and sales process at the end of the comprehensive home assessment could be considered as a way to improve conversion to follow-up measures.

  Some customers may need supplemental communication from an official source (LIPA) to trust contractor recommendations and take action. LIPA could consider sending a follow-up communication (such as an automated email or postcard) to confirm what contractors did during their visit, reinforce contractor recommendations, and reinforce information about applicable rebates and incentives. While the additional administrative work required for such a communication piece may not be feasible in the short term, in the long term, this program element could increase program engagement and build trust in program recommendations.

- **Program administration**: Improving satisfaction with rebate processing time—a leading dissatisfier of participants—might be possible with enhanced communication to customers about approval and rebate processing time. We recommend that LIPA set rebate processing expectations early in the participation process, possibly explaining how BPI standards and third-party verification affect timing. Status updates on rebate processing or a rebate confirmation (e.g., postcard) might also improve customer satisfaction during the processing period.

- **Long Island program integration:** Given the presence of other energy efficiency programs on Long Island for which LIPA customers may be eligible, and increased marketing of these programs (by NYSERDA, municipalities, contractors, etc.), confusion among customers as well as contractors may become a larger issue.[61] Assessing benefits and opportunities for integration could help address this potential confusion, and possibly increase measure uptake if contractors are able to assess and present LIPA's program offerings clearly.

  LIPA could start by evaluating the opportunity to improve integration and coordination with other energy efficiency programs available to LIPA customers. For example, program qualification materials that address differences between programs, eligibility, opportunities to leverage multiple programs, and implications

[61] LIPA programs, NYSERDA audit program (GJ-GHY), and National Grid gas programs—all of which an HPwES customer may be eligible for—have separate reporting requirements and require separate data entry into Real Home Analyzer software.

for the approval process could help contractors make better, timelier recommendations. Customer-facing program materials that address other information customers may hear in the media could also help improve customer understanding of LIPA programs.

Beyond communications integration, the HPwES program could streamline multi-program data entry for contractors by coordinating software tools and requirements. Software integration might improve follow-up measure adoption by reducing the time contractors spend generating comprehensive recommendations and communicating pricing information to customers. LIPA may want to consider integrating HomeAnalyzer software to allow for one-time data entry for a house that qualifies for multiple programs—i.e., if home assessment data are entered for a NYSERDA free home audit, allow this data to be pulled into LIPA program software to see HPwES recommendations and eligibility.

- **Further research:** Through contractor interviews and participant surveys, we identified a few potential issues that we recommend LIPA investigate further before changing any of its program processes:

- To determine what impact other Long Island programs such as Green Jobs-Green New York may be having on Home Performance program participation and uptake of follow-up measures, LIPA may want to begin tracking whether each customer participated in any non-LIPA energy efficiency programs, before or after HPD or HPwES participation.

  LIPA may also want to investigate two lower-priority communication issues: First, whether using alternative channels to communicate "What to Expect" may lead to more prepared HPD customers, and second, whether providing additional educational materials for HPD customers that explain building science behind contractor recommendations could improve measure uptake (currently, some contractors provide their own educational materials).

2.2.4 Residential Energy Affordability Partnership (REAP)

The objective of the Residential Energy Affordability Partnership (REAP) is to assist low-income households with energy efficiency improvements. In particular, the program focuses on account holders having difficulty making payments. The logic behind this program is that a reduction in utility bills through energy efficiency would lower LIPA's financial risk with collection and bad debt while improving residential energy efficiency on Long Island. Specific income requirements must be met before households are eligible for the REAP program.

Net Impacts

The evaluation team used two methodologies to estimate ex post savings for the REAP program, including engineering review and billing analysis. Due to challenges in fitting an appropriate model for estimating ex post savings, the final savings values were determined through the engineering review. We discuss each approach in detail below.

Engineering Review

We conducted an engineering review of the savings algorithms and deemed savings values for each program measure. We were able to collect all ex ante deemed savings values, along with documentation of the methodology employed to calculate savings. We omitted insulation measures, programmable thermostats, and low flow shower heads from the analysis as the program did not fund any of these measures during the program year.

Table 2-32 provides a review of measure specific net impacts for REAP. Given that REAP is a direct installation equity program serving low-income customers, the evaluation team assumed that this customer segment will not invest in energy efficiency without incentives as they have limited financial resources and many other competing needs. As a result, a NTGR of 1.0 is used. In general, evaluated program savings totals were lower than ex ante claimed savings for both kW and kWh. However, the engineering review produced substantially higher savings for Hot Water and lighting measures as compared to the ex ante equivalents.

Table 2-32. REAP Measure Specific Net Impacts

Measure Category	N	Net Ex Ante Impacts		Net Ex Post Impacts		Realization Rate	
		kW	kWh	kW	kWh	kW	kWh
Lighting	33,734	150.6	2,497,185	227.7	2,503,301	151%	100%
Refrigerator	1,215	259.3	1,918,120	121.1	1,378,119	47%	72%
HVAC	253	41.2	35,748	41.2	35,748	100%	100%
Hot Water	282	1.5	16,305	2.3	22,557	159%	138%
Total	**35,484**	**452.6**	**4,467,359**	**392.3**	**3,939,746**	**87%**	**88%**

The following are measure-specific explanations for the differences in ex ante and ex post savings estimates:

- **Lighting**: For lighting measures, the evaluation team determined that an incorrect coincidence factor was used to estimate ex ante demand savings. The correction to the coincidence factor accounts for the difference between ex ante and ex post demand savings. In terms of energy savings, we concluded that the algorithm and values used are reasonable and we recommend no changes.
- **Refrigerators**: For Refrigerator measures, the evaluation team noticed inconsistencies between the deemed savings as determined by program algorithms and the tracked savings for installations occurring in 2010. Though recommended values align closely with deemed savings values (within 8%) as indicated in Appendix G, savings tracked by the program were significantly higher than deemed

savings on average. The evaluation team recommends a review of the tracked savings calculation to ensure consistency between the deemed savings calculation and tracked savings.

- HVAC: Air sealing and HVAC duct sealing measures account for the HVAC energy and demand savings associated with the REAP program. Savings are associated with reduced energy use for space cooling and heating resulting from improving the tightness of the building shell and duct systems of participating homes. We concluded that the algorithms and values used to estimate ex ante demand and energy savings are consistent with industry standards and we recommend no revisions. Given the deemed savings algorithms, however, it is not possible to fully evaluate savings-specific details of each project which are not included in the program-tracking data. Air and duct sealing measures are quantified by the number of hours billed by a contractor in the program-tracking data and values vary widely among line items. Given that the savings algorithm is deemed appropriate, we have not de-rated the ex ante savings values. We recommend a thorough review of the manner in which these calculations are applied to install quantities in the program-tracking database to estimate ex ante savings.
- Domestic Hot Water: Pipe insulation, tank wrap and temperature reset measures account for the domestic hot water (DHW) savings attributable to the REAP program. The vast majority of ex post demand savings and nearly half of ex post energy savings result from the installation of pipe insulation. The evaluation team found that deemed savings value and algorithm used to estimate ex ante energy and demand savings are not well documented. As such, we used a DOE 3E-Plus software to analyze heat loss from insulated and un-insulated pipes and determine ex post savings per liner foot of pipe insulation. As it was not clear from the 2010 tracking data if all projects involved electric water heating, and because the program partially incentivizes pipe wrap for oil and gas water heaters, we referenced a study that determined the market penetration of electric water heaters nationwide to account for a mix of electric and non electric hot water heaters. While we cannot identify some of the inputs used in the *ex ante* savings algorithm, we suspect discrepancies in ex ante and ex post savings estimates are attributable to the coincidence factor and the blend of electric and non electric hot water heaters. We recommend including the fuel source for DHW in the program tracking data such that savings are only attributed to measures installed in homes with electric hot water heaters.

  Additionally, the program's tracked data for DHW measures was not sufficiently detailed to ensure an apples-to-apples comparison with evaluated savings. For example, though the recommended demand savings for pipe insulation align closely with the program's deemed savings value (within 1%), the average tracked savings for this measure are significantly less than recommended. Currently, tracked savings do not indicate the length of insulation installed per line item. Therefore, the evaluation team is comparing per-foot savings with savings associated with an indeterminate length of insulation. The evaluation team recommends additions to the program's tracking database to capture additional per-install details.

Billing Analysis

The Evaluation Team also pursued a billing analysis to determine ex post savings for the REAP program. First, modeling efforts were limited by the small amount of information available on each participating home, as well as the fact that the measure variables were highly intercorrelated, because most participants installed most of the measures offered through the program. Given these limitations, we specified and estimated models that showed good fit and significant coefficients for participation. Fitting the model well required the inclusion of several interaction terms. In the best fitting model specification, each of the interaction terms also provided good standard errors and was significant. When we evaluated the model using standard diagnostic approaches, and summed the standard error for all of the interaction and main effects terms—taking into account the propagation of errors—the total standard error was large, leading to wide confidence intervals and poor relative precision. As a result, the evaluation team does not recommend the results of the billing analysis with confidence. Therefore, we recommend using the engineering estimates for kWh and kW savings presented in Table 2-32 for this program.

Process Findings

We based our 2010 process assessment of the REAP program on data from three data collection and analysis efforts, including:

- **Participant telephone survey**: Opinion Dynamics conducted a telephone survey with 100 participating REAP customers.
- **In-depth interviews with program staff and REAP implementation contractors**: Opinion Dynamics conducted interviews with one LIPA staff member, as well as five staff members from Honeywell.
- **Review of program databases and materials provided**: Opinion Dynamics reviewed the program-tracking database and program promotional materials.

Program Participation

In 2010, 2,607 LIPA residential customers received free home energy audits and had energy efficiency measures installed through the REAP program. These measures, installed at no cost to the customer, include refrigerators, CFL bulbs, pipe insulation, hot water heater tank wrap, and faucet aerators. Overall, the most common measure received by all participants is lighting, followed by refrigerator replacement.

The program has succeeded in reaching older lower income LIPA customers, who compose a sizable share of the income limited population on Long Island. For example, 41% of survey respondents are 65 years of age or older.[62] While this is consistent with the population of eligible customers in Suffolk and Nassau counties, the program marketing strategy suggests that the program would like to see broader participation, particularly within the multifamily housing segment. In addition, almost three quarters of participants

[62] The American Community Survey, 2005-2009 American Community Survey 5-Year Estimates, reports that between 43% and 46% of low-income residents are 65 years of age or older. We based our determination of "low income" upon LIPA REAP program requirements, which are based on income and household size.

(73%) own their homes, and the majority (64%) lives in single-family residences. Further, as expected, income levels among participants are low. Over half of participant households have an income under $35,000 a year; 37% earn less than $25,000 a year while 23% earn between $25,000 and $34,999 a year.

Marketing and Outreach

The program has used a multifaceted marketing and outreach approach to identify and target low-income customers, which includes bill inserts and letters aimed at specific Long Island communities. In addition, the program conducts targeted outreach among multifamily buildings. This includes delivering presentations and providing information about eligibility, program offerings, and the signup process. These multifamily buildings are identified by LIPA as a result of receiving support from the Department of Housing and Urban Development, and, as such, meet the income eligibility requirements of the program.

LIPA and Honeywell also provide information about REAP to various nonprofit agencies, such as Catholic Charities and the Anti-Hunger Task Force of Long Island, which support low-income populations in the community. Marketing and outreach staff also attempt to generate interest for the REAP program among eligible community members. For example, during 2010, staff spent multiple days canvassing parks and distributing information about how to participate in REAP and what the program entails.

As shown in Table 2-33, most REAP participants learn about the program through word of mouth (35%) and bill inserts (28%). Also evident is the fact that the LIPA website is not a major source of information for REAP participants; in fact, most participants (76%) have not visited LIPA's website at all in the past year. However, among those who use the LIPA website, more than half (59%) think it is extremely easy to find information about the REAP program.

Table 2-33. How Participants Learned about REAP (Multiple Response)

Information Source	Participants (n=100)
Friend/colleague/word of mouth	35%
Bill insert	28%
Newspaper/Printed Ad	8%
Phone Call/Visit to LIPA	8%
Letter from LIPA	6%
LIPA website	4%

Overall, research findings suggest that the marketing and outreach strategies employed by the program match the preferred communication methods mentioned by program participants. According to a majority of participants, bill inserts (49%) and direct mail (48%) are the best ways to reach them about future energy efficiency program offerings through LIPA. Participants also mentioned television (16%), telephone (15%), and email (14%) as somewhat preferable ways to inform customers about energy efficiency programs.

Despite the varied and wide-ranging marketing and outreach campaign, 23% of respondents—when asked how LIPA could improve the program—suggest that LIPA distribute more information about the program as participants do not think many people are aware of it. Participants noted fliers, pamphlets and television commercials as potential ways to get additional information to LIPA customers about the program.

Given the large degree of information sharing via word or mouth, LIPA should also consider providing participants with information about the program at the time of their participation. Participants can then distribute these materials when they speak about their experience in the program. Based on high satisfaction with the program, this strategy would allow the program to leverage ongoing communication within communities.

Program Processes

Participation Process

Participating customers indicate that it was easy to learn about and participate in the program. Most participants (86%) reported that it was easy to access information about how to participate in REAP (a rating of 6-7 on a scale from 1 to 7 where 1 is “very difficult” and 7 is “very easy”) and that the program was clearly explained (91%).

Most participants (80%) call the LIPA 1-800 number to sign up for their free home energy assessment and energy efficiency measures offered through REAP. Although 80% of customers sign up for the REAP program by calling the LIPA 1-800 number, only 34% of participants are familiar with the LIPA information line, indicating that many participants use the LIPA information line but do not know it by that name.

The scheduling of their refrigerator delivery was easy for almost all participating customers (88%) who received new refrigerators in 2010. Homeowners (non-renters) made up nearly three quarters of that 88%. Among those customers who received a refrigerator, most participants (77%) are satisfied with the overall quality of their refrigerator.

Customer Assessment Experience

Contractor communication with customers about energy efficiency is a central aspect of each home energy assessment, and results from both contractor and participant interviews demonstrate the importance of this program component. As described by one technician:

> *"We try to make it so that they're not constantly paying to have everything they own plugged in. You get to realize after going through a number of houses on Long Island that pretty much every single room has a television, VCR, DVD player and probably a radio in it, which are all plugged in, all of which are running. So, a lot of people just need someone to point out to them that they're actually paying to keep all this 'stuff' on. We inform them about how their lighting is affecting the cost of energy in their home and what they can do to reduce it; and about other little habits like turning your heat down when you leave your house."*

Participants also reported that the home assessments help them to learn about energy efficiency, as most customers (82%) learned at least some amount of information about energy efficiency, with 38% noting that they learned a lot about energy efficiency through the REAP program. This finding shows that the home energy assessment is a valuable opportunity to provide education and enhance customer knowledge about ways to save energy in their homes.

Measure Verification

Conservation Services Group (CSG) conducts quality assurance (QA) site visits for the REAP program. As part of this process, CSG performs visual site inspections only and does not collect metering or savings related data. Based on these inspections, CSG provides monthly QA reports to LIPA and Honeywell for their review. However, it is not clear how program staff use the monthly reports, which include documentation of installed measures, contractor—customer interaction, and inspection for potential health and safety hazards, to inform updates to the tracking data or other program changes. For example, if CSG finds that fewer measures were installed in a home than what Honeywell reported, it is unclear whether the program database is updated to reflect the absence of those measures in the household.

It is critical to update the program database as a result of QA visits to accurately account for program savings. In particular, given that there is no persistence factor for the program, tracking data should reflect whether any of the measures installed have been removed. This is most often an issue with CFL bulbs, which customers may remove after participating in the program. Since CSG tracks items removed during their site visits, we recommend that the program begin to update tracking data based on this information if it is not doing so already, or formally document the process for using QA findings in program tracking.

Further, the timing of measure installation through the program also poses a challenge for the QA process. For example, items eligible for installation through the program may be installed during two separate visits, which can occur months apart. As a result, if a QA visit is scheduled before the second batch of measures is installed, the program does not have a mechanism to verify installation. In some instances, CSG has also visited homes where items designated for installation through a follow-up visit have not yet been installed up to six months after the initial visit.

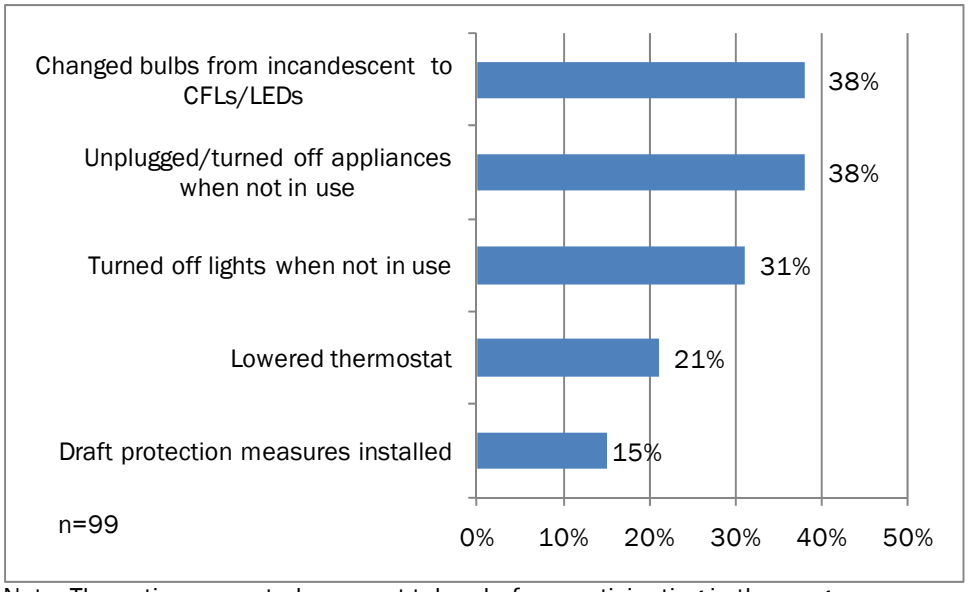
While REAP program staff has done a good job of instituting and carrying out QA procedures to verify measure installation, the evaluation team recommends that LIPA develop a formal process for updating program-tracking data based on findings from these

site visits. In addition, program staff should consider documenting the process by which QA findings are disseminated and discussed so that internal audiences are aware of the protocols in place.

Additional Energy Saving Actions

Customers seem to be responding to the message about additional ways they can save energy, as over half (54%) of the participants said that they (or someone in their household) have taken additional energy saving actions since participating in the program. Overall, the installation of more efficient light bulbs (38%), unplugging and turning off appliances (38%), and turning off lights (31%) are the most common actions reported (Figure 2-21).

Figure 2-21. Energy Saving Actions after REAP Participation (Multiple Response)



Note: The actions reported were not taken before participating in the program.

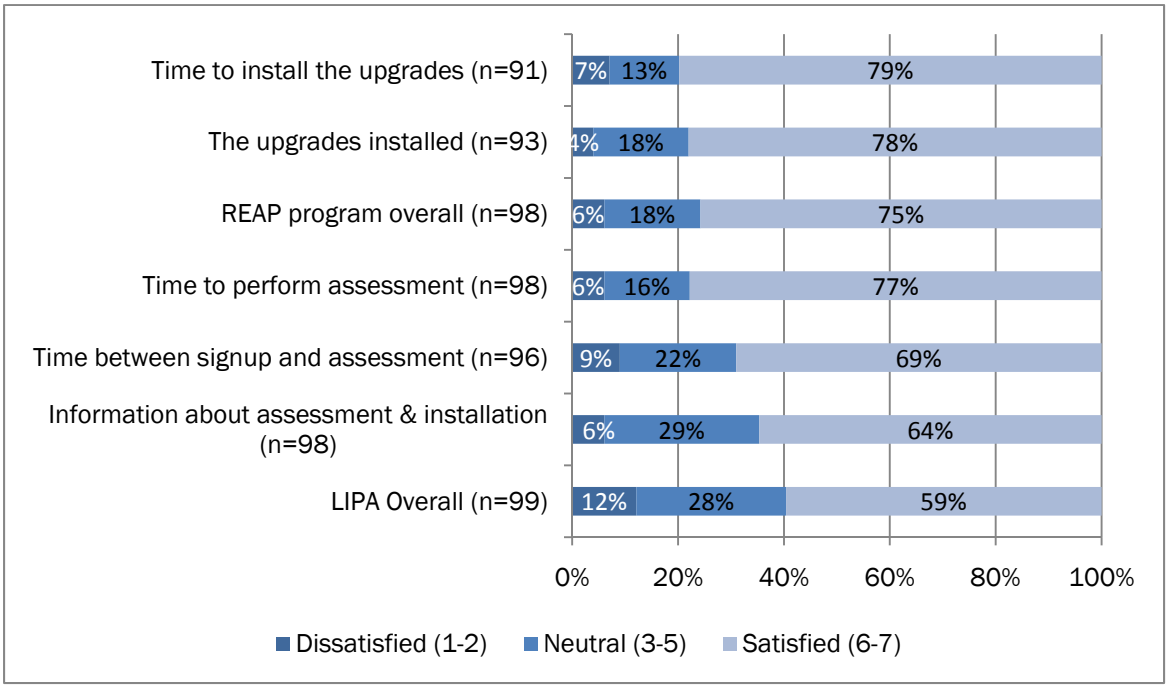
In addition, since participating in REAP, nearly three quarters of participants (73%) have shared information about how to save energy with friends, family, or neighbors.

Customer Satisfaction

Program Administration

In general, satisfaction with the REAP program is high: 75% of participants are satisfied with the REAP program overall. In addition, as shown in Figure 2-22, participants demonstrate high satisfaction with the installed items, process for installation, and assessment. Those who received a refrigerator through the program are significantly more likely to provide a higher satisfaction rating for the program and LIPA overall.

Figure 2-22. Participant Satisfaction with Elements of the REAP Program



Program Benefits

The measures installed through the program have also benefited customers in other ways. For example, almost a third of participants (28%) report that it is easier to maintain a comfortable temperature in their homes as a result of the upgrades installed through REAP, possibly reflecting the air and duct sealing efforts of the program. Only 8% of participants find it harder to maintain a comfortable temperature.

Data Tracking

Overall, the REAP program collects data necessary for successful program tracking and management, as well as to support the evaluation process. Honeywell is responsible for tracking participant and measure level data for the program and provides high-level reports to LIPA on a regular basis. Based on our review of the tracking data, it appears correctly populated and comprehensive in nature. It is also sufficient from a customer contact information standpoint, which is critical to our survey research.

However, we did identify issues related to the use of program data. More specifically, in order to create program-tracking Excel spreadsheets for LIPA and the evaluation team, Honeywell extracts data from their database and organizes it into a number of discrete files capturing data related to the initial site visit, installed items, refrigerators, CLFs, and other installed measures. The problem is that the initial site visit and installed items files cannot be perfectly matched, which means that customer contact information (maintained exclusively in the initial site visit file) is not present for all projects. According to Honeywell staff, every project can be linked to a specific customer within their own system, but this is not always possible in the Excel files.

Going forward, LIPA and Honeywell should work together to develop a new system for generating extracts from the Honeywell database so that an accurate count of total projects, unique participants, and installed measures is maintained. We expect that the implementation of Seibel will address this issue and recommend that LIPA ensure this occurs. These changes will enhance the ability of LIPA staff to monitor program performance.

The evaluation team identified inaccuracies in the tracked deemed savings values for some measures. Specifically we determined that for some measures included in the program tracking database, the reported ex ante savings value did not equal the savings value calculated using the deemed savings algorithm for the measure. We identified no specific pattern in this discrepancy as we identified reported ex ante savings values that were both higher and lower the savings values we derived using the measure's savings algorithm. These discrepancies are limited to a subset of program measures and more often affect the tracked savings demand savings values. The table below shows the specific measures for which we identified this discrepancy.

Table 2-34. Measures with Inconsistency in Ex Ante Value and Expected Value

Measure	kW	kWh
Refrigerator	X	X
DHW Pipe Insulation	X	X
DHW Temperature Turndown	X	
DHW Water Heater Jacket	X	
Air/Duct Sealing	X	X

Conclusions and Recommendations

While the REAP program did not achieve its 2010 savings and demand goals, the program succeeded in reaching 2,607 low-income customers. Given the budget constraints faced by this program, it attempts to enroll as many eligible participants as possible and has done well in its recruitment efforts. In addition, participants are extremely satisfied with the program, and over half (58%) reported installing additional measures or taking additional actions to save energy following program participation.

Our key recommendations related to the program processes are:

- **Marketing and Outreach:** While LIPA seems to be effectively reaching certain customer segments of the low-income market, program and marketing staff should consider targeting additional residential customer segments such as renters and those under the age of 50. Targeting these market segments has the potential to increase savings for the program given that different residence types and energy usage patterns exist among these types of residential customers.

  LIPA should also consider drawing on the high levels of communication between friends and relatives about the program to disseminate information to a broader audience. Providing materials to participants that they can share is one way the program could get additional information into the market and raise awareness of the services LIPA offers.

- **Customer Education**: The program should continue its efforts to educate customers during the audit process about additional steps they can take to save energy in their homes. Based on survey findings that show many participants take these recommended energy saving actions after participating in the REAP program, it is clear that the interaction between contractor and customer provides a valuable opportunity for the program to encourage changes in behavior related to energy use.

  Further, given the additional actions already taken by some REAP participants, as well as the current level of information sharing with friends and family, program staff should consider whether budget is available to create additional educational materials for distribution to participants. These materials would give participants other tips and ideas for how to save energy in their homes and also have the potential to reach a broader audience.

- **Quality Assurance (QA):** QA reporting is a valuable way to learn about program strengths and aspects of the program that are in need of improvement. The program should continue its current QA efforts, but explore formal documentation of existing QA procedures to ensure that measures designated for installation during follow-up visits to participants' homes are indeed installed after the initial visit. While it is not currently part of the program's process, it is also worthwhile to consider exploring how the REAP program could benefit from adding a quality control (QC) component to ensure that data from the monthly QA reports is taken into consideration when creating and implementing changes to future program design.

- **Data Tracking:** To the extent possible, LIPA and Honeywell should work together to develop a database extract that fully captures contact information for all program participants in a single location. Given current file structure, those participants who receive an additional in-home visit may not appear in Honeywell's Initial Site Visit file, which holds all customer contact information. We understand that the implementation of Siebel will address this issue and encourage program staff to work collaboratively to ensure the system supports this capability.

2.2.5 Information and Education Program

LIPA's Education and Information program provides energy saving information to residential customers through printed materials, home energy audits, advertising, and marketing directed to homeowners and students. LIPA promotes the home audit component of the program through information sessions (In Concert with the Environment) to customers, trade shows, and participation in community events. In addition, the program delivers NYSERDA Energy Smart Student Workshops for school aged children.

Net Impacts

Overall, the program exceeded the expected MW and was only slightly under the expected MWh. Table 2-35 shows a categorical breakdown of net evaluated savings (ex post) compared with tracked program savings (ex ante) for the two program components.

Table 2-35. Information & Education Net Impacts Summary

Category	N	Net Ex Ante		Net Ex Post		Realization Rate	
		kW	kWh	kW	kWh	kW	kWh
In Concert with the Environment	4,113	354	969,591	335	608,146	95%	63%
Home Energy Audit	7,685	661	1,811,647	1,151	2,138,189	174%	118%
Total	**11,798**	**1,015**	**2,781,238**	**1,486**	**2,746,335**	**146%**	**99%**

In 2010, the evaluation ream utilized the same analytic approach and data sources as the 2009 analysis. We derived deemed savings values and algorithms from two sources, "An Impact Evaluation of the Long Island Power Authority's Clean Energy Initiative: Information and Education Program," Final Report March 6, 2008 and a white paper entitled "LIPA Residential Information and Education Program," which further qualified the impact findings.

The deemed savings recommended in the above-referenced studies do not explicitly identify whether the savings apply line loss factors. However, program impact estimates almost always reflect savings at the customer meter. Since line losses had not been explicitly included in the estimates, we concluded that they had not been factored into the recommended values and included them in our estimation of ex post net savings. The NTG factor used to calculate both ex ante and ex post is 1.0.

The differences between ex ante and ex post savings estimates by program component are due to differences in the per participant energy and demand savings values used to estimate the two values (Table 2-36).

Table 2-36. Information & Education per-Participant Impacts

Category	Ex Ante		Ex Post	
	kW/ participant	kWh / participant	kW / participant	kWh / participant
In Concert with the Environment	0.078	219.7	0.074	137.8
Home Energy Audit	0.078	219.7	0.136	259.3
Average	0.078	219.7	0.114	216.9

The program applies a deemed savings value of 219.7 kWh/participant and 0.0078 KW/participant to determine ex ante savings. These values reflect an assumed proportion of the Home Energy Audit (HEA) and In Concert with the Environment (ICWE) participants. To determine ex post savings, the evaluation team applied the program component specific savings per participant deemed savings values shown above. Based on this change in deemed savings values, ex post energy savings differed very little from the ex ante estimate (99% realization rate), indicating the ratio of ICWE to HEA participants was consistent with ex ante assumptions. However, ex post demand savings are notably higher than the ex ante estimates, as the program appears to have incorrectly calculated and applied the kW per participant deemed savings value.

Process Findings

The Information and Education program accounts for approximately 4% of demand savings and 2% of energy savings goals associated with the ELI portfolio. As such, per the 2010 evaluation plan, we did not conduct a process assessment of the program.

2.2.6 Residential New Construction

LIPA's Residential New Construction program works with local residential building contractors and the supporting contractor and architect infrastructure to encourage the construction of more energy efficient, ENERGY STAR certified homes. The program draws on an established network of Home Energy Rating System (HERS) providers to work with builders during the design and construction of participating homes. The HERS raters also verifies that ENERGY STAR standards have been met. In addition, the program uses marketing and outreach to educate both homeowners and builders about the program and the benefits of participating.

Net Impacts

Overall, the Residential New Construction program achieved the expected KW and kWh. Table 2-37 shows the net evaluated savings (ex post) compared with tracked program savings (ex ante).

Table 2-37. Residential New Construction Net Impacts

Category	Net Ex Ante		Net Ex Post		Realization Rate	
	kW	kWh	kW	kWh	kW	kWh
New Homes	806.4	1,448,552	806.4	1,448,552	100%	100%
Total	**806.4**	**1,448,552**	**806.4**	**1,448,552**	**100%**	**100%**

The evaluation team examined the savings algorithm and inputs associated with the whole-home energy rating. The parameters of the user-defined reference home (UDRH) align well with REM/Rate software standards and other equivalent incentive programs. Based on our review of program documents, the program uses a "true-up" calculation using REM/Rate software to estimate ex ante savings for participating homes. The evaluation team deems this an appropriate method and finds no major discrepancies in algorithms or assumptions associated with the Residential New Homes program. The program assumes a net-to-gross factor of 1, with no participant free ridership or spillover. Per the evaluation plan, the evaluation team did not conduct research to update the NTG factor for this program, and applied the program planning value to determine ex post net savings. The ex post net savings values are identical to the ex ante net savings values for both demand and energy (realization rate of 100%).

The program's current method of calculating home energy performance is based on an older score rating system from ENERGY STAR with the addition of an updated reference home. We recommend that, when new ENERGY STAR standards are announced, LIPA consider updating its rating system and minimum requirements to be consistent with the new national protocols.

Process Findings

The Residential New Construction program accounts for approximately 1% of demand savings and less than 1% of energy savings goals associated with the ELI portfolio. As such, per the 2010 evaluation plan, we did not conduct a process assessment of the program.

2.3 Renewable Energy Programs

2.3.1 Solar Photovoltaic (PV) Program

The LIPA Solar Photovoltaic (PV) program is an incentive program that offers rebates to approved residential and nonresidential customers to defray a portion of the cost of installing solar PV systems. The program provides financial support that encourages the development of customer-sited electric generation, helping customers gain better control over their electric bills and reduce their carbon footprint as well as offsetting LIPA's energy and capacity requirements.

Net Impacts

Gross impacts are defined as the change in energy (or demand) consumption that results directly from program-related actions taken by program participants, regardless of why they took those actions. Net impacts are the impacts that can be attributed to the program. Net impacts may be lower than total program gross impacts due to energy savings that would have occurred in the absence of the program (free riders). Conversely, net impacts may be higher than total program gross impacts due to energy impacts that occurred because of the program, but the program did not incent them (spillover).

Values in Table 2-38 include line losses of 6.8% on energy consumption, whereby a multiple of 1.073 = (1/(1-0.068) has been applied to the reported numbers. A line loss of 9.2% on peak demand, with a multiple of 1.1013 = (1/(1-0.092) was applied to the reported numbers. We used program net-to-gross factors (1.0).

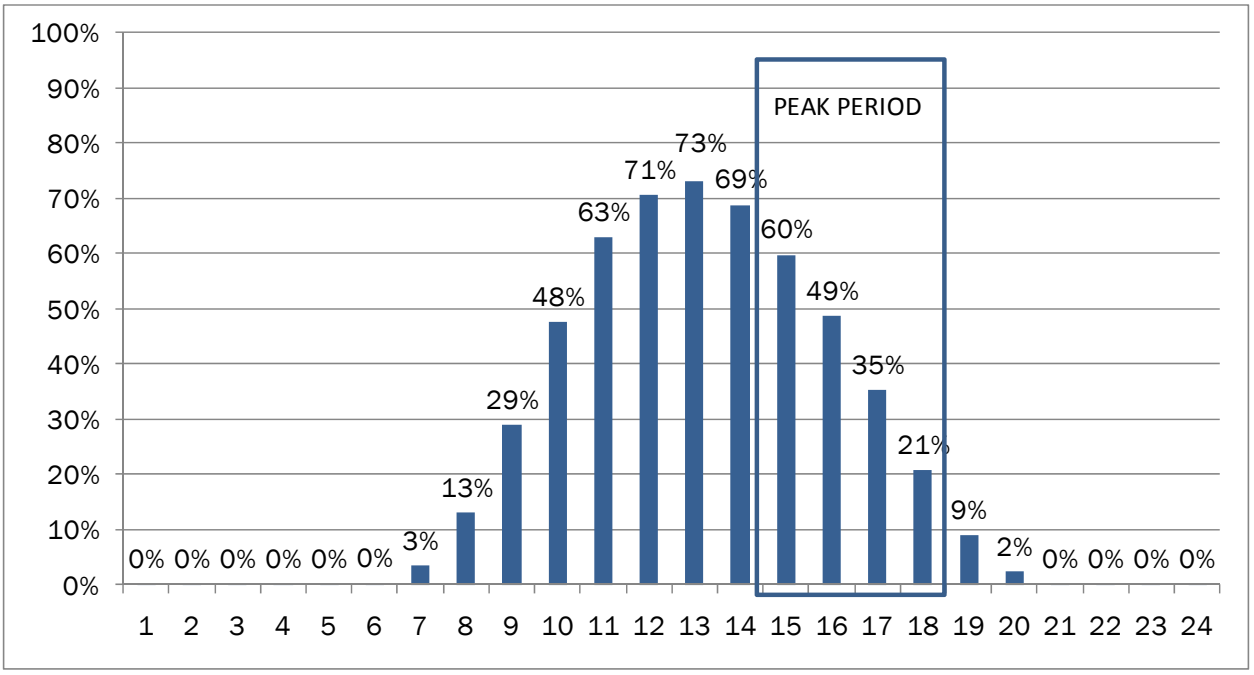
Table 2-38. Solar PV Net Impacts

Category	Net Ex Ante Savings		Net Ex Post Savings		Realization Rate	
	MW	MWh	MW	MWh	MW	MWh
Nonresidential	1.40	3,027	0.97	2,631	69%	87%
Residential	5.18	11,122	3.60	9,666	69%	87%
Total	**6.58**	**14,149**	**4.57**	**12,297**	**69%**	**87%**

We used LIPA's interval metered data as the basis for our demand reduction analysis. We took the highest 15 PV production days from 2010 and averaged the hourly generation during the hours of 2:00 p.m. to 6:00 p.m. during those days. This is consistent with the peaks defined by the NYISO and NYSERDA.

The data shows that the grid's peak is later in the day than the peak output of the PV panels, resulting in a lower than expected coincidence factor. LIPA has been using a coincidence factor of 0.65. Our analysis calculates a coincidence factor of 0.41 using the four-hour peak demand period of the highest 15 production days in 2010. See Figure 2-23 for an illustration of the hourly percent of output. Because the evaluated peak coincidence factor is less than the expected, the demand realization rate was 0.69 (4.57/6.58).

Figure 2-23. Peak Day PV Percent of Installed Capacity



In our 2010 evaluation effort, we looked at the potential for free ridership through participant surveys. Some participants indicated they would have purchased the PV system without the rebate from LIPA. However, there were also federal and state[63] tax credits in place in 2010, and 96% of residential participants received or plan to receive both the federal and state tax credits in addition to the LIPA rebate. An additional 4% of residential participants plan to receive only the federal tax credit.

Additional tax credits such as these are beginning to play a larger part in customer choices, while evaluation measurements of the interplay are catching up on the best approach to fairly assess the attribution. For 2010, we applied the program net-to-gross factors, but we plan to investigate this further in the future.

[63] The New York state tax credit is only available to residential program participants.

Process Findings

We based our 2010 process assessment of the Solar PV program on data from three data collection and analysis efforts, including:

- **In-depth interviews with program staff and participating Solar PV contractors:** Opinion Dynamics conducted interviews with one LIPA staff member, one staff member from National Grid, and two participating contractors in the Solar PV program.
- **Review of program databases and materials provided:** Opinion Dynamics reviewed the program-tracking database and program promotional materials.
- **Participant telephone surveys:** Opinion Dynamics administered a telephone survey to participants of the Solar PV program. The survey yielded completes from 71 participating Solar Pioneer customers and 32 completes from Solar Entrepreneur program participants.

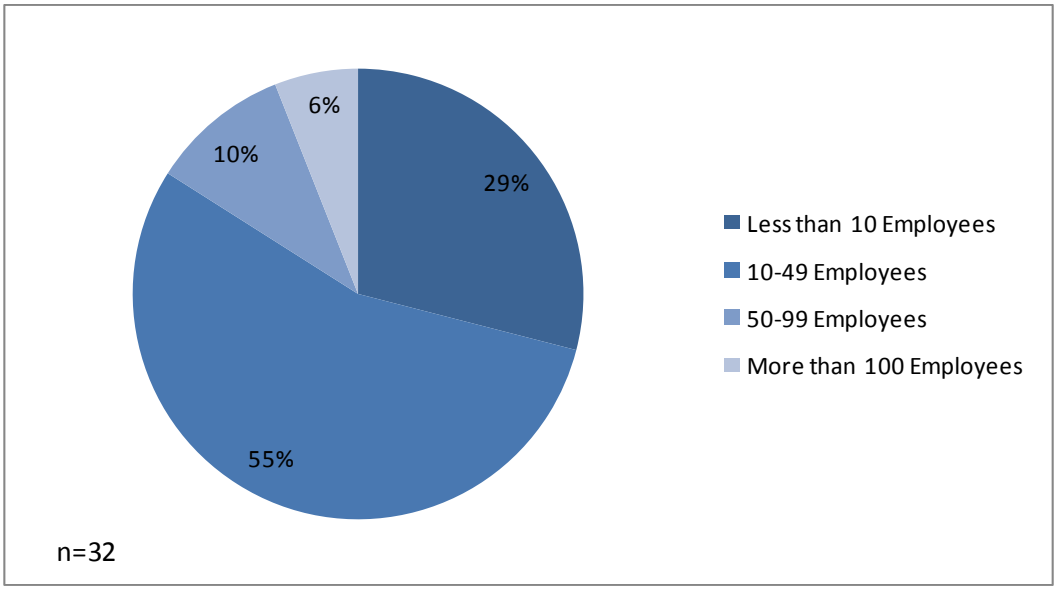
Program Participation

The LIPA Solar PV program is an incentive program—offering rebates to approved residential and nonresidential customers to offset the cost of their solar PV system installation.

As noted in
Table 2-39, the program installed 1,357 LIPA residential and nonresidential solar PV systems in 2010. Specifically, the Solar Pioneer program enrolled 1,185 residential participants, while the Solar Entrepreneur program enrolled 172 nonresidential participants. Eighty-six percent of residential survey respondents are 55 years of age or older and nearly three-quarters (73%) have obtained undergraduate or graduate level degrees. Furthermore, more than two thirds (67%) have an average annual household income of $100,000 or more—which indicates that Solar Pioneer program participants are an educated and affluent participant population. Not surprisingly, the vast majority (96%) of residential participants are owners of single-family properties. Among this participant group, 53% report a lot size of one acre.

Nonresidential customers who participated in LIPA's Solar Entrepreneur program represent a combination of commercial, municipal, and nonprofit market segments, with varying numbers of employees. As shown in Figure 2-24, the majority (55%) of nonresidential survey respondents have 10 to 49 employees at the facility where the Solar PV equipment was installed. Additionally, close to one third of the businesses are small, with fewer than 10 employees.

Figure 2-24. Nonresidential Business Size



The rebate amounts for the Solar PV program in 2010 totaled $33,479,892, with nonresidential customers accounting for nearly 19% of the total rebated dollars from the program. Customer participation is seven times higher among residential customers compared to nonresidential customers.

Table 2-39. Solar PV Participation

Sector	Projects	Percent	Rebate Amount	Percent
Nonresidential	172	12.7%	$6,334,419	18.9%
Residential	1,185	87.3%	$27,145,473	81.1%
Total	**1,357**	**100.0%**	**$33,479,892**	**100.0%**

Source: 2010 Program-tracking Database

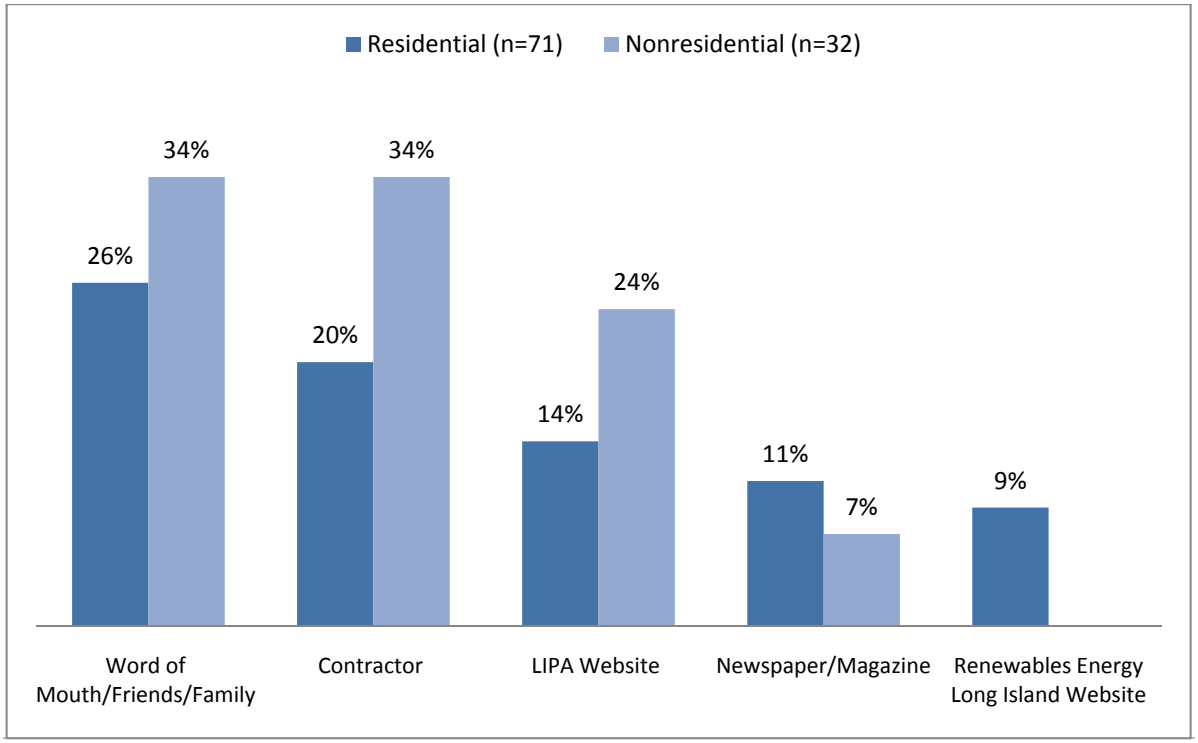
Marketing and Outreach

Research findings suggest that the marketing and outreach strategies of the Solar PV program staff have been successful in attracting potential participants to the program, as the program had twice the planned participants in 2010[64].

LIPA's Solar PV program distributes various marketing materials (e.g., brochures, fact sheets) at trade association meetings and solar industry events. In addition to its own outreach, the program relies on groups such as Renewable Energy Long Island (RELI) and Long Island Solar Energy Industries Association (LISEIA) to promote renewable energy on Long Island among residential and commercial customers and contractors.

As shown by the survey data, the program is establishing a positive network of referrals with customers and contractors, as program participants learned about the program in 2010 more through word-of-mouth (e.g., friends, family), than from other sources and program materials. In fact, nearly two-thirds (68%) of nonresidential participants and nearly half (46%) of residential participants who responded to the survey became aware of the Solar PV program from word-of-mouth and contractor referrals (see Figure 2-25). Currently, the program does not send bill inserts or direct mailings to increase awareness and participation. LIPA staff does not see the need for additional marketing because participation is so high without this type of targeted marketing effort. In general, the program primarily relies on contractors to promote the program to their existing customer base, a strategy that has been effective so far.

Figure 2-25. Solar PV Program Awareness



[64] We obtained goals from the interview with the Solar PV Program Manager.

To maintain and increase awareness of and participation in the Solar PV program, LIPA should continue to market the program at trade associations and events. Additionally, LIPA should consider additional modalities for communicating the program. For instance, 6 out of 10 survey respondents prefer that LIPA notify them about future renewable energy or energy efficiency programs through direct mail/bill inserts. LIPA should consider these as effective marketing channels for future marketing and outreach strategies.

LIPA's current marketing and outreach activities have been successful in generating high levels of customer participation for the Solar PV program. However, initial conversations with participating contractors reveal that contractors could be even more effective in describing the program and answering customer questions (which would support higher rates of customer satisfaction) if they had access to more up-to-date brochures and fact sheets with current rebate levels and changes to the program each year in a timely manner. LIPA took action to lower rebates in response to federal tax policy changes and market conditions such that there was a gradual downward trend in the incentive amount during the course of the year. LIPA posted information on these changes on its website and communicated the changes to all contractors via email.

Participation Process

The process for participating in LIPA's Solar PV program—from signup to rebate issuance—is lengthy. According to program staff and participating contractors, it takes at least six months for the contractor or customer to receive his/her rebate. Although survey respondents see the rebate and installation process as lengthy, nearly all respondents indicated that their contractors clearly explained the program to them (98% residential and 93% nonresidential). Furthermore, the majority of respondents (68% residential and 55% nonresidential) reported that it was easy to access information about how to participate in the Solar PV program.

In most instances, the contractor completes the customer's application as a courtesy and also because the application requires technical information about the PV installation equipment. The application materials include the customer's contact information (name, address, phone number) and LIPA customer account number. In addition, the application form collects PV system information, such as the inverter model and manufacturer, the panel model and manufacturer, the number of panels, tilt angle, orientation (e.g., East, South, West), expected rebate amount, etc. In addition to the primary rebate application, customers and contractors submit other applicable documents, such as the rebate assignment letter, LIPA array sizing worksheet, interconnection agreement, and the pre-screening application.

When the contractor (or the customer, if self-installed) submits the application materials, National Grid's rebate processing department processes them, and Distributed Resource Management (DRM) conducts a technical review of the application. Interviews with the LIPA Program Manager revealed that only three or four employees are handling a very large number of rebate applications. Given the exceeded demand of more than 1,300 participants in 2010, the program has attempted to fulfill the rebate applications in a timely manner for customers. Conversations with two participating contractors through

February revealed that the rebate process is quite time consuming. The rebate application approval alone can take up to three months, with the rebate processing taking an additional six months. This delay is a source of dissatisfaction among customers and contractors.

In the event that contractors or customers do not submit the required paperwork to LIPA, LIPA sends a letter to both the customer and the contractor to inform them which required line items and documents are missing. Contractors or customers must return the completed application to LIPA within 30 days or must reapply for the rebate. During initial contractor interviews, we learned that some customers do not respond to these requests within the 30-day time frame. LIPA offers extensions to install after the 30 days on a case-by-case basis for equipment delays and unusual weather events.

Contractors or customers send the closeout documents back to LIPA once the system is installed. After the documents are received by the rebate-processing department, the meter and testing department at National Grid will go to the PV installation site and install a net meter, but there is often a time lag between when PV installations are complete and net meters are installed. LIPA does not approve the rebate for processing until the field technician verifies the net metering and all paperwork is submitted and deemed to be complete.

Customers and contractors have a close working relationship throughout the rebate application and Solar PV equipment installation process. As such, customer satisfaction with contractors is vitally important to the Solar PV program. Many program participants found their contractors through word-of-mouth referrals from friends and family (residential: 34%; nonresidential: 39%), which reinforces the importance of high contractor satisfaction levels among customers.

Overall, survey respondents are satisfied (a rating of 6-7 on a scale from 1 to 7 where 1 is “extremely satisfied” and 7 is “extremely dissatisfied”) with the contractor they used for the Solar PV program. Program participants were especially satisfied with their contractor’s professionalism (residential: 94%; nonresidential: 93%). In fact, nearly all respondents (97% nonresidential and 95% residential) would recommend their contractor to friends and family.

Program Satisfaction

Findings from in-depth interviews with two participating contractors reveal that the Solar PV program has been successful at expanding the market for Solar PV due to the rebates for customers who could not otherwise afford to install PV systems.

These same two contractors indicate two aspects of the rebate process that LIPA can improve to increase both contractor and customer satisfaction. The most prevalent customer complaint or area of frustration is the wait time between first submitting their rebate application to LIPA to finally having their net meter installed—at which point they would begin to receive their per kW-rebates.

The most common contractor complaint or area of frustration is the time that it takes to receive the installation rebate. Contractors have a major concern with the installation-rebate processing time, which LIPA staff and contractors say can take up to six months, at best.

During interviews with program staff and contractors, we learned that customers almost always sign the rebate over to the contractor. The contractor deducts the approved rebate amount off the customer bill and then has to wait for the rebate to come before being paid in full for the job. As such, contractors invest significant up-front capital in the solar PV projects with the expectation that they will receive the LIPA rebate after system installations are completed. Delaying the installation of net meters and final installation approval (about six months at the earliest) prolongs the time it takes for contractors or customers to receive the rebate.

While contractors express frustration with the rebate processing time, they recognize that the LIPA rebate is extremely influential in customers' decisions to install PV systems. Still, the two contractors suggested implementing a secure portal website for the rebate application process to shorten the time it takes for LIPA to approve the rebate and begin installing the system. Since 2009, LIPA has taken action to improve the application process to allow for a higher volume of applications to be processed more efficiently, but with such high demand, there is still a need for LIPA to explore how to reduce the time to process applications and fulfill rebates.

Overall satisfaction with the Solar PV program is high, as 93% of residential respondents and 74% of nonresidential respondents are satisfied with the Solar PV program (a rating of 6-7 on a scale from 1 to 7, where 1 is "extremely satisfied" and 7 is "extremely dissatisfied"). Fifty-three percent of residential and 47% of nonresidential participants are satisfied with LIPA. In fact, 73% of residential respondents and 66% of nonresidential respondents have a more favorable opinion of LIPA overall as a result of participation in the LIPA Solar PV program.

When asked how LIPA could improve the program, respondents primarily suggested an increase to the rebate amount. Other suggestions include increase marketing of the program, shorten the rebate processing time, and have better communication following installation of the Solar PV equipment. While these program changes may not be feasible in the immediate future, LIPA should take feedback from participants into consideration when considering changes to future Solar PV program design and implementation.

Data Tracking

Overall, the Solar PV program collects data necessary for basic program tracking and management during the application signup phase of the program. However, based on our review of the participant data, the program-tracking database does not contain all the information collected on the application form. For example, it appears that not all customer data from the program applications is tracked, as a fair amount of Solar Pioneer residential customers had missing phone numbers in the program-tracking database. Furthermore, a vast majority of Solar Entrepreneur records did not have a contact name associated with the organization, making it difficult for us to reach the best person in the organization to discuss attribution issues.

Even more important is that none of the Solar PV program participants have any contractor information associated with each unique participant application number. While all information is important for keeping accurate and complete records, documenting contractor information with each Solar PV installation is critical for the evaluation efforts as it pertains to our survey research with contractors, as well as affecting LIPA's ability to effectively manage and track contractor information for LIPA rebate processing. Adding contractor information to the program-tracking file for the Solar PV program will assist LIPA staff in monitoring program performance and tracking contractor information in correspondence to each particular job.

Measure Verification

To install the customer's net meter, field technicians must conduct a functional test to make sure that the inverter turns itself off if there is an outage on the distribution system (e.g., make sure the inverter is off for the required five minutes). The technician then ensures that all the wiring is installed correctly and in compliance with the LIPA guidelines and State interconnection requirements. If the system fails the field test, the job is considered "in violation." The field technician then communicates this "violation" notification back to LIPA. LIPA notifies the contractor and customer to tell them what they need to fix to receive the rebate. According to the Program Manager, approximately 5% of the PV installations are in violation. Once the system passes the field test, the inspectors verify that and then install the net meter.

The Solar PV program does not currently implement formal QA/QC procedures to supplement the electrical system inspection, though LIPA plans to issue an RFP to conduct QA/QC evaluations in the 2011 program year.

Conclusions and Recommendations

While the Solar PV program exceeded its 2010 participant enrollment and energy demand goals, process findings indicate that the amount of time to process program rebates and the amount of time to install net meters represent challenges for contractors and customers.

Based on the data collected from interviews and analysis of survey findings, we make the following initial recommendations related to the program processes:

- **Marketing and outreach:** Since the program relies heavily on contractors to enroll program participants, it is important that the contractors have the most up-to-date information, including information on timing for rebates, to set appropriate expectations. LIPA maintains a website with updated application materials for contractors' use, and also attempts to communicate up-to-date program information through its customer service representatives and emails regarding new application procedures.
- **Quality Assurance (QA):** Quality Assurance reporting is a valuable way to learn about program strengths and aspects of the program that are in need of improvement. According to interviews with the Program Manager at LIPA, LIPA has issued an RFP to conduct QA/QC evaluations for the program. If possible, the QA/QC work should examine:
  - The delay in rebate processing, specifically the time it takes for a participant's application to be approved and also the time it takes from when the customer's net meter is installed and the issuance of the rebate check to the contractor or customer. According to LIPA, a six sigma process review has been initiated in 2011 that may help with this delay.
  - The reason for a delay in timing from when the customer's installation is complete and the net meter is installed by LIPA.
  - Proper installation in terms of location, tilt, and shading. In 2011, LIPA intends to move to a performance-based incentive structure to account for these factors.
- **Data tracking:** To the extent possible, LIPA and National Grid should work together to develop a database extract that fully captures contact information for all program participants (Pioneer and Entrepreneur) in a single location. While the omissions of certain participant contact information appear to be random and did not significantly impact the evaluation activities, we recommend updating the file structure or extract process to ensure completeness of both participant and contractor information. According to LIPA, the new Siebel database is now being used for all tracking and reporting.

2.3.2 Backyard Wind Initiative

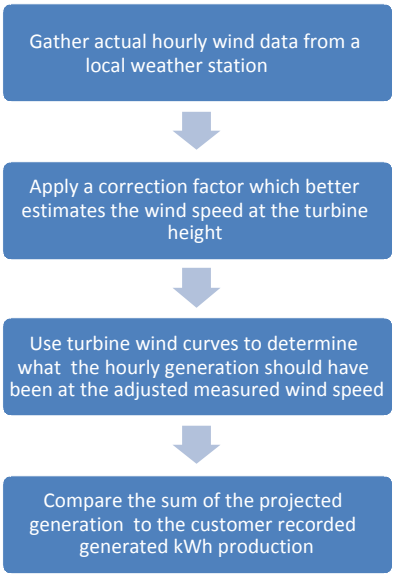
The Backyard Wind program promotes the use of wind energy by increasing consumer awareness and demand for small wind systems, accelerating development of local infrastructure for wind turbine maintenance and delivery, and overcoming financial barriers to purchasing systems. The program seeks to address economic barriers to wind energy by offering rebates, building partnerships with equipment distributors, and training market actors. LIPA staff also reports working with County and Town government officials to modify zoning regulations where appropriate.

Net Impacts

To determine ex post net energy and demand impacts, the evaluation team conducted a review of performance data for wind turbines incentivized through LIPA's Backyard Wind

program. The system performance data consisted of electric generation data gathered by the wind turbines' inverter. The inverters track cumulative energy production, which customers log on the first of each month and report to LIPA. The program installed six wind turbines in 2010. Two of these systems were completed late in the year and thus performance data are not available. As such, we based our impact evaluation on the performance data reported for the remaining four systems, extrapolated to the six units installed in 2010.

We normalized the reported annual savings to a typical wind speed year so that impacts reflect the efficiency of the wind turbine at capturing wind energy and not necessarily the particular annual fluctuation in any one year. The following chart illustrates the normalization algorithm:



The evaluation team started by acquiring both the hourly typical wind speed (TMY3 weather data), and actual hourly wind speed from the nearest weather station (Westhampton Airport). Next, we computed the ratio of the annual average wind speed at the airport to the hub height annual average wind speed. AWS Wind Navigator was the source of the wind speed as a function of height. We applied this ratio as an adjustment factor to scale the weather station wind speeds to reflect those at the sites at hub height.

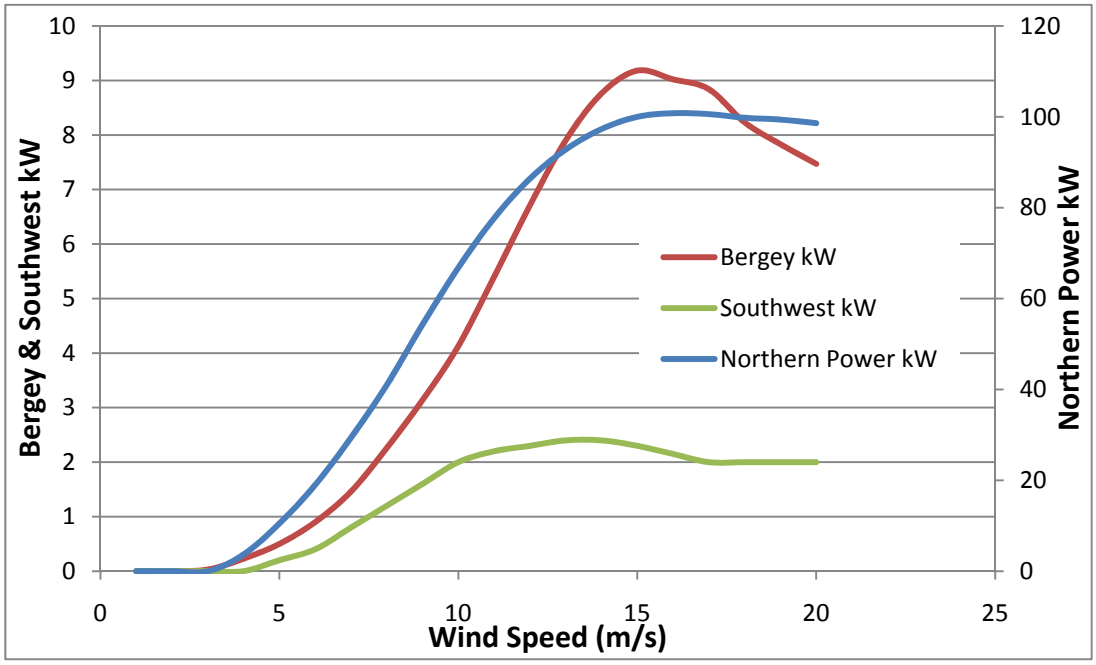
We acquired the turbine power curves for each turbine installed and used these to calculate the predicted generation for each hour, based on actual wind conditions. The turbine efficiency is the sum of the actual production of the turbine recorded by the owner divided by the sum of the predicted performance for every hour in the period.

The ex post gross energy savings for any one project is the product of the generation projected using Typical Meteorological Year (TMY) wind data (this is equal to the ex ante savings estimates) and the turbine efficiency[65].

[65] These calculations essentially replicate the methodology used by LIPA's software to predict performance using actual wind speed rather than typical wind speed.

To determine ex post demand savings, the evaluation team used the average wind speed during each of LIPA's annual peak hours, dating back to 1999. We obtained wind speed data from the National Oceanic and Atmospheric Administration (NOAA) during LIPA system peak hours from the West Hampton Beach Airport. We then adjusted wind speeds to represent estimated hub height wind speed. We used these data, along with the power curves, for installed wind turbine types presented in Figure 2-26, to determine ex post demand savings. Note that the wind speed data revealed a large swing in wind speeds on the peak day, but on average, favorable results.

Figure 2-26. Wind Turbine Power Curves by Turbine Technology



The evaluation team also conducted research to develop an updated NTG factor (see discussion below) but chose to use the program values..

The evaluation team determined that the installed turbines delivered higher energy and demand generation than was reported in the program-tracking system (realization rates of 122% and 156 % respectively). Table 2-40 and Table 2-41. provide a summary of the impact evaluation results. It is noteworthy that the Project 1 turbine was down for approximately half of the monitoring period. However, the full savings are included in the net savings.

Table 2-40. Summary of Results

Program Component	Number of Units	Net Ex Ante*		Net Ex Post*		Realization Rate	
		kW	kWh	kW	kWh	kW	kWh
Residential	2	0.5	4,323	0.9	4,426	176%	102%
Commercial	4	15.4	134,011	23.9	164,049	155%	122%
Municipal	0	-	-	-	-	N/A	N/A
Total	**6**	**15.9**	**138,333**	**24.8**	**168,475**	**156%**	**122%**

**Net savings are 65% of first-year values*

The table above has the rolled up savings for the size sites. The individual site information is below. However, there are differences between the two totals that require explanation. The program is not claiming full first year savings for 2010 although the site *expected annual production values* in Table 2-41 are for the full year while the site ex ante values in Table 2-40 are not. (i.e., Site Ex Ante kWh = Expected Annual Production * 0.65). Additionally, the per-site values in Table 2-41 are at the customer meter and do not include line losses or a net-to-gross ratio, which are included in the net ex ante values in Table 2-40 (e.g., Site Ex Ante kWh*1.073*0.86 = Program Net Ex ante kWh). These differences mean that the totals between the two tables do not match.

Table 2-41. Site Level Results (at Customer Meter)

N	Type	Installed kW	Technology	2010 On-Line Date	Notes	Expected Annual Production	RR on Expected Production	Ex Ante kWh	Ex Post kWh	RR on Ex Ante kWh
1	Commercial	100	Northern	April	Shakedown issues	157,558	73%	102,413	115,526	113%
2	Commercial	10	Bergey	September		12,498	101%	8,123	12,577	155%
3	Commercial	10	Bergey	September		12,498	138%	8,123	17,193	212%
4	Residential	1.8	Southwest	July		1,398	23%	909	325	36%
5	Commercial	10	Bergey	~ December	No production data	9,590	79%	6,233	7,592	122%
6	Residential	1.8	Southwest	~ December	No production data	4,800	79%	3,120	3,800	122%
						198,341	79%	128,922	157,013	122%

The evaluation findings indicate that LIPA's method of estimating ex ante energy savings is quite accurate, if the turbines are all working properly. Higher than assumed wind speed for installed systems account for the realization rates over 100%. Nonetheless, based on our evaluation, we provide the following recommendations:

- As in 2009, at least one turbine installed in 2010 was operational through the Measurement and Verification (M&V) period. In 2010, Project #1 was expected to produce 79% of the program's energy savings. This unit was down for approximately half the monitoring period[66]. The repeated observation of inoperable units across both evaluation years indicates that either a service factor should be applied to the ex ante savings to account for potential equipment failures or that a

[66] Discussions with program staff indicate that the turbine is currently operational.

sufficient shakedown period should occur before considering a unit is online and counting the energy generated at the site. The existing data set across the two years (i.e., nine turbines) is too small to be used to determine a service factor.

- With the limited number of wind turbines on the market, all installed units should be under continuous monitoring to identify trends in turbine performance. For example, there is only one Southwest wind turbine with monitoring data. This turbine significantly underperformed partly because it used a 40 ft hub height, which did not receive preapproval. Long-term data monitoring and an increased data set may reveal trends in turbine performance.
- Demand impacts will vary significantly from year to year. Ten years of wind data showed a range of 4 to 21 mph during the peak hour. Our analysis averaged these for the program kW impact.

Net-to-Gross Estimates

LIPA uses deemed NTG values for planning and evaluation. As part of the 2010 Backyard Wind evaluation, Opinion Dynamics conducted research to update the NTG values used to calculate ex post net savings, but ultimately used the same deemed value of 1.0 as the contribution of non-LIPA incentives could not be measured effectively.

The federal government, as well as LIPA, incents wind turbines, so there is more than one source of influence for purchase behaviors. The three participants interviewed report receiving the federal tax credit in addition to the LIPA rebate. According to the participants and contractors interviewed, few, if any, customers would install a wind turbine without both incentives. However, some participants rate the influence of the federal tax credit as higher than LIPA's rebate. This is because there being a cap on the LIPA rebate and no cap on the federal tax credit, meaning that the federal tax credit amount becomes larger and can even surpass the amount of the LIPA rebate as the total cost of the project increases.[67] We need to further investigate the best measurement of contribution and parsing out influence. In future evaluations, we will explore more closely the contribution of both the LIPA rebate and the federal tax credit.

Process Findings

We based our 2010 process assessment of LIPA's Backyard Wind initiative on data from three data collection and analysis efforts, including:

- **In-depth interviews with program staff**: Opinion Dynamics conducted in-depth interviews with the Program Managers at LIPA and National Grid.

[67] The federal tax credit is 30% of installation cost, with no limit, for residential and commercial projects. Municipal projects are not eligible for the federal tax credit. LIPA's residential rebate is the lesser of the estimated annual wind output x $3.50 per kWh up to 16,000 kWh OR 60% to total installed cost, with a maximum rebate of $56,000. LIPA's commercial rebate is the lesser of the estimated annual wind output x $3.50 per kWh for the first 16,000 kWh and then $0.50 per kWh thereafter up to 175,200 kWh OR 60% of total installed cost, with a maximum rebate of $135,600. LIPA's municipal rebate is the lesser of the estimated annual wind output x $4.50 per kWh for the first 16,000 kWh and then $1.50 per kWh thereafter up to 101,333 kWh OR 60% of total installed cost, with a maximum rebate of $135,600.

- **In-depth interviews with participating small wind contractors**: Opinion Dynamics conducted interviews with three participating contractors, representing three 2010 projects. We attempted a census of all four participating contractors in the program in 2010.
- **In-depth interviews with participating customers**: Opinion Dynamics conducted interviews with three commercial customers. We attempted a census of all six participants in 2010.
- **Review of program databases and materials provided**: Opinion Dynamics reviewed the program-tracking database and program promotional materials.

Program Participation

The LIPA program completed six projects in the 2010 program year, including four commercial and two residential projects. The actual rebate amounts totaled $260,148. The program splits the incentive payments. Of this amount, $169,096 (representing 65% of the 2010-rebated total) has been paid to participants at installation, with the remaining 35% paid after 12 months of operation based on the program's performance-based structure. The program also claims only 65% of the ex ante savings in the first year with plans to include the trued up amount in year two (the entire 35% or possibly less).

Of the six projects in 2010, four contractors completed five of these, while the participant completed one project.

Both the number of projects and ex post savings (65% of 2010 totals) from the Backyard Wind initiative did not meet the initiative's 2010 program goals. For better comparison, Table 2-42 shows both the program's total 2010 energy savings goals and 65% of those goals. The program's shortfall is mainly due to the newness of the program and the significant price and permitting barriers discouraging or delaying installation. We discuss these barriers in more detail later in this section.

Table 2-42. 2010 Backyard Wind Results Compared to Program Goals

	Number of Projects		Energy Savings (kWh)		
	Goal	Actual	Goal	65% of Goal	Net Ex Post*
Commercial	2	4	376,000	244,400	141,082
Municipal/NFP	4	--	188,000	122,200	--
Residential	19	2	268,000	174,200	3,806
Total	**25**	**6**	**832,000**	**540,800**	**144,888**

**Net Ex Post savings are 65% of first-year values.*

Although the number of installations did not meet program goals, the program still benefits from interest among residential and nonresidential customers on Long Island. In the course of our evaluation of LIPA's Solar PV program, we asked participants of that program if they considered installing a wind turbine at their homes or facilities. Thirty percent of residential respondents and 21% of nonresidential respondents report that they considered installing a wind turbine. Zoning or permitting issues is the main reason why residential participants did not install the wind turbine in 2010.

Marketing and Outreach

According to its marketing plan, the Backyard Wind Program identifies its target market as self-selected, highly motivated customers located in areas with both good wind energy potential and sufficient land (determined by the township) to site a wind turbine. Due to these constraints, the program is limited to small farms, vineyards, and other open spaces primarily located on the East End of Long Island. In light of this, the program was successful in reaching its target market, as small farms and vineyards account for all four of the commercial installations.

According to the program's marketing plan, customer outreach and marketing efforts consist of the program's website, outreach and educational events, and printed materials (e.g., brochures and fact sheets) to distribute at these events,. In 2010, the planned community outreach events consisted of information meetings targeting each of the 12 townships in the LIPA service territory as well as meetings with the farm bureau. According to the Program Manager, the program has implemented each of these outreach efforts in 2010.

The program does not send bill inserts or direct mailings as a means to increase participation due to the targeted nature of the participant. In general, the program primarily relies on contractors to promote the program to their existing customer base.

In addition to its own outreach, the program relies on groups such as Renewable Energy Long Island (RELI) and Long Island Solar Energy Industries Association (LISEIA) to promote renewable energy on Long Island among residential and commercial customers and contractors.

Program Processes

Participation Timeline

The process for participating in LIPA's Backyard Wind initiative is lengthy. According to interviews with participants and contractors, the time between the decision to install the wind turbine and the completion of the projects can be about two years. Permitting issues account for the bulk of this time. Most participants installed wind turbines in townships that had no previous experience with wind energy and therefore lacked established building codes and permits. As a result, new codes and permits had to be developed and approved within each jurisdiction before the participant could even apply. In many cases, both the participant and contractor had to work with the township to help develop the appropriate codes and permits. Fortunately, future participants and other townships can leverage this initial work, reducing their permitting hurdles and participation time.

Application Process

In most instances, the contractor completes the customer's application, which lists the customer's contact and LIPA account information, contractor information, and equipment information, including the specific turbine generator and inverter installed, its warranty, and its nameplate kW rating. This is sufficient information for an application, although obtaining the estimated tower height would be useful for future evaluation. Additionally, the application allows the participant to assign the rebate over to a third party (the contractor). The participant or contractor then submits the application with other applicable documents, such as permitting information and the parallel generation agreement (PGA).

After submission, National Grid's rebate processing department processes the application. Despite the small number of applicants, the rebate processing time usually extends to the full 60 days noted on the application due to the limited staff size at the processing center and the demands of other LIPA programs. This lengthy rebate time is a source of dissatisfaction by customers. To document the steps needed, the program created a checklist for participating contractors outlining the rebate processing. This document includes, in order, the specific steps required for rebate payment, including verification of the completed application, verification of the net metering and rebate qualifications, the wind calculation, the signed PGA, the preapproval letter, and the setting of the net meter, among others.

In the event that not all of the required paperwork is submitted to LIPA, a letter is sent to the customer and the contractor to inform them which line items/documents are missing. The appropriate party must return the completed application to LIPA within 30 days or reapply for the rebate. LIPA offers extensions to customers on a case-by-case basis.

The program uses a performance-based structure. The participant receives 65% of the rebate upon installation and then is required to provide 12 months of monitored data to verify the estimated output of the system to receive the remaining 35% of their preapproved rebate amount. According to the marketing plan, LIPA's performance-based structure is designed to harness the best wind resource sites on Long Island and ensure that the sites are built in accordance with strict quality standards. This structure differs from NYSERDA's program, which is more prescriptive in nature and provides different

rebate levels based on capacity, tower height, and customer class, but does not account for performance.

Data Tracking

Due to the limited number of participants in the Backyard Wind initiative in 2010, maintaining a comprehensive database is not difficult for this program. Review of the program-tracking database reveals that all fields from the program application and subsequent calculations, including the actual rebate and assigned energy savings, are present. Only one field (equipment purchase date) had missing data, but this does not affect the implementation or evaluation of the program.

Measure Verification

The Backyard Wind program currently does not have any formal QA/QC process in place. The application requires information on the installed equipment and this equipment must come from the program's list of approved equipment. A functional test of the turbine is performed during the net meter installation, but this installation and inspection only covers the meter and related equipment to ensure proper connectivity to the grid. After the net meter is installed, the application can receive final approval and the rebate is processed.

Although the program involves only a small number of participants and the program staff work closely with participants and contractors, two of the six projects had kWh realization rates of less than 75%, suggesting that a more formalized QA/QC process may be beneficial. If possible, this process should include on-site wind data tracking.

Training

Outside of its outreach events, the program staff stated it conducted training of small wind contractors in 2009. The program staff relies on the trainings conducted by NYSERDA for its program, and also relies on the trainings of renewable energy groups, such as RELI and LISEIA.

Program Satisfaction

Customer Satisfaction

In-depth interviews with three of the six 2010 customer participants reveal mixed satisfaction with the Backyard Wind program and its components. In general, these customers are pleased with their contractors and the work performed; however, they express dissatisfaction with 1) the overall length of time it took to complete the installation of the project and 2) the time it took to receive the rebate.

Satisfaction with the contractor is very high among the three participating customers. On a scale of 1 to 7, with 1 meaning "extremely dissatisfied" and 7 meaning "extremely satisfied," all participants rate their contractor as a 6 or 7 on most categories, including ease of scheduling, quality of work performed, professionalism, and overall satisfaction. Participants also give favorable satisfaction ratings to both the actual wind turbine installed and the time it took to install the wind turbine (after the resolution of permitting and other issues). The interviews with customers report slightly less, but still high,

satisfaction with the contractors' knowledge of the program and processes, as two felt that the contractor did not fully explain crucial parts of the program such as demand charges on the bill, and the length of time required to complete the entire project. As reflected in their overall high ratings of their contractors, all three participants would recommend their contractor to friends, family, or colleagues.

Compared to their positive views of contractors, participants rate their satisfaction with the program and its processes less favorably. Both LIPA and the Backyard Wind initiative received very mixed overall satisfaction ratings. For example, all three participants give low satisfaction ratings (4 or lower out of 7) to the amount of time between signing up for the program, having the equipment installed, and receiving the LIPA rebate. Furthermore, participants report mixed satisfaction with the information that LIPA sends them regarding the participation process, particularly regarding information on the demand charges.

Contractor Satisfaction

Interviews with three contractors participating in LIPA's Backyard Wind program found that they are generally satisfied with the Backyard Wind program. The contractors believe that there is demand for wind power on Long Island; however, it is largely stifled by the high cost. They believe that any program that can help absorb the significant expense for customers would help expand the market potential for wind turbines. This will ultimately help generate a larger renewables economy in Long Island—a goal of LIPA. The contractors also give high praise to the program staff for its support.

Although contractors report high satisfaction with the program overall, they identify several potential areas for improvement. First, contractors find that the rebate timing can be a potential issue for contractor satisfaction. Although contractors find that customers understand the performance-based structure of the rebate (e.g., receiving the final 35% of the rebate if the system meets its estimated output), the additional wait time for the full rebate leads to customer dissatisfaction, which in turn affects contractor satisfaction with the program. Additionally, contractors believe that some downtime may be required during the first year of operation of a complex system and any downtime will potentially affect the total rebate amount without markedly affecting the performance of the turbine over its 20- to 30-year life. One of the sites in 2010 was offline for approximately three months, which affected the system's ability to meet its 12-month goal. The contractor was ultimately able to work with the program to extrapolate past results over the 12 months, but allowances like this negate the benefits of a performance-based structure. LIPA should consider this example along with the system complexity expressed by the contractor and the impact on its performance-based structure.

Similarly, contractors note that there is currently no way to validate rebate payouts as there is no valid data to judge system performance compared to on-site wind data. When calculating system performance, contractors take wind data from equipment at nearby sites like airports and extrapolate to other areas and tower heights. Although this method is simple and works well, the contractors believe that the program could obtain more accurate and usable data by requiring participants to install measurement equipment and data loggers on the turbine itself.

Contractors also report some dissatisfaction with the AWS Wind Navigator tool, which is based on the tool used for NYSERDA's wind program. All three contractors maintain that the tool is helpful, but relying on it to make installation or rebate approval decisions can be misleading as the wind data may not translate well to the proposed site or tower height. Other possible solutions, such as monitoring a potential site for a period of time before installation, are costly alternatives to the current process. However, contractors' general dissatisfaction with the tool may require LIPA to seek alternative methods.

Finally, one contractor suggests that LIPA expand its list of approved equipment. Because of the recent growth of the market, new companies and new products are emerging. At least one of this contractor's customers installed a wind turbine in 2010 but could not participate in the program because their equipment was not on the approved list. The customer knew of this before installation and decided to install without the program.

Barriers to Participation

While there is evidence from the interviews that interest in small wind systems continues to gain traction in Long Island, the small number of projects in LIPA's Backyard Wind program suggests a number of large barriers to greater participation. One contractor stated that their company had approximately 300 leads for wind systems in 2010, but only installed two turbines. Interviews with program staff, participants, and contractors reveal three primary barriers.

First, participating customers and contractors report that the permitting process is extremely cumbersome and takes approximately one to two years to complete with local townships. This long delay is due to the lack of existing building codes and permits for wind turbines in many of the townships. As a result, the customers and contractors were required to work closely with the townships to update or create these codes. Fortunately, this work will likely help future participants as they can leverage the new codes to install their wind turbines. Additionally, the program may want to consider taking a tack similar to the residential new construction program where the program worked directly with towns to put codes in place for ENERGY STAR new homes.

The second barrier to the program is the upfront investment and lack of available financing. Although the LIPA rebate, federal tax credits, state sales tax incentives, and any other grants or funding may combine to significantly reduce the total cost of a small wind system, the customer is still responsible for paying for the project's total cost upfront and receives the incentives later. Given the large upfront expenditure associated with the wind turbine, few people or companies can afford this investment without financing. Unfortunately, there appears to be a dearth of available, affordable financing for renewable energy projects, as financial institutions have not yet appropriately valued improvements in energy efficiency or renewable energy. LIPA has an opportunity to be an advocate of renewable energy projects and provide information to financial institutions.

Only one participant mentioned a third barrier, but it has the potential to be significant for all renewable energy programs. Although a wind turbine can potentially reduce a customer's energy use in kWh, the net metering requires a rate that includes demand, which can be a substantial part of their bill, especially among commercial customers during peak demand periods. As indicated previously, the wind turbine has not been

shown to provide a reliable reduction in peak demand. This caused confusion for at least one participant who felt that the program and contractor did not explain this well enough. According to the Program Manager, LIPA has taken steps to better describe the effects of net metering. Despite counseling from the program on the policy and the benefit of the elimination of the demand ratchet for commercial customers, this participant still believes that they should not pay the demand charges on the bill. Despite improved description of net metering by LIPA, confusion over demand charges may continue to surface as a barrier to potential participants. This barrier may be largest for those customers that have low energy use but relatively high demand equipment like on-demand water heaters or three-phase equipment.

Conclusions and Recommendations

The Backyard Wind initiative did not meet its energy and demand savings goals for 2010. This is attributable to the lower than expected participation. The number of participants could increase in 2011, as the permitting barrier becomes less pronounced due to townships leveraging the experience from previous turbine installations, but may be countered by the high costs and demand-billing component.

Our key recommendations related to the program processes are:

- Establish permit guidelines: The program should continue to support local agencies, contractors, and townships to establish guidelines for permits and building codes relating to the installation of wind turbines. As the program incents more turbines to be installed on Long Island, it will become easier to meet permit and code requirements. The program may want to consider working directly with towns to put codes in place, similar to the residential new construction program for ENERGY STAR new homes.
- On-site wind data tracking: To best utilize the program's performance-based structure, we recommend exploring the cost of tracking wind data on-site. If cost effective, this will allow all parties to accurately measure the turbines' performance over the first 12 months and beyond.
- Promote informed contractors: Given the large investment required to install a wind turbine, it behooves LIPA to keep contractors well informed about the program's details, including the other available incentives, the total time required to complete the project, the demand charges, and the intricacies of net metering. This will reduce future issues with the customers and contractors and provide the program with quality marketing.

3. DETAILED METHODS

3.1 Data Collection

3.1.1 Overview of Data Collection

This report documents the findings from the 2010 evaluation of LIPA's portfolio of ELI and renewable energy programs. The evaluation team used a variety of data collection methods to compile the primary data required to support the impact and process assessments included in the evaluation effort, including in-depth interviews with program staff and trade allies, quantitative telephone surveys with program participants, and measurement and verification (M&V) site visits. Table 3-1 lists the primary data collection efforts associated with the evaluation of each program.

Table 3-1. Primary Data Collection Efforts in 2010 Evaluation

Program	Data Collection Type			
	In-Depth Interviews		Telephone Survey	
	Program Managers	Retailers / Contractors	Participants	On-site M&V
CEP	4	7	107	20
EEP	5	22	140	N/A
Cool Homes	1	29	141	N/A
HPD / HPwES	1	9	70/106	N/A
REAP	2	2	100	N/A
Solar Pioneer	2[a]	2[a]	71	N/A
Solar Entrepreneur			32	N/A
Backyard Wind	2[b]	3	3	N/A
Information and Education	N/A	N/A	N/A	N/A
ENERGY STAR New Homes	N/A	N/A	N/A	N/A

[a]We conducted in-depth interviews with two contractors from firms that participate in the Solar PV Program—both Solar Pioneer and Solar Entrepreneur.

[b]One interview was conducted with the LIPA Renewables program manager to gather information on the Backyard Wind and Solar PV programs.

The evaluation team also used secondary data sources in the evaluation effort. Specifically, we used measure-level program tracking data and specific project applications in support of the ex post impact assessment and to develop sample frames for our participant surveys and in-depth interviews with program trade allies. In addition, we used program documentation, implementation plans, and marketing materials in support of the process evaluation Below, we provide a general description of these data collection efforts.

Quantitative Telephone Surveys

We used quantitative telephone surveys to gather structured data from relevant populations to support the process and impact assessment of ELI programs. We completed all telephone surveys using Computer-Assisted Telephone Interviewing (CATI) software. Using CATI ensures data consistency and virtually eliminates the chance of an interviewer skipping a question or entering a response that is outside the range of valid responses. Our use of in-house resources and CATI software allowed us to apply the most rigorous QA/QC protocols possible to all quantitative data sets prior to analysis.

We conducted quantitative telephone surveys with customers participating in every ELI program assessed in this evaluation[68]. The surveys covered a range of topics in support of the process and impact assessments including program satisfaction, effectiveness of program marketing and outreach activities, perceived barriers to and motivations for program participation, energy efficiency knowledge and actions, and areas for future program improvement. We also used the surveys to gather information for the development of Net-To-Gross (NTG) ratios for some programs.

In addition, we conducted quantitative surveys with contractors, In conjunction with the ongoing Residential HVAC Market Characterization Study, we conducted a telephone survey with 28 contractors participating in the LIPA Cool Homes Program. In addition to assessing current installation practices, the survey explored subjects germane to the process assessment. Specifically, we used the survey to gather information regarding the participation process, program promotion, benefits and barriers to participation, and overall satisfaction with the program.

In-Depth Interviews

In-depth interviews with key constituents played an important role in gathering the information needed to support this analysis. In-depth interviews are less structured than quantitative surveys, allowing for greater flexibility. This method allows respondents to talk in greater detail about their experience or perspective while still shaping the discussion so that we collect the important, relevant, and necessary information The flexible format also allows us to uncover other information we might not have otherwise considered, adding richness to the data.

[68] We did not conduct a process assessment of the Information and Education and Residential New Homes program in this evaluation cycle and thus did not field a quantitative telephone survey regarding these programs.

We conducted a number of interviews with program staff and trade allies, including contractors and retailers, as, summarized below.

Program Staff Interviews. We used in-depth interviews with program staff and implementation contractors to develop a comprehensive understanding of program implementation and key processes. In general, the interviewers collected data regarding program design and implementation, internal communication and program tracking systems, challenges confronted in 2010, and plans for program change in 2011. We completed the following interviews with program staff:

- **Home Performance:** We spoke with the National Grid Program Manager and program implementer, Conservation Services Group (CSG).
- **REAP**: We conducted seven in-depth interviews with the National Grid Program Manager, the Honeywell Program Manager, two Marketing Coordinators (LIPA/REAP) at Honeywell, two field technicians at Honeywell, and the Program Manager at Conservation Services Group (CSG).
- **Cool Homes**: We conducted two interviews, one with the National Grid Program Manager and another with the implementation contractor, CSG.
- **EEP**: We conducted five in-depth interviews: one with the National Grid Program Manager, one with the Applied Proactive Technologies, Inc. (APT) Program Manager, two with the upstream and downstream Program Managers at Energy Federation, Inc. (EFI), and one with the Program Managers at Appliance Recycling Centers of America (ARCA).
- **Renewable Energy**: We conducted in-depth interviews with LIPA and National Grid Program Managers from the Renewables, Solar PV, and Backyard Wind programs. Specifically, we conducted one interview with the Solar PV Program Manager, one interview with the Backyard Wind Program Manager, and one interview with the Renewables Program Manager.
- **CEP**: We conducted four in-depth interviews with four program and project managers at National Grid.

Home Performance Contractor Interviews. We conducted in-depth interviews with five contractors from firms enrolled in Home Performance Direct (HPD), and four contractors from firms enrolled in Home Performance with ENERGY STAR® (HPwES). These nine contractors were selected by LIPA as the most active participants in each program.[69] In addition, the HPD firms we spoke with also complete work as part of HPwES.

The contractor interviews focused on current marketing, audit, educational, and sales practices (i.e., sales of follow-up measures), providing feedback or suggestions on how the program could improve these practices to increase program participation, and measure uptake. We also discussed potential areas for program improvement.

[69] In total, five (of six) HPD contractors that participated in the interviews represent 97% of HPD jobs conducted in 2010, and the five (of 14) HPwES contractors that participated in the interviews represent 83% of HPwES jobs completed in 2010. One of the HPwES representatives was enrolled in the program in 2010, but based on tracking data, did not complete any jobs in 2010.

Lighting Retailer Interviews. We conducted interviews with 12 retailers participating in the lighting component of the EEP program. The interviews dealt with retailers' satisfaction with the program, their sales and stocking practices of ENERGY STAR lighting, and their promotion of the program.

Room Air Conditioner Retailer Interviews. We interviewed 10 retailers participating in the Room Air Conditioner component of the EEP program. We spoke with nine store-level managers and one corporate buyer about the program's impact on their sales and stocking practices, the program's promotion, and their satisfaction with the program processes.

Renewables Contractor Interviews. We conducted in-depth interviews with two contractors from firms that participate in the Solar PV Program. We also conducted interviews with three participating contractors of the Backyard Wind program, representing three 2010 projects. The interviews focused on application procedures; program roles and responsibilities; and sales practices, marketing strategies, and program challenges—providing feedback or suggestions on how the program could improve such practices to increase program participation, and measure uptake. We also discussed potential areas for program improvement.

Backyard Wind Participant Interviews. We conducted interviews with three commercial customers of the Backyard Wind Program.

CEP Trade Ally In-Depth Interviews. We conducted seven in-depth interviews with rebate administrators and contractors serving the Commercial Efficiency program.

3.1.2 Program-Specific Sample Designs

This section provides a detailed description of the sample design for each quantitative data collection effort, including telephone surveys, on-site M&V, and engineering desk reviews, by program.

We conducted surveys with program participants for most of the programs evaluated. Where possible, we proceeded with the participant surveys before receiving year-end program data to keep the evaluation on track and meet reporting deadlines. We did this for programs for which missing year-end participants would not be systematically different from other participants so as not to bias the sample.

We calculated response and cooperation rates for all surveys using the standards and formulas set forth by the American Association for Public Opinion Research (AAPOR).[70] The response is the number of completed interviews divided by the total number of potentially eligible respondents in the sample. The cooperation rate is the number of completed interviews divided by the total number of eligible sample units actually contacted. In essence, the cooperation rate gives the percentage of participants who completed an interview out of all of the participants with whom we actually spoke.

[70] *Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys*, AAPOR, 2011. http://www.aapor.org/Standard_Definitions/3049.htm

Commercial Efficiency Program

Participant Survey

The Commercial Efficiency program 2010 evaluation plan called for a survey with up to 140 program participants using a stratified random sample design. We planned to oversample large energy savings projects to assure sufficient information for net analysis. The goals of the participant survey were to verify equipment installation, determine net-to-gross adjustment factors, and explore participant perception of program processes. However, the year-end program tracking database contained shortcomings that prevented us from administering the participant survey as planned. Namely:

- Participant contact information data fields contained a mix of contractor, rebate administrator, and participating company decision-maker information. Reaching company decision-makers, as they are ultimately responsible for paying the bill (as opposed to trade allies or rebate administrators), is critical to accurate estimation of free ridership and spillover factors. Our inability to obtain such information for all program participants led to a sample frame that was insufficient for providing a valid response for net analysis.
- A considerable number of custom program contact names and numbers were missing from the program tracking database. Since names and phone numbers are crucial to our ability to reach and conduct interviews with program participants, absence of this information introduced a considerable degree of coverage error (i.e., we were unable to include appropriate customers into our sample frame).

Since the contact information was not always available for company decision-makers, we performed a due diligence analysis of the program participant database to try to identify applications with contractor and rebate administrator contact information. Within this analysis, we used the LIPA customer database to substitute contractor or rebate administrator information with the company contact information. We attempted the same approach for custom program participants with missing contact information. We used account numbers as a unique identifier but determined this exercise was not always successful and in cases where we were able link company contact information to participant information, the resulting contact information was not necessarily for the CEP project decision-maker. This contributed to coverage bias.

The above-mentioned database limitations and biases to the sample frame limited our ability to accurately verify measure installation, assess free ridership and spillover, and confidently extrapolate survey results onto the population of program participants. As a result, the participant survey effort focused on gathering process-related data only. Since the survey scope no longer included measure verification and net-to-gross components, we no longer required the stratified random sample design.

The evaluation team included all program applications in the sample population with two exceptions:

- Custom program applications for the Whole Building Design component of the program. The dynamics of the program component are different enough for process-related questions to not be applicable. We excluded these participants from the sample population.
- Across the custom, prescriptive, and not-for-profit components, we excluded applications that were marked as 2009.[71]

As a result, we ended up with 315 prescriptive, 188 not-for-profit, 431 custom, and 73 Fall Lighting Stimulus applications. Following that, we identified unique program participants[72] with valid contact information and assigned the overlapping participants into either custom, prescriptive, not-for-profit, or Fall Lighting Stimulus program using the following guidelines:[73]

- In cases when participants participated in the Custom and Prescriptive programs, we assigned them as custom program participants.
- In cases when participants participated in the custom and not-for-profit programs, we assigned them to the program where aggregated energy savings for each individual program participant were the highest.
- In cases when participants participated in the Fall Lighting Stimulus and any other program, we gave preference to other programs over the Stimulus initiative.

The resulting sample frame included 487 unique program participants. Due to the size of the sample frame, we attempted a census of all program participants in the sample frame. As a result, there are no precision intervals or confidence levels associated with the completed interviews. We conducted the surveys between February 15 and March 4, 2011. We completed 107 interviews, which represents a survey response rate of 29% and a cooperation rate of 36%.

[71] This determination was made on the APPL_EFFV_YR data field in the program database. We excluded these projects based on our understanding that a 2009 entry was not part of the 2010 program. We later learned that this was not the case. All impact analyses include these projects.

[72] We define unique program participants as having a unique phone number.

[73] These assignments were made for the purposes of the analysis of survey results.

Table 3-2. Commercial Efficiency Program Sample Design

Program Component	Original Number of Applications		Sample Frame (Based on Unique Phone Numbers)		Sample		Completed Interviews	
	N	%	n	%	n	%	n	%
Prescriptive	315	31%	217	45%	217	45%	63	59%
Custom	431	43%	159	33%	159	33%	11	10%
Not-for-profit	188	19%	61	13%	61	13%	24	22%
Fall Lighting Stimulus	73	7%	50	10%	50	10%	9	8%
Total	**1,007**		**487**		**487**		**107**	

As seen in Table 3-2, the resulting breakdown of completed interviews by program over-represents prescriptive and not-for-profit projects and under-represents custom and Fall Lighting Stimulus projects. This is likely due to missing contact information for custom program participants, which ended in higher non-response and coverage biases. We usually correct for such discrepancies by weighting the data. However, after exploring responses to key survey questions across program segments, we found little difference in responses. Therefore, when reporting on the survey responses combined across all program participants, we present unweighted results.

Trade Ally Interviews

The original trade ally sample plan called for 10-15 interviews with program participating contractors. Due to the absence of a CEP contractor database, we attempted to identify participating contractors using the program participant database. This task was complicated by the fact that trade ally information was often mixed with participant information, which made it difficult to accurately isolate all the trade allies that were part of the program in 2010. We ended up with a total of 32 trade allies in our sample frame. Of those, 24 were rebate administrators[74] and eight were contractors. Of the 24 rebate administrators, we attempted to conduct interviews only with the ones that were either located New York or had a strong presence in the state. We attempted to contact all of the contractors in our sample frame. As a result, we completed interviews with four rebate administrators and three contractors.

M&V Site Visits and Engineering Desk Reviews

The evaluation team used a combination of M&V site visits and engineering desk reviews to determine ex post savings estimates associated with custom projects. Custom projects, by their nature, cover a wide range of different measures with varied impacts. For this reason, we employed a stratified random sample design, which optimizes sampling by

[74] Rebate administrators are companies who work directly with companies to find incentives and help the company throughout the process. This involvement can range from simply obtaining the incentive to helping throughout the design of a project as well as the implementation.

project size (ex ante impacts) to obtain 90/10 statistical precision. In addition, because the nearly half of the projects completed in 2010 were completed in the final two months of the program year, we developed the sample in two phases to permit the evaluation team sufficient time to recruit, schedule, plan and complete the on-site assessment. We used the population of custom projects completed from January through August 2010 as the sample frame for the phase one sample, which was selected for the M&V site visits consisted of. We used the population of custom projects completed from September through December 2010 as the sample frame for the phase two sample, which was selected for desk-reviewed projects.

We used the Dalenius-Hodges technique to determine appropriate stratum for each sample frame and the Neyman allocation method to obtain optimal samples by strata. The sample design provides statistically valid impact results at the 90% confidence level +/- 8% for the custom projects overall.[75]

Table 3-3. CEP Custom Projects Sample Design

Stratum	Boundaries (kWh)	Total Ex Ante Savings (kWh)	Projects in Population[a]	Projects in Sample
Phase 1 – M&V Sites (sample drawn from Jan to Aug 2010 participants)				
1	4,800 – 50,000	2,346,000	87	4
2	50,001 – 160,000	4,045,000	47	5
3	160,001 – 1,400,000	3,856,000	11	11
Total		**10,247,000**	**145**	**20**
Phase 2 – Desk Reviews (sample drawn from Sep to Dec 2010 participants)				
1	4,800 – 50,000	3,321,000	172	4
2	50,001 – 250,000	11,292,000	122	8
3	250,001 – 1,500,000	7,812,000	14	8
Total		**22,425,000**	**308**	**20**

[a]The sample frames were split into two populations with no overlap.

[75] We are 90% certain that the population mean is within 8% of our sample mean.

After sample selection, we obtained project application documents from LIPA to provide background information on the measure(s) installed within each custom project application, as well as their ex ante savings calculations. We sent selected customers notification letters and then contacted them by phone to recruit participation in the M&V process. We conducted 20 site visits between November 2010 and January 2011.

For on-site visits, before visiting each site, the evaluation team developed an M&V plan to outline the metering and analysis strategies needed to determine evaluated project savings. Senior staff internally reviewed and finalized the plans before each site visit. Results from all sites are provided in site-specific reports (Appendix I).

The 20 projects that we desk-reviewed included 13 lighting and/or lighting controls projects, 4 projects involving the installation of EC motors, 2 projects where VFDs were installed on HVAC equipment, and 1 compressor project.

As noted above, the evaluation team used on-site M&V and engineering desk reviews on the selected sample to develop ex post energy and demand savings estimates (see below for a description of on-site M&V and desk review approach). We then compared the ex post savings estimates to the ex ante tracking estimates to develop a realization rate for the selected sample. We applied the realization rates from both samples back to the population of custom projects, weighted by kWh savings, and combined the two sample frames to obtain overall program impacts. More specifically, we used the ratio adjustment method[76] to extrapolate results for each site back to the overall CEP population. Figure 3-1 shows the algorithm we used to extrapolate to the population.

Figure 3-1. Ratio Adjustment Algorithm

$$I_{EP} = \frac{I_{EPS}}{I_{EAS}} * I_{EA}$$

Where

I_{EP} = the evaluated population impact
I_{EA} = the expected population impact
I_{EPS} = the evaluated impact from the sample
I_{EAS} = the expected impact from the sample

Residential Programs

Cool Homes

Participant Survey

The Cool Homes 2010 evaluation included a telephone survey with 141 program participants.[77] The evaluation team completed interviews with 70 participants who received a rebate for the early retirement of a central air conditioner (CAC) or heat pump,

[76] Judith T. Lessler and William D. Kalsbeek. Nonsampling Error in Surveys. 1992. p. 269.

[77] A number of applications submitted in 2009 were processed in 2010. However, given the length of time since these customers participated in the program, we did not call them as part of our survey effort.

and 71 participants who received a rebate for a ductless mini-split, furnace fan, geothermal heat pump, air source heat pump or split CAC (non-early retirement).[78] We fielded the participant survey between February 8 and February 16, 2011. The survey response rate was 17% with a cooperation rate of 45%.

We based the sample of Cool Homes' participants on the program-tracking database that LIPA provided. However, the database for this program does not contain customer telephone numbers. As a result, we used an automated look-up process to match participating custom addresses to telephone numbers. We also manually reviewed numbers that we were unable to match and ultimately achieved a 66% match rate. From this sample frame, we drew a simple random sample of 1,000 participants.

The evaluation team included all program participants in the sample frame. In cases where one individual received a rebate for more than one piece of equipment, we asked participants either about an early retirement measure (if they had one) or the measure with the fewest sample points (so that quotas could more easily be met). The following table presents the population values and completed survey information for the Cool Homes Program. The total sample size of 141 provides results at 90% confidence and 7% precision.

Table 3-4. Cool Homes Survey Sample Design

Measure	Database Population	Sample Frame	Sample	Completed Interviews
Split CAC Early Retirement	633	452	223	61
Split CAC Non-Early Retirement	1,449	978	498	46
Air Source Heat Pump Early Retirement	100	64	30	9
Air Source Heat Pump Non-Early Retirement	151	98	49	5
Ductless Mini-Split	399	298	137	14
Furnace Fan	259	106	51	5
Geothermal Heat Pump	50	29	12	1
Total	**3,050**	**2,025**	**1,000**	**141**

As a result of our oversampling of early retirement participants, we applied weights to the telephone survey data to match the composition of measures within the participant population. Table 3-5 shows the weights for the telephone survey data.

[78] We oversampled early retirement participants compared to their percentage in the population to allow for statistically representative results.

Table 3-5: Cool Homes Telephone Survey Weighting

Measure Type	Participant Population	Un-Weighted Survey	Weight
Early Retirement	15%	50%	0.31
Non-early Retirement	85%	50%	1.69

Contractor Survey

The Cool Homes evaluation also includes a quantitative survey of 28 participating HVAC contractors. We fielded the contractor survey between December 10, 2010 and February 17, 2011.[79] The survey response rate was 14% with a cooperation rate of 24%.

The evaluation team developed the sample frame for the contractor survey using data provided by LIPA program staff, supplemented by a list of HVAC contractors sourced from a national marketing database company. The sample frame included HVAC contractors from all zip codes on Long Island, including Queens and Brooklyn. We cross referenced the participating contractor list from LIPA with the supplemental sample list to ensure the representation of participating contractors. We then stratified based on company size (i.e., number of employees) and participant/non-participant status: Tier 1 firms have more than 20 employees while Tier 2 firms have 20 or less employees. Table 3-6 contains an overview of the sample frame for the survey effort.

Table 3-6. Cool Homes Contractor Survey Sample Design

Sample Group	Target Completes	Completed Interviews
Tier 1	10	2
Tier 2	15	26
Total	**25**	**28**

As shown in the table, we implemented a stratification scheme in an attempt to oversample the largest contractors (as a percentage of the population), and thus a higher "coverage" of total HVAC sales (i.e., the respondents represent a greater percentage of total HVAC sales than would be realized through a non-stratified, random sample).

Home Performance Programs

The 2010 Home Performance program evaluation included a telephone survey with 176 program participants. The survey included completed interviews with 70 participants in the Home Performance Direct (HPD) program, 70 participants in the Home Performance with ENERGY STAR (HPwES) program, and 36 participants who took part in both programs.[80] We fielded the participant surveys between January 24 and February 6, 2011. The survey

[79] We are conducting an additional survey of non-participating contractors as part of the HVAC Market Characterization study.

[80] Opinion Dynamics refers to HPwES-only participants as "free market" participants and those who participated in both programs as "follow-up" customers.

response rate for HPwES was 14% with a cooperation rate of 36%. For HPD, the survey response rate was 20% with a cooperation rate of 45%.

We based the sample of Home Performance participants on the program-tracking files that LIPA provided, and we included all unique program participants with valid contact information in the sample population. From this sample frame, we drew a simple random sample of 1,100. The total number of completed interviews for both HPD and HPwES provide results at 90% confidence and 10% precision.

Table 3-7. Home Performance Participant Survey Sample Design

Program	Database Population[a]	Sample Frame	Sample	Completed Interviews
Home Performance Direct	997	982	400	70
Home Performance with ENERGY STAR				
Follow-Up Customers (HPD & HPwES)	766	757	577	70
Free Market Customers (HPwES Only)	166	157	123	36
Total	**1,929**	**1,896**	**1,100**	**176**

[a]The database population is defined as the number of unique households by Site ID.

When presenting results of the combined (follow-up and free market) HPwES program, we applied weights to the telephone survey data to match LIPA's population of participating customers in each HPwES program component. Table 3-8 shows the weights for the telephone survey data.

Table 3-8: HPwES Telephone Survey Weighting

Participant Type	Participant Population	Un-Weighted Survey	Weight
Follow-up	82%	66%	1.24
Free Market	18%	34%	0.52

The evaluation team conducted an un-weighted analysis of the HPD survey data.

REAP

The REAP evaluation included a telephone survey with 100 program participants. Opinion Dynamics fielded the survey between January 12 and January 15, 2011. The survey response rate was 26% with a cooperation rate of 62%.

The sample of REAP participants was based on the program-tracking database that LIPA provided in November 2010, and we included all program participants with valid contact information in the sample population (approximately 81% of the population). We drew a simple random sample of 500 participants for fielding the survey. The following table

outlines the participant population and completed interviews for the REAP survey. The evaluation team conducted an un-weighted analysis of the survey data. The total completed sample size of 100 provides results at 90% confidence and 8% precision.

Table 3-9: REAP Participant Survey Sample Design

Program	Database Population[a]	Sample Frame	Sample	Completed Interviews
REAP	2,900	2,357	500	100

[a]The total number of participants listed reflects the population in LIPA's tracking system as of November 15, 2010. The final population of participants changed after the date of this extract and is reflected elsewhere in the report.

Note: Participant totals are based on unique Enrollment ID number.

EEP

The EEP program includes upstream incentives for lighting products and room air conditioners and direct-to-consumer rebates for select household appliances, pool pumps, and appliance recycling For the 2010 evaluation of the EEP program, the evaluation team focused on the three program measures—excluding lighting—with the largest expected demand and energy savings: dehumidifiers, appliance recycling and room air conditioners. We conducted surveys with dehumidifier and appliance recycling participants to gather data needed for the evaluation. Because the EEP program offers discounts for room air conditioners at the retail level, upstream of the retail customer, program records did not include contact information for program participants. We conducted interviews with participating room air conditioner retailers instead of program purchasers. We also conducted interviews with participating lighting retailers to help evaluate program performance.

Dehumidifier Participant Survey

The 2010 EEP evaluation included a telephone survey with 70 Dehumidifier program participants conducted between January 13 and January 15, 2011. The survey response rate was 20% with a cooperation rate of 49%.

We used participant data received from LIPA that contained participants through October 2010 to construct the sample frame. Of the 3,621 participants in the program-tracking data, we removed 139 contacts because of missing or invalid phone numbers (see Table 3-10). From this sample frame, we drew a simple random sample of 400 participants. The completed sample size of 70 provides results at 90% confidence and 10% precision.

Table 3-10. Dehumidifier Program Participant Survey Sample Design

Database Population	Sample Frame	Sample	Completed Interviews
3,621	3,482	400	70

Refrigerator Recycling Participant Survey

The EEP 2010 evaluation included a telephone survey with 70 Refrigerator Recycling Program participants. We used participant data received from LIPA that contained participants through December 2010 to construct the sample frame. The program database contained 4,228 unique participants.[81] Because some participants recycled more than one appliance, the total number of participants is less than the sum of the participants recycling refrigerators and freezers. The program database contained valid contact information for all participants; therefore, the sample frame is the participant database. From this sample frame, we drew a simple random sample of 250 participants (see Table 3-11).

To limit the survey burden placed on respondents, interviewers asked respondents about only one appliance. If the respondent recycled two of the same type of appliance, the interviewer asked the respondent to think only about one appliance when answering the questions. To ensure that we completed interviews with the smaller population of freezer recyclers, we asked respondents only about their freezer if they recycled both a refrigerator and a freezer. We completed 59 interviews that focused on refrigerators and 11 focused on freezers. The total sample size of 70 provides results at 90% confidence and 10% precision.

Table 3-11. Refrigerator Recycling Program Participant Survey Sample Design

Appliance	Participant Population	Sample	Completed Interviews
Refrigerator	3,631	215	60
Freezer	771	42	11
Total [a]	**4,228**	**250**	**70**

[a]These totals are less than the sum of refrigerators and freezers because a participant may have recycled one of each type of unit.

We fielded the participant survey between January 18 and January 20, 2011. The survey response rate was 31% with a cooperation rate of 72%.

Room Air Conditioner Retailer Interviews

The evaluation team interviewed 10 retailers participating in the Room Air Conditioner program from January 28 to February 4, 2010. Because one retail chain represented roughly 90% of program sales with 18 retail locations, we limited that retailer to only three store-level interviews and one corporate-level interview to get a wider perspective of the program. Therefore, five of the respondents represented the top-selling store locations,

[81] The database we received from LIPA and used to draw the sample for the participant survey contained 4,228 participants who recycled a total of 4,504 appliances. We later learned that we were missing some participants, so the totals in this section do not match the final totals in the impact and process sections of the report.

while the remaining five represented the bottom-selling store locations because they were the single-store locations with fewer sales.

Table 3-12: Room Air Conditioner Retailer Interviews Sample Design

Retailer Type	Population	Target Completes	Completed Interviews
Local Chain	18	4	4
Local Single Store	8	6	6
Totals	**26**	**10**	**10**

Lighting Retailer Interviews

We conducted interviews with 12 participating lighting program retailers from January 28 to February 14, 2010. We attempted to complete interviews with two store locations for each of the top-selling three retail chains and one interview with each the remaining retail chains. We first attempted to interview store managers whose stores had the greatest sales for each retail chain. If a top-selling manager declined the interview or was not available after multiple attempts, we replaced him/her with the manager with the next highest sales. In the end, we interviewed twelve store-level managers and one corporate-level buyer about their experiences with the program.

We had originally intended to complete 30 interviews with both participating and non-participating store managers. After completing several interviews, however, we learned that most retailers could not provide the information on sales and stocking practices that we had hoped to receive. Therefore, we reduced the number of target completes as fewer interviews are necessary to evaluate retailer satisfaction and experiences with program processes.

Table 3-13. Lighting Retailer Interviews Sample Design

Participating Population	Target Completes	Completed Interviews
430	30	12

We made numerous attempts to speak with non-participating lighting retailers to assess barriers to program participation. Unfortunately, non-participating retailers were unwilling to speak with us because either corporate policies forbid it, or, as store-level managers, they are not involved in decisions to participate in the LIPA program.

Solar PV Program

In support of our evaluation of LIPA's Solar PV program, we conducted quantitative telephone surveys of program participants and in-depth interviews with a sample of participating contractors.

Participant Surveys

The Solar PV Program evaluation included a telephone survey with 71 participants from the Solar Pioneer program and 32 participants from the Solar Entrepreneur program in 2010. We fielded the Solar Pioneer survey from February 15 to February 21, 2011. The survey response rate was 22% with a cooperation rate of 60%. We fielded the Solar Entrepreneur survey from February 15 to March 17, 2011. For the Solar Entrepreneur survey, the response rate was 36% with a cooperation rate of 53%.

We drew the sample from the Solar PV program-tracking database that LIPA provided. Many of the participants did not have complete contact information. We matched participant account information with the 2009 LIPA Customer Information System (CIS) database to identify phone numbers for the nonresidential participants. For the residential participants, we took an additional step of conducting a reverse-lookup of phone numbers using the participant address provided in the program-tracking files. In the end, we obtained phone numbers for 72% of Solar Entrepreneur and 87% of Solar Pioneer participants.

The participants with valid contact information comprised the survey sample frame. We drew a sample of 400 Solar Pioneer participants and completed interviews with 71. We drew a sample of 128 Solar Entrepreneur participants and completed interviews with 32.

Table 3-14. Completed Solar PV Program Survey Points

Program	Population Database	Sample Frame	Sample	Completed Interviews
Solar Pioneer Program	1,185	1,027	400	71
Solar Entrepreneur	172	123	123	32

Contractor Interviews

We conducted in-depth interviews with two contractors from firms that participate in the Solar PV Program. As the program tracking data did not include participating contractor information, we drew our sample from the Renewable Energy Long Island website, which lists contractors who perform solar PV system installations. We made ten calls and completed one interview with a participating Solar PV contractor. Although the contractor list on the Renewable Energy Long Island website is extensive, it is unclear whether all contractors participated in LIPA's Solar PV program. We also completed an interview with a Solar PV contractor that we interviewed as part of the Backyard Wind program.

The interviews with contractors focused on application procedures; program roles and responsibilities; and sales practices, marketing strategies, and program challenges—providing feedback or suggestions on how the program could improve such practices to increase program participation, and measure uptake. We also discussed potential areas for program improvement.

Backyard Wind Program

Participant and Contractor Interviews

We took the sample of Backyard Wind participants and contractors for in-depth interviews from the program tracking files that LIPA provided on January 21, 2011 We attempted to interview all six program participants and completed six. We also interviewed three contractors who installed the systems.

3.2 Analytical Methods

The evaluation team used a variety of analytical methods to generate the 2010 process and impact findings. Table 3-15 provides a summary of analytic methods used to evaluate program processes and impacts by program. We utilized an engineering review of deemed savings to determine ex post savings for all programs. For the Commercial Efficiency program, we augmented the impact assessment with engineering desk review and M&V site visit analysis of a statistically valid sample of custom projects. For the REAP and Home Performance programs, we validated our engineering results with a billing analysis. We relied heavily on the quantitative analysis of participant survey data and qualitative in-depth interviews to inform the process assessment for most programs.

Table 3-15. Primary Analytical Methods used in 2010 Evaluation

Method	Purpose	CEP	EEP	Cool Homes	HPwES / HPD	REAP	Solar PV	Backyard Wind	Info & Ed	New Homes
Qualitative analysis of in-depth interviews	Process	✓	✓	✓	✓	✓	✓	✓		
Quantitative Telephone Surveys	Process/ Impact	✓[a]	✓	✓	✓	✓	✓			
Descriptive statistics (means, frequencies, etc)	Process	✓	✓	✓	✓	✓	✓	✓		
Billing Analysis	Impact				✓	✓				
Engineering Review of Algorithms	Impact	✓	✓	✓	✓	✓	✓	✓	✓	✓
Engineering Desk Review of Custom Projects	Impact	✓								
Onsite M&V of Custom Projects	Impact	✓								

[a]Telephone surveys were not designed to serve as a source for impact analysis for CEP.

The remainder of this section describes key analytic approaches used to develop the findings presented throughout the report.

Analysis of Interval Metered Data

The evaluation team used interval metered data that LIPA provided to determine ex post energy and demand savings for the Solar PV program. We collected interval-metered data on a total of 39 rebated solar PV installations The sampling of data is statistically valid, providing over 90% confidence and a precision within 15%. Our analysis evaluated the total performance of the sampled units, relative to the database-predicted performance. Both the interval metered data and database values used AC watts, initially at the customer meter. Then, we adjusted reported results for line losses to reflect savings at the generator. Note that our analysis methodology determined a realization rate for the sampling, and then applied it to the population. This methodology weights the impact by size, ensuring that large projects have a more significant influence on overall results.

Table 3-16. Gross Impacts

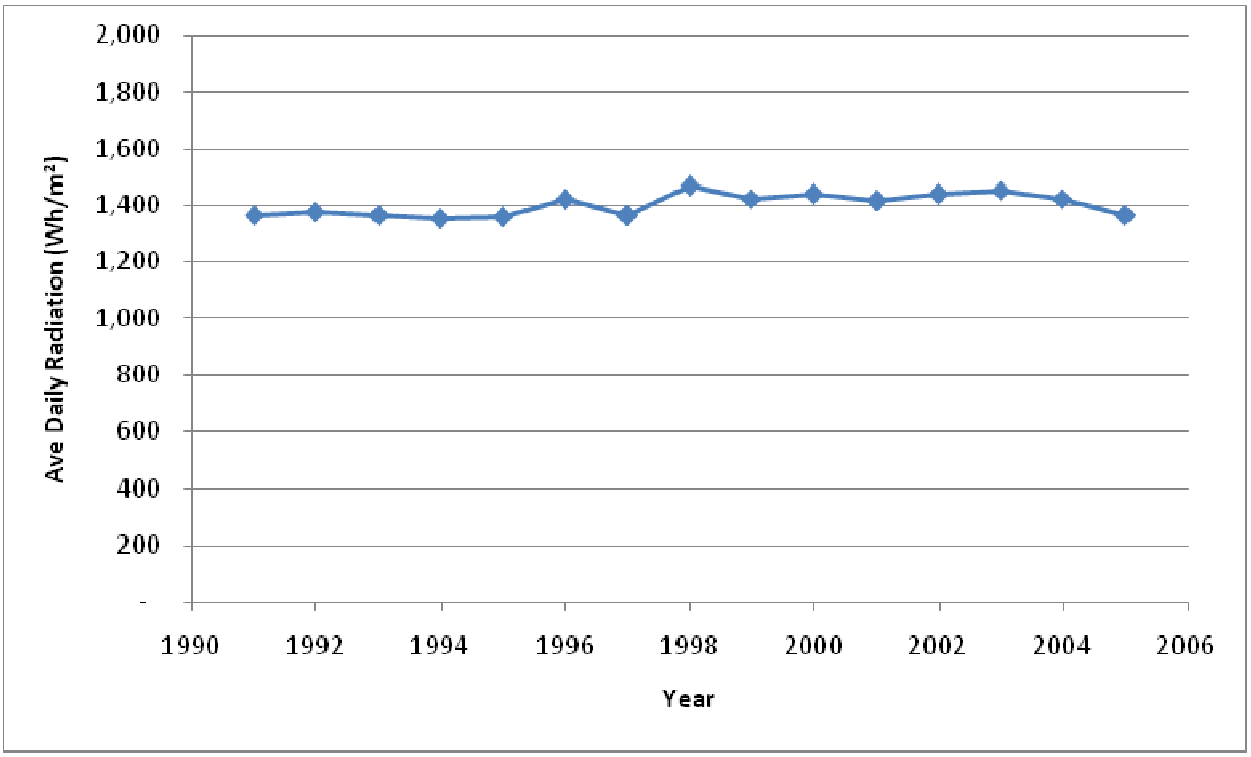
Sector	Ex Ante		Ex Post		Realization Rate	
	MW	MWh	MW	MWh	MW	MWh
Residential	5.18	11,122	3.26	9,009	63%	81%
Commercial	0.66	1,421	0.42	1,151	63%	81%
Not for Profit	0.74	1,606	0.47	1,301	63%	81%
Total	**6.58**	**14,149**	**4.15**	**11,461**	**63%**	**81%**

Our ex post energy analysis used the available Long Island interval metered sites to calculate the percent of expected savings for the sites based on actual operating conditions. We applied the calculated percentage to the overall population to obtain impacts.[82] The measured kWh in 2010 fell short of the database-predicted performance by 19%, resulting in a realization rate of 81%.

The ideal situation would have been to obtain the actual solar radiation in Long Island over several years to determine if 2010 was a "less sunny" or average year (which would affect the output of the PV units). However, solar radiation data is not like temperature data, and few weather stations routinely gather insolation. Islip gathered this data, but only through 2005. Therefore, we reviewed historic annual solar radiation data for Islip, New York, to determine the fluctuations in annual solar radiation and see if there are truly large swings in insolation as there are for temperature from year to year. The data showed that throughout the course of an entire year, solar weather patterns have little fluctuation from year to year. Figure 3-2 shows that the solar radiation in Islip has little fluctuation from year to year (standard deviation of 40 Wh/m^2 or 3%). This indicates that our analysis based on 2010 performance will be indicative of expected future performance.

[82] Both the metered and database data were AC watts at the customer meter.

Figure 3-2. Islip Solar Radiation Trend



Net-to-Gross Analysis

One objective of energy efficiency program evaluations is to identify the portion of the gross energy savings associated with a program-supported measure or behavior change that would not have been realized in the absence of the program. The program-induced savings, indicated as a net-to-gross ratio (NTGR), is made up of two concepts—free ridership (FR) and spillover (SO), and is calculated as (1-FR+SO)..

- Free riders are program participants who would have implemented the incented energy efficient measure(s) irrespective of the program's existence.
- Participant spillover refers to non-program specific energy efficient installations or behaviors that were influenced by an energy efficiency program, but did not receive an incentive from a program.

Evaluators have typically estimated the NTGR through a variety of techniques, the most common method of which is the self-report approach (SRA). The SRA offers a number of advantages over other techniques, including:

- *The SRA can be conducted without a control group.* Identifying a valid control group can be a difficult, if not impossible, process. For example, program participants often have substantial differences from the non-participant population (e.g., socio-economic variables, attitudes and behaviors), and the non-participant population is still often exposed to program marketing and outreach, making it more difficult to find a true, "uncontaminated" baseline.

- *The SRA can leverage survey efforts that accomplish other objectives, such as process and impact evaluation data collection.* The SRA can be administered via a battery of telephone survey questions, and thus can leverage survey efforts that explore many other topics, including program satisfaction, market drivers and barriers, and impact evaluation data acquisition (e.g., measure persistence, usage characteristics, or site visit recruitment).

In 2007, the California Public Utilities Commission created a document containing guidelines for using the SRA.[83] The purpose of the guidelines was to develop a set of essential issues that evaluators using SRA should consider, together with some recommendations on "best practices" for SRA implementation. Our evaluation team specifically addressed and adhered to as closely as possible each of the issues presented below.

1. Timing of the Interview. To minimize the problem of recall, SRA interviews should be conducted with the decision maker(s) as soon after the installation of equipment as possible. We conducted all surveys in late 2010 or early 2011, and thus contacted most respondents within 12 months of program participation.
2. Identifying the Correct Respondent. Recruitment procedures for participation in an interview involving self-reported net-to-gross ratios must address the issue of how the correct respondent(s) will be identified. In the 2010 evaluation, we used the SRA for residential customers only, and screened customers to ensure that they were aware of program participation.
3. Set-Up Questions. It [is] essential that the interviewer guide the respondent through a process of establishing benchmarks against which to remember the events of interest We used a series of "set-up questions" that set the mind of the respondent into the train of events that led to the installation
4. Use of Multiple Questions. Evaluators should assume that using multiple questionnaire items to measure a construct such as free-ridership is preferable to using only one item since the use of multiple items increases reliability. We used a series of questions, including open-ended responses, to help assess the NTGR.
5. Validity and Reliability. The validity and reliability of each question used in estimating the NTGR must be assessed. We used an abbreviated set of questions from the California SRA algorithm, which underwent significant validity and reliability testing. We selected the modified approach, rather than the full algorithm, to limit the burden and potential survey fatigue on the respondent.

[83] Energy Division of the California Public Utilities Commission. 2007. Guidelines for Estimating Net-To-Gross Ratios Using the Self-Report Approaches. Developed by the Master Evaluation Contract Team. October 2007.

6. **Consistency Checks**. When multiple questionnaire items are used to calculate a free-ridership probability, there is always the possibility of apparently contradictory answers. We included consistency checks, as well as open-ended clarification questions for respondents that gave inconsistent answers.
7. **Making the Questions Measure-Specific**. It is important for evaluators to tailor the wording of central free-ridership questions to the specific technology or measure that is the subject of the question. We asked respondents questions regarding one measure at a time and clearly identified the measure of interest during the survey.
8. **Partial Free-ridership**. Partial free-ridership can occur when, in the absence of the program, the participant would have installed something more efficient than the program-assumed baseline efficiency but not as efficient as the item actually installed as a result of the program. The telephone surveys probed for respondents that would have installed some, but not all, of the program measures (e.g., some of the direct install lighting measures).
9. **Deferred Free-ridership**. Deferred free riders are those customers who would, in the absence of the program, have installed exactly the same equipment that they installed through the utility DSM program, but the utility induced them to install the equipment earlier than they would have otherwise. That is, the utility accelerated the timing installation of the equipment installation. Once again, the telephone surveys probed for a timing effect.
10. **Scoring Algorithms** As discussed below, the telephone survey used a scoring algorithm to assign each respondent a unique free ridership score.
11. **Handling Non-Responses and "Don't Knows."** Respondents that answered "don't know" or refused to respond to certain questions were, as much as possible, kept in the analysis and scored based on the questions they could answer. If a respondent, however, could not answer the majority of NTG questions, however, we dropped that respondent from the scoring.
12. **Weighting the NTGR**. We utilized NTGR weights, based on the expected energy savings, where appropriate (e.g., responses regarding the lighting and air sealing free ridership for the Home Performance Direct were weighted based on the respective energy savings of each measure).
13. **Ruling Out Rival Hypotheses**. An evaluator should attempt to rule out rival hypotheses regarding the reasons for installing the efficient equipment. The use of open-ended responses, particularly for spillover, helped the evaluation determine true attribution and rule out alternative hypotheses.
14. **Precision of the Estimated NTGR**. All sample sizes were selected so that the SRA would provide estimates with 90% confidence and 10% precision.
15. **Pre-Testing Questionnaire**. We pre-tested all surveys prior to fielding.
16. **The Incorporation of Additional Quantitative and Qualitative Data in Estimating the NTGR**. For most measures, we utilized the SRA. For central air conditioners, however, we will rely on supplemental approaches, including focus groups.

17. **Qualified Interviewers**. For the basic SRA in the residential and small commercial sectors, the technologies discussed during the interview are relatively straightforward (e.g., refrigerators, CFLS, T-8 lamps, air conditioners). In such situations, using the trained interviewers working for companies that conduct telephone surveys is acceptable. We used our own, in-house call center with fully trained, professional staff to conduct all surveys.

Measure Selection and Algorithms for Net-to- Gross Analysis

The 2010 LIPA programs included a large number of measures, not all of which could be included in the NTG assessment. The evaluation team, therefore, prioritized the measures based on their contribution to energy and demand savings, and selected a number of measures for the study. Below, we present each measure, along with more details regarding the approach.

EEP Program - Dehumidifiers

Dehumidifiers, offered as part of the Energy Efficiency Products program, represent one of the program's top contributors to demand savings, and thus were included in the NTG assessment.

Free Ridership

For each survey respondent, we developed a free ridership score that consists of three scores: overall program influence, partial program influence, and influence of program components. All scores range from 0 to 1 where 0 indicates the respondent is not a free rider and 1 indicates the respondent is a complete free rider. The average of these three scores produces the final free ridership rating

Overall Program Influence

The first question asks when respondents learned about the rebate—before or after they decided to purchase the dehumidifier.

> N0. When did you first learn that you could receive a ten dollar rebate from LIPA for purchasing an energy efficient dehumidifier? Was it before or after you purchased your dehumidifier?

If the respondent learned about the rebate after purchasing the dehumidifier, we confirm that response with a follow-up question. If confirmed, the respondent is considered a free rider and does not receive any further questions about the purchasing decision.

> N0a. Just to be clear, did you buy your dehumidifier and then later learn that you could get $10 from LIPA?

Respondents who learned about the rebate before they purchased the dehumidifier were asked the following question to determine overall program influence:

> N7. If the ten dollar rebate had NOT been available, what is the likelihood that you would have purchased the exact same dehumidifier? Please use a scale from 1 to 7, where 1 is "Not at all likely" and 7 is "Extremely likely".

Partial Program Influence

Respondents who say they would have been likely to purchase the same dehumidifier in the absence of the program (i.e., free riders), were asked if the program influenced the timing of their purchase.

> N8a. Did the ten-dollar rebate cause you to purchase your dehumidifier earlier than you were planning or did the rebate have no influence on when you purchased it?

Respondents who purchased their dehumidifier earlier due to the program were asked when they would have made the purchase if the rebate had not been available:

> N8b. If you hadn't received the ten-dollar rebate, when would you have purchased your dehumidifier? Would you say within 3 months of when you did, 3 to 6 months later,6 months to a year later, or more than a year later?

The program was given credit for purchases made earlier. The adjustment varies depending on how much earlier the purchase was made

Influence of Program Components

The program can influence purchase decisions through several mechanisms: the rebate, retailer training, and marketing materials. We asked a question about each:

> N10. I'm going to ask you to rate the importance of several factors that might have influenced your decision to buy a higher efficiency dehumidifier as opposed to a STANDARD efficiency dehumidifier. Please use a scale from 1 to 7, where 1 means not at all important and 7 means extremely important. How important was
>
> a. The availability of the ten dollar LIPA rebate
> b. Recommendation from the retailer
> c. Information in any marketing materials

Greater importance of the program components means a lower level of free ridership.

Spillover

To assess spillover, we asked respondents whether they had taken any energy saving actions outside of a program since purchasing their dehumidifier through the LIPA program. These actions had to be due to their program participation. We found no evidence of Dehumidifier program spillover.

EEP Program - Refrigerator Recycling

Refrigerator recycling, offered as part of the Energy Efficiency Products program, represents one of the program's top contributors to demand savings, and thus was included in the NTG assessment.

Free Ridership

The purpose of the appliance recycling program is to reduce the number of older appliances operating within a utility's service territory. A program free rider is someone who would have disposed of their appliance on their own in a manner that takes the appliance off the grid so that another LIPA customer cannot use it. Customers who would have gotten rid of their old appliance on their own are not automatically free riders. What they would have done with the appliance is a critical part of free ridership estimation.

Without the LIPA program, participants could have done one of the following things with their appliance:

- The participant could have kept the appliance but stored it unused.
- The participant could have kept the appliance and used it.
- The participant could have gotten rid of the appliance in a manner leading to its eventual destruction.
- The participant could have gotten rid of the appliance in a manner that allowed it to be used by someone else.

Of these scenarios, two—appliances kept but stored unused and those discarded in a manner leading to destruction—are considered free riders since the refrigerator or freezer would not have continued to consume energy in absence of the program. In both of the other scenarios, the appliance would have remained active had the program not intervened and recycled the appliance.

We asked respondents several survey questions to determine what they would have done with their appliance in the absence of the program and to ultimately fit them into one of the four scenarios.

First, we determined whether the respondent would have kept the appliance or gotten rid of it if the program had not existed:

> A2. Had LIPA's Refrigerator Recycling Program not been available, what would you most likely have done with your old <SURVEYAPP>? Would you have still gotten rid of it or would you have kept it?

Respondents who said they would have kept the appliance were asked if they would have used it or stored it:

> A5. Since you would have kept the <SURVEYAPP> had LIPA's Refrigerator Recycling program not been available, would you have kept it plugged in or stored it unplugged indefinitely?

We considered respondents free riders if they said they would have stored the appliance unplugged. Respondents are not free riders if they would have kept the appliance and used it.

Respondents who said they would have gotten rid of their appliance if the program had not been available were asked how they would have done that:

> A7. Since you wouldn't have kept the appliance, what would you have most likely done with the <SURVEYAPP> had you not gotten rid of it through LIPA's Refrigerator Recycling program? Would you have…
>
> 01. Sold it
> 02. Given it away for free
> 03. Taken it to a dump or a recycling center
> 04. Hired someone to take it to a dump or recycling center
> 05. Had it removed by the store where you got your new appliance

We considered respondents free riders if they said they would have taken the appliance or hired someone to take it to a dump or recycling center or had it removed by the store where they got their new appliance. We assumed, given the old age of most appliances, that the resale market for such appliances was small and retailers would not be able to sell them to a dealer for resale. We did not consider respondents free riders if they said they would have sold the appliance on their own or given it away for free.

Spillover

To assess spillover, we asked respondents whether they had taken any energy saving actions outside of a program since participating in the refrigerator recycling program. These actions had to be due to their program participation. We found no evidence of refrigerator recycling program spillover.

EEP Program - Room Air Conditioners

Room air conditioners also represent an important contributor to demand savings for the Energy Efficiency Products program. As an upstream program, however, incentives are paid to retailers rather than end-use customers. The evaluation team conducted a telephone survey of participating Room AC retailers. While the retailers provided valuable information regarding their program satisfaction and recommendations for program improvement, they were unable to provide a reliable assessment of the program influence on their sales (i.e., what sales "lift" the program might have provided). Therefore, we were unable to calculate an NTGR from the interviews, relying instead on the ex ante value.

Home Performance Direct and Home Performance with Energy Star

Home Performance Direct (HPD) and Home Performance with ENERGY STAR (HPwES) were both important contributors to the residential energy savings, and thus were included in the NTG assessment.

HPD Free Ridership

For HPD, the top measures for energy savings were CFLs and air/duct sealing, so the questions focused on these two end-uses.

For each survey respondent, we developed a free ridership rating that consists of two scores, overall program influence and partial program influence. Both scores range from 0 to 1 where 0 indicates the respondent is not a free rider and 1 indicates the respondent is a complete free rider

Overall Program Influence: CFLs

For CFLs, respondents were first asked a program influence question:

> CN3. Before the home assessment, did you have any CFLs installed in your home?"

Respondents that answered "yes" to this question, were considered likely free riders.

Partial Program Influence: CFLs

Likely free riders were asked whether the program influenced the quantity and timing of the CFL installation:

> CN4. If you had not received free CFLs during the home assessment, would you have installed the same number or fewer CFLs than were installed?
>
> CN5. If you had not received free CFLs from the home assessment, when would you have bought CFLs on your own?

Respondents who would have purchased fewer CFLs than installed or purchased the CFLs over a year from the installation date were considered partial free riders.

Overall Program Influence: Air/Duct Sealing

Respondents that had air sealing and/or duct sealing were asked if they were planning to perform air and/or duct sealing before learning about the program:

> DN3. Before learning about the HPD program, were you already planning to perform <SEALTYPE>?

Respondents who said "yes" were considered potential free riders.

Partial Program Influence: Air/Duct Sealing

Potential free riders were asked if the work was already in their budget:

> DN4. Was it already in your budget to perform <SEALTYPE> before you learned about the HPD Program?

Respondents who had not budgeted for the work were considered partial free riders.

Those who had budgeted for the work were asked if the program impacted the timing of the work.

DN5. Would you say it happened earlier than you had originally planned BECAUSE of the comprehensive home assessment?

No respondents, however, reported that the program impacted the timing of the installation.

HPwES Free Ridership

For HPwES, there were a number of key savings measures, including insulation, lighting, hot water measures, air/duct sealing, and windows/doors. Participants who performed air or duct sealing were asked about that measure because these measures resulted in the greatest energy savings. If the participant did not perform air or duct sealing, we randomly selected a measure from those they did install.

For each survey respondent, we developed a free ridership rating that consists of three scores, overall program influence, partial program influence, and influence of program components. All scores range from 0 to 1 where 0 indicates the respondent is not a free-rider and 1 indicates the respondent is a complete free-rider. The average of these three scores produces the final free ridership rating.

Overall Program Influence

First, respondents were asked about when they learned about the incentive:

N1. When did you first learn that you could receive a rebate from LIPA for the <MEAS1>? Was it before or after < RMEAS1>ing your <MEAS1>?

Respondents who learned of the rebate after measure installation were considered free riders and did not receive any additional questioning about their decision making:

Respondents who learned of the rebate before the measure installation were asked to report on the overall program influence:

N3. If the LIPA program had NOT been available, what is the likelihood that you would have < RMEAS1>ed the <MEAS1> at all? Please use a scale from 1 to 7, where 1 is “Not at all likely” and 7 is “Extremely likely”.

Partial Program Influence

Respondents who said it was likely that they would have installed the measure on their own without the program were asked if they installed it earlier due to the program (partial free riders):

N5a. Did the LIPA rebate cause you to < RMEAS1> <MEAS1> earlier than you were planning or did the rebate have no influence on when you did it?

Influence of Program Components

The program can influence decisions to make energy efficient home improvements through several mechanisms: the rebate, the home assessment, and marketing materials. Some measures also had federal tax credits available, which could have also played a role. We asked a question about each:

N6. I'm going to ask you to rate the importance of several factors that might have influenced your decision to < RMEAS1> the <MEAS1>. Please use a scale from 1 to 7, where 1 is "not at all important" and 7 is "extremely important". How important was…?

N6a. The availability of the LIPA rebate

N6d. [ASK IF MEAS1=INSULATION or WINDOWS/DOORS] The availability of Federal tax credits

N6b. The Comprehensive Home Assessment

N6c. Information from the LIPA marketing materials

We calculated an overall program component influence score based on the responses to these questions. After analysis of the results, we decided to exclude the response to the federal tax credit question. The tax credit and the LIPA rebate appear to have had an equal influence on decision making, and we felt it was unfair to penalize the program because of availability of the tax credit.

HPD and HPwES Spillover

Spillover for the Home Performance Programs was assessed via a number of questions that determined if the respondent—as a direct result of the program—installed additional efficiency measures, or adopted energy efficiency behaviors, but did not receive any additional utility rebates as part of these savings. First, respondents were asked if they took any actions, and if so what these were:

SO2. Since your participation in the LIPA HPD Program, have you made any additional energy saving home improvements for which you did NOT receive a utility incentive or rebates?

SO3. What additional improvements did you make since the assessment to reduce your household energy consumption?

Respondents that made improvements were then asked to describe, on both an anchored scale and through their own words (in an open-ended question), the impact of the program on their improvements.

SO4. How much influence did your experience with the LIPA HPD program have on your decision to make these additional improvements? Use a scale from 1-7, where 1 is "no influence at all" and 7 is "a great deal of influence". [1-7, 98=DK, 99=Ref]

SO5. Can you explain how your participation in the HPD program influenced your decision to make these additional improvements?

Only respondents that answered a "6" or "7" in terms of program influence, and who didn't provide contradictory answers in the open-ended question, were considered candidates for spillover. For each respondent that met these criteria, the savings

from the additional actions were quantified, and then compared to the savings from their program measures. Spillover was calculated as the sum of the additional savings, divided by the sum of the net (of free ridership) savings, for all program participants (calculated separately, however, for HPD and HPwES).

Estimation of Savings Using Billing Analysis

The evaluation team used billing analysis to estimate ex post energy and demand savings for the Home Performance program. Specifically, we used fixed effects panel model to examine pre- versus post-participation energy usage participant homes and estimate savings due to program participation. The analysis captures the average effect on energy consumption that is directly attributable to LIPA program measures. We then compared the results from the billing analysis with engineering-based estimates of evaluated Ex Ante savings (reported in the 2009 Annual Report) to develop a savings realization rate for 2009 participants.

The Home Performance program is designed to encourage follow-up measure installation through the HPwES program. Given the overlap in participation between these programs, we combined HPD and HPwES participants into a single model, to capture the effect of installing measures within both programs. We used 2009-2010 participation data to determine which measures each participant installed, and used measure level engineering estimates of savings for the statistically adjusted engineering (SAE) analysis. Since some 2009 HPD participants did not participate in HPwES until 2010, we also examined 2010 data to ensure that we captured all relevant measure installation information related to the Home Performance programs.

We adjusted the model for weather, control for individual factors (i.e., unobserved household-specific characteristics that may affect energy usage), and control for unobserved time period factors (i.e., unobserved time-varying factors such as the macroeconomic climate that may affect energy usage).[84] The model look at each customer's average daily consumption in each electric billing period as a function of energy-saving measures installed through the program, weather, unobserved household-specific factors, and unobserved time period-specific factors.

The final model specification is expressed in algorithm form in Section 3 of this report.

Savings Estimation Approach

To estimate savings attributed to the program, we used the regression models to estimate average daily consumption for participant households in the presence and absence of program intervention. We evaluated these consumption values at the sample means of average daily heating degree days and average daily cooling degree days. For Home Performance, we calculated separate average daily consumption values based on program participation type – Home Performance Direct Only, HPD and HPwES, and HPwES Only (Free Market). We then compared modeled savings (the difference between our modeled

[84] We included the billing data of 2010 participants prior to the date of their first installation date to serve as a comparison group to control for time-varying energy consumption trends – in other words, to approximate the energy usage we'd expect from participant households in the absence of program measures.

estimates of pre-participation average daily consumption and post-participation average daily consumption) which the average daily savings expected for each program participant based on the measures they installed. Finally, we calculated realization rates for each combination of program participation variables, based on average modeled vs. expected savings.

Data Preparation

LIPA provided participation data at a participant (household) level and measure level for all customers who participated in the Home Performance programs from 2008-2009, and customers who participated in REAP from 2009-2010. LIPA also provided a billing history going back 30 months from February 2011 for 2009-2010 participants whose account identifier we could verify based on program data. Prior to carrying out the statistical modeling, some matching, cleaning, data quality assurance (QA) and transformations of the data were required. For analysis purposes, we focus primarily on the 2009 participant cohort, but retained 2010 participants as a comparison group, and cleaned 2010 participant and billing records to the same specifications as 2009 participants.

Cleaning Participation Data

HPD and HPwES

We used Home Performance project records (at a site ID level) as the basis for our analysis sample, because these records had home addresses, phone numbers, and customer names that we needed to match LIPA customer account information and a LIPA account number to each site ID. We drew our analysis sample from project records available in early January 2011. We then matched measure-level records to project-level records, and retained project-level records that matched job-level records. We dropped one participant for whom negative kWh savings estimates cancelled out positive savings estimates.[85]

We assigned program participation indicators—HPD Only, HPD and HPwES (Follow-Up HPwES) and HPwES Only (Free Market) to Home Performance Direct and HPwES participants based on any record of participation in either HPD or HPwES in program-to-date tracking (the beginning of the participant data). We dropped a minimal number of participants with non-standard program participation patterns—e.g., participated in HPwES prior to HPD, or participated in HPwES in 2008. After cleaning the measure data, we estimated average daily expected savings for each participant based on the sum of gross deemed kWh savings for all of the measures that each participant installed within HPD or HPwES. We used these expected savings values for the analysis population as the basis for realization rates.

[85] The HP participant database contains negative savings values. In many cases, these negative savings values are offset with a positive savings value for the same type of measure. Often these positive savings values are higher in magnitude than the corresponding negative value. All negative savings values were kept in the analysis so that we could analyze the sum of all deemed gross savings per household.

REAP

For REAP, we used Initial Site Visit records as the basis for our analysis sample, because these records had the LIPA customer account number associated with each job identifier (enrollment ID). If participant records tracked in participation data did not have an account number associated with the enrollment ID, we exluded them from analysis We drew our analysis sample from Initial Site Visit records available in early January 2011, which did not reflect complete information for 2010 REAP participants. Therefore, our 2010 participant group (serving as a comparison group for analysis) is smaller than the complete 2010 participant population.

We cleaned participant and measure data separately for both 2009 and 2010 Program Years. First, we identified and removed duplicate records, as well as records associated with master-metered accounts (based on the presence of duplicate account numbers associated with more than one participant household). For example, two or more enrollment identifiers, with similar street addresses but different apartment numbers and resident names, could be linked to the same LIPA customer account number.

When cleaning 2009 measure data, we identified and removed records with missing savings and zero quantities. In instances with positive kWh savings and zero quantities or positive quantities and missing or null savings, we removed an entire household from further analysis. Additionally, we looked at outliers by measure quantities and savings, and removed households with unfeasibly high lighting measure quantities (40 and above) and households with refrigeration removal measures (where savings were deemed unreasonable). We aggregated the remaining records into the four End Use categories, which were then rolled up to a unique household level (defined as unique Enrollment ID).

Finally, we merged the measure data set for 2009 participants into the project-level data set. We retained for further analysis only those participants whose clean measure data matched cleaned participant data. After cleaning the measure data, we estimated average daily expected savings for each participant based on the sum of gross deemed kWh savings for all of the measures that each participant installed within REAP. We used these expected savings for the analysis population as the basis for realization rates.

For 2010 measure data, we did not conduct any measure data cleaning and retained all households regardless of improvements they made or savings associated with those improvements. We aggregated the data by enrollment ID and used the first installation date as the cut-off for retaining 2010 participant billing records, as this group serves as the comparison group for analysis.

Matching Participant Information with LIPA Account Information

HPD and HPwES

Home Performance programs do not track LIPA customer account identifiers with participation records. Therefore, we manually matched customer data in the participation database to LIPA customer account information, using customer address, name, and phone number, when available. The participation database did not contain phone numbers for some participants, and did not contain apartment or unit numbers for most residential addresses. Thus, in many cases, it was difficult to match participant records to

account information based on phone number or address, especially if the same address (street number and name) occurred multiple times in LIPA account data with different unit numbers. In these cases, we attempted to verify street address matches based on customer name, though the customer name was not always available in participant data. Therefore, numerous Home Performance participant households were excluded from analysis due to unidentifiable LIPA account numbers.

For Home Performance programs, we compared customer information associated with billing data (provided from LIPA in February 2011) with customer information associated with participation data (generated in late 2010 and early 2011) to ensure that customer names, addresses, and phone numbers of program participants matched. In some cases, participant information did not adequately match customer account information in the final billing data file; we dropped these records from analysis.

REAP

The REAP program does track LIPA customer account information with participant records. We used the customer account numbers provided with participation data to match billing histories to program participants. Not all 2010 participant households are available for use as the comparison group as full 2010 participation data was not available until February 2011, after we submitted a request for billing data. However, we received billing history on all 2009 participant households with an account identifier and open account. We also dropped from analysis cases where billing data was unavailable for a customer account, likely indicating an account closure.

Cleaning Billing Data

We took a two-step approach to cleaning customer billing data. First, we removed individual billing periods—i.e., meter reads—that contained insufficient data for analysis. Second, we cleaned the data for customer accounts with anomalous or insufficient data for billing analysis. We describe each billing data cleaning criteria a below.

- **Cleaning individual billing periods:** We removed billing periods with a duration of zero days—i.e., same start and end data. Records for these billing periods either recorded zero kWh or positive kWh; many were the first read in the available billing history, or a Turn-On read. We also dropped billing periods lasting longer than 90 days, since we need to assign each billing period to a specific month for analysis purposes, and longer read periods would introduce greater error into the model. For participants who participated in 2010 only, we dropped all billing periods occurring after their first installation date, as these 2010 participants serve as the control group.
- **Non-fulltime Residents:** We restricted our analysis to customers without long periods of very low or zero consumption, to ensure that participants spent equivalent amounts of time in their homes in the months before and after program participation. We dropped households with average daily consumption at or below 0.5 kWh/day for four or more months per year, on average (across their billing history)
- **Inadequate billing history before program participation:** HPD and HPwES program measures are expected to generate energy savings in heating season, cooling season, and the shoulder months. To be able to assess changes in consumption due to program measures before and after installation, we required participants to have a

billing history covering heating and cooling months both before and after program participation. We dropped participants who did not have, at a minimum, 60 days of billing data from peak heating months, and 60 days of data from peak cooling months before each participant's first installation date. We defined peak heating and cooling months based on weather patterns in the 10 years prior to the participation year (1999-2008), and gave participants full credit for each billing day occurring within those months as well as partial credit for billing data in cooling months.[86]

- **Inadequate billing history after program participation:** We also required 2009 participants to have a minimum number of billing days in heating and cooling months after program participation. We dropped 2009 participants who did not have, at a minimum, 60 days of billing data from peak heating months, and 60 days of data from peak cooling months after each participant's last installation date.

Assigning Time Periods to Billing Data

The billing data was provided in billing cycle format, which means that customers have different read days and different read cycle lengths depending on their meter read cycle. For the analysis to be comparable across customers, it is necessary to assign each billing period to a specific calendar month, so that we can compare energy usage between customers, across time periods. We first assigned a month to each period based on the midpoint of the billing period—so that the month would refer to the month in which the majority of energy use occurred (e.g., if the read period started on June 20 and ended on July 19, we assigned that period to July). In cases where two, shorter read periods occurred within the same billing period, we combined kWh usage for both periods and recalculated average daily consumption across the combined period.

Incorporating Weather Data

We obtained daily weather data for the Long Island MacArthur (Islip) Airport in Suffolk County from the Northeast Regional Climate Center (NRCC). We chose Islip Airport as the basis for weather analysis based on discussions with LIPA forecasting staff and Islip Airport's central location in LIPA service territory. The daily data is based on hourly averages from each day. We calculated cooling degree days for each day (in the analysis and historical period) based on average daily temperature and dew point using the same formula as LIPA forecasting.[87] We calculated heating degree days from the average daily

[86] Long Island MacArthur Airport (Islip) in Suffolk County served as the weather station for all weather data. We used average daily temperature and dew point from the Northeast Regional Climate Center (NRCC) for 1999-2011 as the basis for historical and program period weather calculations. Heating and cooling months were defined by average daily heating degree days or cooling degree days in each month – peak cooling months are July and August, and peak cooling months are December, January and February. We also considered billing dats occurring in June, September, November, and March for participants who had less than 60 days of data in peak months.

[87] *A "degree day" is a unit of measure for recording how hot or how cold it has been over a 24-hour period. The number of degree days applied to any particular day of the week is determined by calculating the mean temperature for the day and then comparing the mean temperature to a base value of 65 degrees F. (The "mean" temperature is calculated by adding together the high for the day and the low for the day, and then dividing the result by 2.) If the mean temperature for the day is, say, 5 degrees higher than 65, then there have been 5 cooling degree days. On the other hand, if the weather has been cool, and the mean temperature is, say, 55 degrees, then*

temperature using a balance temperature of 65 degrees). We merged daily weather data into the billing dataset so that each billing period captures the heating degree days and cooling degrees for each day within that billing period (including start and end dates). For analysis purposes, we then calculated average daily heating degree days (HDDd) and average daily cooling degree days (CDDd), based on the number of days within each billing period.

Final Dataset

Ultimately, our Home Performance dataset includes 47,899 monthly and bimonthly billing records, reflecting electricity use for 2,156 participants, 814 of whom participated in the 2009 program year. About half (49%) of the 2009 participant population was available for analysis after data preparation and cleaning.

On-site Measurement and Verification and Desk Reviews

We evaluated the demand and energy impacts of LIPA's Commercial Efficiency program separately for prescriptive/not-for-profit projects and custom projects. For the prescriptive/not-for-profit projects, we reviewed program-tracking algorithms for the various prescriptive measures with updates to these algorithms made as needed (see Appendix C). We applied the associated changes to demand and consumption to the program-tracking data to obtain ex post impacts for each measure. For custom projects, we performed a focused M&V effort to determine the program impacts. We evaluated a representative sample of 20 custom sites via on-site monitoring and verification, and evaluated 20 more sites via desk reviews of each project's energy calculations.

On-site evaluation strategies varied depending on project category. The 20 visited sites featured categories as follows: lighting (11), controls (4), motors (2), refrigeration (1), HVAC (1), and whole building (1). We employed the following general metering and analysis strategies for each category:

- **Lighting**: The M&V process for lighting involved first verifying the quantities and types of installed fixtures and controls, as well as the characteristics of the baseline fixtures. On/off light sensors and light level loggers were deployed on a sample of fixtures where applicable. Hourly weekday and weekend operating schedules were determined from analysis of two to four weeks of metered data. Energy and demand savings were calculated from standard fixture wattages or cut sheets, plus the verified quantities of installed fixtures and controls and metered operating profiles. In addition, energy savings associated with reduced space cooling was calculated using a standard EER for commercial facilities or refrigerated equipment, depending on where the fixtures were installed.
- Controls and Motors: The M&V visit first confirmed that equipment was installed and operating as documented, by cross-checking nameplate data with the project application information. Baseline equipment characteristics and operation were also investigated by questioning the facility staff. Current loggers and power meters

there have 10 heating degree days (65 minus 55 equals 10). Quoted from http://www.srh.noaa.gov/ffc/html/degdays.shtml.

were then deployed for two to four weeks on a representative sample of the newly installed equipment. Operating schedules were determined from metered data, and regressed against Long Island weather when needed for weather sensitive measures such as air-handler fan motors or VFDs.

- **Refrigeration**: In addition to verifying that the installed equipment was consistent with the application, current loggers were deployed on a sample of installed refrigeration units to determine their energy use and operating schedule.
- **HVAC**: New equipment installation and operation was verified, and information about the baseline equipment was confirmed to the extent possible Equipment was metered for four weeks. The monitored operation was adjusted to Long Island weather conditions and extrapolated to cover a typical year of operation. Any interactive effects of systems were also noted and accounted for in the savings calculations.
- **Whole building**: The correct installation and operation of energy efficiency measures was verified, and metering was performed on a sample of equipment We found that spreadsheet analysis, as opposed to whole building modeling, was sufficient for verifying energy savings.

We applied varying strategies to the process of desk reviews as well. The 20 projects that were desk-reviewed included 13 lighting and/or lighting controls projects, 4 projects involving the installation of EC motors, 2 projects where VFDs were installed on HVAC equipment, and 1 compressor project

- **Lighting**: Lighting project desk reviews include checking lighting fixture specifications and wattages against tables of standard wattages, cross-checking invoices and application materials to get correct fixture counts, and verifying the assumed operating hours. Calculations to account for the reduced cooling loads of more efficient light fixtures were also checked.
- **Motors**: All motor projects reviewed involved the installation of EC motors in refrigerator or freezer cases. The review process involved checks between the specifications and assumptions for the baseline and new motors, checks of their energy use calculations, and an accounting for the reduced heat gain in the cooler cases. All methods and assumptions were standardized across projects in this desk review
- **VFDs**: The desk review involved verifying the size and operation of the equipment and processes that the VFDs are controlling, and recalculation and verification of energy savings using standard manufacturer VFD programs
- **Compressor**: Desk review of the compressor project included verifying the size and operation of the old compressor, and recalculating the energy savings of the more efficient new compressor using power laws.

Cost Effectiveness Methodology

The evaluation team developed a cost screening tool to assess cost effectiveness at the program and portfolio level using information derived from LIPA's 2010 Year End Expenditure Report and the evaluation results. We used three metrics to assess the cost

effectiveness of LIPA's ELI and Renewable Energy programs, the Program Administrator (PA) test, the Total Resource Cost (TRC) test, and the levelized cost of capacity and energy. LIPA considers the ELI and Renewable Energy portfolios as alternative supply-side resources. To allow for direct comparison with LIPA's assessment of all supply-side options, we apply the PA test as the primary method of determining cost effectiveness and used assumptions similar to those used by LIPA's resource planning team. Each of the three methods is described below.

Calculation of Program Administrator Costs

The Program Administrator Cost Test measures the net costs of an energy efficiency program as a resource option based on the costs incurred by the program administrator. These costs include all program administrative costs and any rebate and incentive costs. The PA cost test excludes any net costs incurred by the participant, such as the actual incremental measure cost.

The PA cost test calculates a Benefit/Cost ratio by taking the net present value (NPV) of benefits accrued over the life of the measure, including energy, capacity, gas and oil savings, and dividing them by costs as shown in Equation 1.[88] NPV discounts for the time value of money. In other words, savings that accrue in the future are less valuable than immediate savings. Taking a NPV normalizes for the present value of future savings. This evaluation used a nominal discount rate of 5.643%.[89]

$$PA\ Cost\ Test = \frac{NPV(DR)\ of\ Benefits\ [\ MCE*NRG*EUL+mAD]}{2010\ Costs\ [PA]} \qquad \text{(Eq. 1)}$$

A Benefit/Cost ratio greater than 1 indicates a cost effective investment of funds from a program administrator perspective.

Table 3-17 presents the sources for inputs used to calculate cost effectiveness using the PA test.

[88] Note the avoided costs include expected externality costs to be incurred by LIPA, including costs for Regional Greenhouse Gas Initiative (RGGI), NOx and SO2 compliance.

[89] All cost-effectiveness analyses used a nominal discount rate of 5.643% to be consistent with supply side alternatives.

Table 3-17. PA Cost Test Algorithm Inputs

Name	Variable	Units	Source	Is a	Notes
MCE	Annual Marginal Utility Avoided Cost of Energy (includes costs for RGGI, NOx and SO2 compliance)	$/kWh $/MMBTu	LIPA	Benefit	
NRG	Energy Reductions by Measure	kWh	Net Evaluated kWh, includes transmission losses	Benefit	First year annual value[90]
EUL	Effective Useful Life by Measure	Years	LIPA (From Optimal Screening Tool) Averaged by end use	Benefit	
mAD	Marginal Utility Avoided Cost of Demand	$/kW	LIPA	Benefit	
DR	Demand Reductions by Measure	kW	Net Evaluated kW, includes transmission losses	Benefit	First year value – coincident peak estimate
TL	Transmission losses (input to calculation of NRG)	%	LIPA (Accounted for in program savings)	Benefit	
PA	Program Administrator Cost	$ or % of incentives	LIPA (December 2010 Expenditure Report)	Cost	
DR	Discount Rate	%	LIPA (Nominal discount rate of 5.643% used in calculations of supply side alternatives)	Discount Rate	Interest Rate

Calculation of Total Resource Costs

The TRC is a societal benefit cost analysis that determines whether investing in energy efficiency programs is cost justified from a societal perspective Societal benefit cost

[90] For the Energy Efficient Products (EEP) program, the energy and demand savings of CFLs were discounted to account for the change in baseline efficiency levels over the life of the bulb. Beginning in 2012, higher wattage bulbs will begin to be phased out due to the Energy Independence and Security Act (EISA). Based on the expected installation rates, the timeline of the phase outs and the useful life of the CFLs, we estimate a lifetime savings of 92.04% for CFLs installed in 2010.

analysis tests review the benefits accrued over the life of the measure from a societal perspective, including energy, capacity, gas and oil savings.[91] The TRC test considers the same program costs as the PA cost test with the addition of estimated incremental cost of the program measure. Further, the TRC test does not consider the costs of incentives and rebates A Benefit/Cost ratio greater than 1 indicates a cost effective investment of funds from a societal perspective.

Calculation of Levelized Costs

A levelized cost analysis is a way to quickly compare the cost of energy efficiency programs relative to the demand and energy saved from the programs. Levelized costs are expressed as $/kW or $/kWh, meaning that the result can readily be compared to the cost of alternative supply additions or the cost of generating electricity. If the cost of the efficiency investment is less than the cost of capacity additions or generated electricity, efficiency is considered a wise investment.

The evaluation team determined levelized cost estimates at the program and portfolio level. The sources for this analysis are the same as the program administrator test calculations. To determine the levelized costs of the program, we determined the demand and energy savings over the life of the measure installed in a single year, discounted back to the same year of investment. LIPA's investment (incentives and overhead) were divided by the present value of the savings to yield the lifetime levelized cost. Equation 2 shows the methodology used to calculate the levelized cost values. For a description of these costs, see Table 3-17.

$$Levelized\ Costs\ = \frac{2010\ Costs\ (PA) NPV\ of\ NRG\ or\ DR\ from\ 2010\ Installs)}{} \qquad \text{(Eq. 2)}$$

[91] Like the PA test, the TRC avoided costs include expected externality costs for RGGI, NOx and SO2 compliance.

A. SURVEY FREQUENCIES

B. TECHNICAL REFERENCE MANUAL

Appendices C - G provide program level Technical Reference Manuals (TRM). Each TRM contains information on algorithms and assumptions used to determine evaluated (ex post) savings for each measure. The measure level deemed savings realization rate values in each TRM represent a comparison of the current program savings assumption and the evaluation team's recommendation for that assumption and are based on a combination of the algorithms and inputs shown in the TRM. Note that the evaluated savings presented in this report are derived using the inputs documented in the TRMs. For several measures, additional data and analytic steps were used to arrive at the evaluated savings estimate.

Note that for some programs, the measure level realization rates reported in the TRM differ slightly from those reported in Section 2 of this report. There are five key sources of inconsistency:

1. **Tracked ex ante savings did not match theoretical ex ante savings determined from algorithms and assumptions documented by the program.** To ensure an apples-to-apples comparison, the evaluation team applied equipment characteristics (size, efficiency) that reflected an average of 2010 installs. However, the documented algorithm and methodology did not appear to reflect the calculations applied in the program tracking database. This was noticed in the following programs
    a. CEP HVAC – Small packaged and split equipment
    b. CEP HVAC – Large chillers
    c. Cool Homes HVAC

2. **Theoretical ex ante savings could not be determined via program algorithms and assumptions, as none were provided to the evaluation team.** In these cases, only the deemed savings number in kWh was provided in program documentation. No further information on the calculation methodology or inputs was provided. Therefore, the evaluation team could not ensure that these comparisons were truly apples-to-apples. This was noticed in the following programs:
    a. HPD/HPwES Domestic Hot Water
    b. REAP Domestic Hot Water

3. **There were differences in installed quantities between ex ante and ex post total savings calculations.** A difference in count caused the total program savings realization rate to be different from the measure-level realization rate. This was noticed in the following program:
    a. EEP Lighting

4. **Additional net-to-gross effects were applied at the program level.** In this case, program-level savings included the NTG factor, while measure-level savings did not.

Therefore, realization rates were different. This was noticed in the following program:

a. EEP Dehumidifier
b. EEP Appliance Recycling

5. **There was an inconsistency in equipment size threshold between program documents and the tracking database.** This inconsistency caused some of the "large" units to feature tracked savings calculated with the savings methodology typically applied to "small" units. This skewed the program-level realization rate as compared to measure-level. This was noticed in the following program:
   a. EEP Room Air Conditioner

C. COMMERCIAL EFFICIENCY PROGRAM TRM

D. ENERGY EFFICIENCY PRODUCTS PROGRAM TRM

E. COOL HOMES TRM

F. HOME PERFORMANCE DIRECT TRM

G. RESIDENTIAL ENERGY AFFORDABILITY PARTNERSHIP TRM

H. EVALUATED NET-TO-GROSS FACTORS

Expected and Evaluated Net-to-Gross Factors by Program & Measure

Program	Measure	Evaluated minus Expected	Evaluated Values			Expected Program Values					
		NTGR Differences	FR	SO	NTGR	FR	SO	NTGR	Correct NTGR[a]	Source[b]	Notes
Cool Homes	Central AC	-8.0%	10%	0%	90.0%	2%	0%	98.0%		LIPA Cool Homes Saving CAC HP 2010 FINAL.xlsx	In Comment in file: free ridership and spillover for 2009 was identified in the calculation document created by Proctor Engineering. Individual factors were provided for multiple components of a project including efficiency level, refrigerant charge, airflow, and duct sealing. The net effect as a 2% reduction, e.g., 98% net-to-gross. This was simply entered a 2% free ridership and 0% spillover.

Program	Measure	Evaluated minus Expected	Evaluated Values			Expected Program Values					
		NTGR Differences	FR	SO	NTGR	FR	SO	NTGR	Correct NTGR[a]	Source[b]	Notes
Cool Homes	Furnace Fan	0.0%	10%	0%	90.0%	10%	0%	90.0%		LIPA fan motor 04-06-10 FINAL.corrected 8.10.2010.xlsx	In Comment in file: free ridership and spillover have not yet been determined for Furnace Fan ECM. A default net-to-gross ratio of 90% has been inserted consistent with the NY State EEPS proceedings.

Program	Measure	Evaluated minus Expected	Evaluated Values			Expected Program Values					
		NTGR Differences	FR	SO	NTGR	FR	SO	NTGR	Correct NTGR[a]	Source[b]	Notes
Cool Homes	Geothermal Heat Pump	-8.0%	10%	0%	90.0%	2%	0%	98.0%		LIPA Cool Homes Saving GSHP 2010 FINAL.xlsx	In Comment in file: free ridership and spillover for 2009 was identified in the calculation document created by Proctor Engineering. Individual factors were provided for multiple components of a project including efficiency level, refrigerant charge, airflow, and duct sealing. The net effect as a 2% reduction, e.g., 98% net-to-gross. This was simply entered a 2% free ridership and 0% spillover.

Program	Measure	Evaluated minus Expected	Evaluated Values			Expected Program Values					
		NTGR Differences	FR	SO	NTGR	FR	SO	NTGR	Correct NTGR[a]	Source[b]	Notes
Cool Homes	Unitary Heat Pump	-8.0%	10%	0%	90.0%	2%	0%	98.0%		LIPA Cool Homes Saving CAC HP 2010 FINAL.xlsx	In Comment in file: free ridership and spillover for 2009 was identified in the calculation document created by Proctor Engineering. Individual factors were provided for multiple components of a project including efficiency level, refrigerant charge, airflow, and duct sealing. The net effect as a 2% reduction, e.g., 98% net-to-gross. This was simply entered a 2% free ridership and 0% spillover.

Program	Measure	Evaluated minus Expected	Evaluated Values			Expected Program Values					
		NTGR Differences	FR	SO	NTGR	FR	SO	NTGR	Correct NTGR[a]	Source[b]	Notes
Cool Homes	Ductless Mini Split AC	-8.0%	10%	0%	90.0%	2%	0%	98.0%		LIPA Cool Homes Saving CAC HP 2010 FINAL.xlsx	In Comment in file: free ridership and spillover for 2009 was identified in the calculation document created by Proctor Engineering. Individual factors were provided for multiple components of a project including efficiency level, refrigerant charge, airflow, and duct sealing. The net effect as a 2% reduction, e.g., 98% net-to-gross. This was simply entered a 2% free ridership and 0% spillover.
HPD	Air Sealing	-9.0%	9%	7.3%	91.0%	0%	0%	100.0%		None	No evidence of NTGR applied in data received by evaluation team

Program	Measure	Evaluated minus Expected	Evaluated Values			Expected Program Values					
		NTGR Differences	FR	SO	NTGR	FR	SO	NTGR	Correct NTGR[a]	Source[b]	Notes
HPD	Hot Water	0.0%	0%	7.3%	100.0%	0%	0%	100.0%		None	No evidence of NTGR applied in data received by evaluation team
HPD	HVAC	-9.0%	9%	7.3%	91.0%	0%	0%	100.0%		None	No evidence of NTGR applied in data received by evaluation team
HPD	Lighting	-54.0%	54%	7.3%	46.0%	0%	0%	100.0%		None	No evidence of NTGR applied in data received by evaluation team
EEP	Energy Star Refrigerator	0.0%	20%	10%	90.0%	20%	10%	88.0%	90.0%	EEP Final 2010 Tracking Sheet_revised 2010-30-09.xlsx	NTGR values not sourced
EEP	2007 Clothes Washers	0.0%	40%	10%	70.0%	40%	10%	66.0%	70.0%	EEP Final 2010 Tracking Sheet_revised 2010-30-09.xlsx	In comment in file: FR and SO estimated
EEP	2007 Clothes Washers (2007 CEE Tier 2)	0.0%	30%	20%	90.0%	30%	20%	84.0%	90.0%	EEP Final 2010 Tracking Sheet_revised 2010-30-09.xlsx	In comment in file: FR and SO estimated

Program	Measure	Evaluated minus Expected	Evaluated Values			Expected Program Values					
		NTGR Differences	FR	SO	NTGR	FR	SO	NTGR	Correct NTGR[a]	Source[b]	Notes
EEP	2008 Clothes Washers	0.0%	20%	20%	100.0%	20%	20%	96.0%	100.0%	EEP Final 2010 Tracking Sheet_revised 2010-30-09.xlsx	In comment in file: FR and SO estimated
EEP	Energy Star Dehumidifier	-57.0%	72%	0%	28.0%	30%	15%	80.5%	85.0%	EEP Final 2010 Tracking Sheet_revised 2010-30-09.xlsx	NTGR values not sourced
EEP	Energy Star Dishwasher	0.0%	50%	15%	65.0%	50%	15%	57.5%	65.0%	EEP Final 2010 Tracking Sheet_revised 2010-30-09.xlsx	NTGR values not sourced
EEP	Room A/C <=6kBtuh	0.0%	30%	25%	95.0%	30%	25%	87.5%	95.0%	EEP Final 2010 Tracking Sheet_revised 2010-30-09.xlsx	NTGR values not sourced
EEP	Room A/C >6kBtuh	0.0%	30%	25%	95.0%	30%	25%	87.5%	95.0%	EEP Final 2010 Tracking Sheet_revised 2010-30-09.xlsx	NTGR values not sourced
EEP	Energy Star Common CFLs	0.0%	30%	4%	74.0%	30%	4%	72.8%	74.0%	EEP Final 2010 Tracking Sheet_revised 2010-30-09.xlsx	NTGR values not sourced

Program	Measure	Evaluated minus Expected	Evaluated Values			Expected Program Values					
		NTGR Differences	FR	SO	NTGR	FR	SO	NTGR	Correct NTGR[a]	Source[b]	Notes
EEP	Energy Star Specialty CFLs	0.0%	15%	20%	105.0%	15%	20%	102.0%	105.0%	EEP Final 2010 Tracking Sheet_revised 2010-30-09.xlsx	NTGR values not sourced
EEP	SSL	0.0%	5%	25%	120.0%	5%	25%	118.8%	120.0%	EEP Final 2010 Tracking Sheet_revised 2010-30-09.xlsx	NTGR values not sourced
EEP	Energy Star Fixtures	0.0%	2%	3%	101.5%	2%	3%	101.4%	101.5%	EEP Final 2010 Tracking Sheet_revised 2010-30-09.xlsx	NTGR values not sourced
EEP	LED Holiday Lights	0.0%	3%	7%	104.5%	3%	7%	104.3%	104.5%	EEP Final 2010 Tracking Sheet_revised 2010-30-09.xlsx	NTGR values not sourced
EEP	Refrigerator recycle	-11.0%	54%	0%	46.0%	43%	0%	57.0%	57.0%	EEP Final 2010 Tracking Sheet_revised 2010-30-09.xlsx	NTGR values not sourced
EEP	Pool pumps-two spd	0.0%	20%	10%	90.0%	20%	10%	88.0%	90.0%	EEP Final 2010 Tracking Sheet_revised 2010-30-09.xlsx	NTGR values not sourced

Program	Measure	Evaluated minus Expected	Evaluated Values			Expected Program Values					
		NTGR Differences	FR	SO	NTGR	FR	SO	NTGR	Correct NTGR[a]	Source[b]	Notes
EEP	Pool pumps-var spd	0.0%	20%	10%	90.0%	20%	10%	88.0%	90.0%	EEP Final 2010 Tracking Sheet_revised 2010-30-09.xlsx	NTGR values not sourced
EEP	TVs - 30% above ES	0.0%	20%	10%	90.0%	20%	10%	88.0%	90.0%	EEP Final 2010 Tracking Sheet_revised 2010-30-09.xlsx	NTGR values not sourced
HPwES	Air Sealing	-24.3%	26%	0.4%	74.4%	0%	0%	100.0%		None	No evidence of NTGR applied in data received by evaluation team
HPwES	Door/Window	-24.3%	26%	0.4%	74.4%	0%	0%	100.0%		None	No evidence of NTGR applied in data received by evaluation team
HPwES	Hot Water	-24.3%	26%	0.4%	74.4%	0%	0%	100.0%		None	No evidence of NTGR applied in data received by evaluation team
HPwES	HVAC	-24.3%	26%	0.4%	74.4%	0%	0%	100.0%		None	No evidence of NTGR applied in data received by evaluation team

Program	Measure	Evaluated minus Expected	Evaluated Values			Expected Program Values					
		NTGR Differences	FR	SO	NTGR	FR	SO	NTGR	Correct NTGR[a]	Source[b]	Notes
HPwES	Insulation	-24.3%	26%	0.4%	74.4%	0%	0%	100.0%		None	No evidence of NTGR applied in data received by evaluation team
HPwES	Lighting	-24.3%	26%	0.4%	74.4%	0%	0%	100.0%		None	No evidence of NTGR applied in data received by evaluation team
CEP Prescriptive	Lighting	0.0%	8%	0%	92.0%	8%	0%	92.0%		L-3	Reference from 2007
CEP Prescriptive	Performance Lighting	0.0%	15%	7%	92.0%	15%	7%	92.0%		L-3	Reference from 2007
CEP Prescriptive	Motors-Premium Efficiency	0.0%	30%	30%	100.0%	30%	30%	100.0%		M-6	Reference from 2007
CEP Prescriptive	Motors-VFD	0.0%	10%	0%	90.0%	10%	0%	90.0%		M-11	Reference from 2006
CEP Prescriptive	Compressed Air - VFD, Refrigerated Dryers	0.0%	25%	0%	75.0%	25%	0%	75.0%		C-4	Reference from 2008
CEP Prescriptive	Motors - ECM	0.0%	16%	8%	92.0%	16%	8%	92.0%		H-45, M12	References from 2004

Program	Measure	Evaluated minus Expected	Evaluated Values			Expected Program Values					
		NTGR Differences	FR	SO	NTGR	FR	SO	NTGR	Correct NTGR[a]	Source[b]	Notes
CEP Prescriptive	Compressed Air-Air Receivers, cycling refrigerated dryers	0.0%	34%	0%	66.0%	34%	0%	66.0%		C-4	Reference from 2008
CEP Prescriptive	Compressed Air-Compressors Variable Displacement	0.0%	18%	7%	89.0%	18%	7%	89.0%		C-2	Reference from 2005
CEP Prescriptive	Compressed Air-Compressors Variable Speed	0.0%	17%	8%	91.0%	17%	8%	91.0%		C-2	Reference from 2005
CEP Prescriptive	HVAC - Split/Packaged AC, HP, Chiller	0.0%	10%	0%	90.0%	10%	0%	90.0%		H-44	Reference from 2000
CEP Prescriptive	HVAC Controls-Programmable thermostat	0.0%	40%	0%	60.0%	40%	0%	60.0%		H-44	Reference from 2000
CEP Prescriptive	HVAC Controls-Dual Enthalpy Ecnomizer	0.0%	5%	0%	95.0%	5%	0%	95.0%		H-45	Reference from 2004

Program	Measure	Evaluated minus Expected	Evaluated Values			Expected Program Values					
		NTGR Differences	FR	SO	NTGR	FR	SO	NTGR	Correct NTGR[a]	Source[b]	Notes
CEP Prescriptive	Kitchen Equipment - Fryer & Steamer	0.0%	25%	10%	85.0%	25%	10%	85.0%		K-4	Reference from 2006
CEP Prescriptive	Kitchen Equipment - Griddle, Convection Oven, Combi Oven	0.0%	5%	5%	100.0%	5%	5%	100.0%		K-4	Reference from 2006
CEP Prescriptive	Kitchen Equipment - Low Flow Pre-Rinse Spray Nozzle	0.0%	0%	10%	110.0%	0%	10%	110.0%		None	NA
CEP Prescriptive	Kitchen Equipment - Insulated Holding Cabinet	0.0%	35%	10%	75.0%	35%	10%	75.0%		K-4	Reference from 2006
CEP Prescriptive	Vending Machines and Glass Front Refrigerated Cooler Miser	0.0%	1%	0%	99.0%	1%	0%	99.0%		V-1	Reference from 2009
REAP	Lighting	0.0%	0%	0%	100.0%	0%	0%	100.0%		None	Assumed 1.0 as Low Income program

Program	Measure	Evaluated minus Expected	Evaluated Values			Expected Program Values					
		NTGR Differences	FR	SO	NTGR	FR	SO	NTGR	Correct NTGR[a]	Source[b]	Notes
REAP	Refrigerator	0.0%	0%	0%	100.0%	0%	0%	100.0%		None	Assumed 1.0 as Low Income program
REAP	Hot Water	0.0%	0%	0%	100.0%	0%	0%	100.0%		None	Assumed 1.0 as Low Income program
REAP	HVAC	0.0%	0%	0%	100.0%	0%	0%	100.0%		None	Assumed 1.0 as Low Income program
Info Ed	In Concert with the Environment	0.0%	0%	0%	100.0%	0%	0%	100.0%		None	Assumed 1.0 based on program type
Info Ed	Home Energy Audit	0.0%	0%	0%	100.0%	0%	0%	100.0%		None	Assumed 1.0 based on program type
RNC	All	0.0%	0%	0%	100.0%	0%	0%	100.0%		None	No evidence of NTGR applied in data received by evaluation team
Solar Pioneer	All	0.0%	0%	0%	100.0%	0%	0%	100.0%		None	No evidence of NTGR applied in data received by evaluation team
Solar Entrepreneur	All	0.0%	0%	0%	100.0%	0%	0%	100.0%		None	No evidence of NTGR applied in data received by evaluation team
Backyard Wind	All	0.0%	0%	0%	100.0%	0%	0%	100.0%		None	No evidence of NTGR applied in data received by evaluation team

Program	Measure	Evaluated minus Expected	Evaluated Values			Expected Program Values					
		NTGR Differences	FR	SO	NTGR	FR	SO	NTGR	Correct NTGR[a]	Source[b]	Notes

[a] EEP Program incorrectly calculated the NTGR. This column has the NTGR using the correctly applied algorithm.
[b] Where source is a letter and number, reference the TRM references for the full reference.

I. MEASUREMENT AND VERIFICATION RESULTS

Provided as separate document.