LIPA Efficiency Long Island and Renewables Portfolio 2011 Program Guidance Document

Final

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1. INTRODUCTION

The 2011 Program Guidance Document provides a program-by-program gross and net impact review and methods employed in our analyses to obtain the impacts. Opinion Dynamics created the document for use by program staff to provide data-driven planning actions moving forward and full transparency for the methods used to calculate savings. Additionally, at the direction of LIPA, we researched data creation and management and quality assurance/quality control procedures and provide feedback for each program.

This introduction includes a comparison of the estimated demand and energy impacts determined through our evaluation (ex post impacts) to the expected impacts used for program tracking (ex ante). The evaluation team used the most detailed measure level data available from program tracking systems as the basis for our estimation of ex post impacts and measure level ex ante estimates. Because the evaluation team developed ex ante estimates at the measure level first to derive program level estimates, and due to some gaps in the available program tracking data, in some cases, our estimates of ex ante savings do no match the program level ex ante savings presented in LIPA's monthly tracking reports. In this report, we provide comparison between the 1) ex ante net savings calculated by the evaluation team using detailed measure level tracking information and 2) evaluated savings, the ratio of which is defined as the realization rate. Additionally, we provide a comparison between the 1) the same ex ante net savings and 2) ex post savings, the ratio of which is defined as the cost effectiveness realization rate. We have organized the remainder of this document as follows:

- Sections 2 through 11 provide a program-by-program review of energy and demand savings. For each program, this section outlines the energy and demand savings accrued from PY2011 programs and provides measure-specific recommendations for updating the gross energy and demand savings calculations.
- Section 12 provides the results of our process efforts. For 2011, we provide program-specific information for the Commercial program, as there was a significant change in program delivery during 2011. Additionally, our focus this year was to determine the flow of information from inception through to the program tracking database (i.e., Siebel). We provide data flowcharts for each program. These charts show how data flows from the generation of the data to incentive payment. Additionally, we show where program level quality assurance procedures are in place.
- Section 13 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 savings estimates.
- The appendices present supporting documents for the evaluation.

1.1 Key Definitions

Below we provide definitions for key terms used throughout the document:

- Gross Impacts: The change in energy consumption and/or demand at the generator that results directly from program-related actions taken by participants, regardless of why they participated. These impacts include line losses, coincident factors for demand, and waste heat factors and installation rate for lighting. Gross impacts are the demand and energy that LIPA's power plants do not generate due to program-related actions taken by participants.

- **Net Impacts**: The change in energy consumption and/or demand at the generator that results directly from program-related actions taken by participants, and would not have occurred absent the program. The only difference between the gross and net impacts is the application of the NTGR.
- **Net-To-Gross Ratio (NTGR)**: The factor that, when multiplied by the gross impact, provides the net impacts for a program. NTGR consists of two concepts: free ridership and spillover. Free ridership reduces the factor to account for those customers who would have installed an energy efficient measure without the program. Spillover increases the factor to account for those customers who install energy efficient measures outside of the program (i.e., without an incentive), but due to the actions of the program.
- **Ex Ante Net Impacts**: The energy savings expected by the program as found in the program tracking database. The ex ante net impacts include program planning NTG values.
- **Evaluated Net Savings**: The savings realized by the program after independent evaluation determined gross impacts and applied the program planning NTG values. The evaluation team uses the evaluated net savings to compare to LIPA's goals.
- **Ex Post Net Savings**: The savings realized by the program after independent evaluation determined gross impacts and applied ex-post NTG values. The evaluation team uses the ex post net impacts in the cost-effectiveness calculation.
- **Line Loss Factors:** All gross impacts include line losses of 6.6% on energy consumption, whereby a multiple of 1.0707 = (1/(1-0.066) 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).

Within the Economic Analysis, three terms are used.

- **Direct Impacts:** These impacts are equal to the localized portion of direct spending of the LIPA programs. For example, direct impacts would include money (and associated increases in employment) supplied to contractors to install energy efficiency measures in homes and businesses, such as the HVAC contractor installing energy efficient central A/C systems on a project incented by LIPA's Cool Homes program.
- **Indirect Impacts:** These impacts are determined by the amount of the direct impacts spent within Long Island on supplies, services, labor and taxes. For example, indirect impacts would include money (and associated employment) transferred to local businesses by contractors for supplies needed to install energy efficiency measures, such as if a local wholesaler of HVAC equipment had increased sales and added additional workers to help meet the growing demand for the company's products.
- **Induced Impacts:** These impacts are associated with the effects of the direct and indirect impacts on household and business proprietors' income. For example, money expended on Long Island by households or business proprietors benefitting from energy efficiency savings and direct and indirect program spending, such as if the employee of an HVAC contractor used their income (increased by work through LIPA's Cool Homes program) to purchase a car, which stimulates business at the local car dealership.

1.2 Summary of Gross and Net Impact Methods

Below we provide a summary of the methods used to determine Evaluated and Ex Post Net Savings. A more detailed discussion of methods is presented in Section 13.

Gross impact Methods

We conducted multiple activities to assess the evaluated gross energy and demand savings associated with the LIPA programs. The majority of our evaluated gross impacts are based on engineering analysis of savings using algorithms and inputs derived from the program tracking database. We also performed a billing analysis for the Residential Energy Assistance Program (REAP) and on-site measurement and verification for custom projects implemented through the CEP program.

Net impact Methods

The evaluation team used net impact estimates as inputs to three separate analyses required by LIPA management: 1) the determination of annual demand and energy savings goal attainment; 2) the benefit cost assessment; and 3) and economic impact assessment. Based on the specific requirements of each assessment, we developed two separate net savings estimates as described below.

Evaluated Net Savings

An important catalyst in LIPA's decision to invest in the ELI and Renewable Energy portfolios was the desire to offset the need to develop approximately 520 MW of generating capacity on Long Island required to satisfy forecasted energy demand. As such, performance relative to the annual capacity savings goals is a critically important performance metric for LIPA's programs. LIPA derived its annual savings goals from planning assumptions regarding key inputs to the estimation of expected gross and net savings. To allow for consistency and direct comparison between evaluated program performance and established savings goals, the evaluation team developed "evaluated net savings" estimates for each ELI and Renewable Energy program for purposes of assessing goal attainment. This approach is consistent with the approach applied by utilities in nearly half of all states with energy efficiency program offerings. We calculated evaluated net savings by applying LIPA's planning assumptions for NTG to the gross demand and energy savings estimates determined through our evaluation.

Ex Post Net Savings

Among other inputs, the benefit cost and economic impact assessments require an estimate of net program savings. The best-practice approach for both assessments dictates that the net savings used to develop the benefit cost ratio or to quantify economic benefits reflect current levels of naturally occurring energy efficiency, free ridership, and spillover to provide an accurate estimate of the benefits associated with the current year's investment in the programs. As such, the evaluation team used ex post net savings in both assessments. We calculated ex post net savings by applying ex-post net-to-gross factors to evaluated gross impact estimates.

1.3 Summary of Evaluated Demand and Energy Gross and Net Impacts

Overall, our evaluation found that evaluated net savings were closely aligned with program tracking estimates. The realization rates in Table 1-1 and Table 1-2 provide a comparison of evaluated net savings to ex ante savings. We discuss reasons why the evaluated values differ from the ex ante values within Sections 2-11.

Table 1-1. ELI Portfolio Impacts for Goal Comparison

Program	Ex Ante		Evaluated		Realization Rate	
	MW	MWh	MW	MWh	MW	MWh
CEP Mid-Market	3.33	12,768	3.31	12,132	99%	95%
Solution Provider	12.99	61,170	12.89	57,690	99%	94%
Direct Install	0.35	971	0.27	988	76%	102%
Total Commercial	*16.67*	*74,910*	*16.46*	*70,809*	*99%*	*95%*
Energy Efficient Products	11.67	99,706	11.41	86,487	98%	87%
Cool Homes	6.01	5,862	4.08	4,769	68%	81%
Residential Energy Affordability Partnership	0.50	4,071	0.24	1,791	48%	44%
Home Performance with ENERGY STAR®	0.25	1,629	0.24	2,441	96%	150%
Home Performance Direct	0.54	2,463	0.43	2,281	79%	93%
Residential New Homes	1.19	2,309	1.19	2,309	100%	100%
Total Residential	*20.16*	*116,042*	*17.59*	*100,078*	*87%*	*86%*
ELI Total	36.84	190,952	34.05	170,886	92%	89%

Table 1-2. Renewable Portfolio Impacts for Goal Comparison

Program	Ex Ante		Evaluated		Realization Rate	
	MW	MWh	MW	MWh	MW	MWh
Solar Pioneer	7.83	16,102	5.44	13,995	69%	87%
Solar Thermal	0.00	10	0.004	10	100%	100%
Backyard Wind	0.02	218	0.03	320	191%	147%
Renewable Total	**7.86**	**16,329**	**5.48**	**14,325**	**70%**	**88%**

1.4 Summary of Cost Effectiveness Results

Based on an analysis of program and portfolio level impacts and costs, the savings generated by the ELI portfolio 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 4.4 for the ELI portfolio and 1.7 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 2.7 and 0.6 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
CEP Mid Market	$18,965,829	$6,866,539	2.8	$4,552,184	4.2
Solution Provider	$81,302,363	$25,579,150	3.2	$16,266,471	5.0
SBDI	$2,225,751	$673,373	3.3	$532,586	4.2
Subtotal Commercial Efficiency Program	**$102,493,943**	**$33,119,063**	**3.1**	**$21,351,241**	**4.8**
Energy Efficient Products	$65,347,583	$20,564,097	3.2	$9,156,325	7.1
Cool Homes	$18,615,511	$7,561,579	2.5	$5,016,425	3.7
REAP	$1,389,924	$3,590,683	0.4	$2,706,413	0.5
Home Performance with ENERGY STAR	$4,601,321	$3,972,733	1.2	$3,616,835	1.3
Home Performance Direct	$1,512,325	$3,425,392	0.4	$2,312,526	0.7
Existing Homes Subtotal	*$26,119,082*	*$18,550,387*	*1.4*	*$13,652,200*	*1.9*
Residential New Homes	$14,130,720	$3,292,139	4.3	$2,614,664	5.4
Subtotal Residential	**$105,597,384**	**$42,406,623**	**2.5**	**$25,423,188**	**4.2**
Subtotal ELI	**$208,091,327**	**$75,525,686**	**2.8**	**$46,774,429**	**4.4**
Solar PV	$46,724,968	$78,308,680	0.6	$28,255,303	1.7
Solar ARRA Grant	--	--	--	($8,344,500)	--
Solar Hot Water	$28,037	$105,701	0.3	$83,885	0.3
Backyard Wind	$586,791	$1,569,314	0.4	$308,590	1.9
Subtotal Renewable	**$47,339,796**	**$79,983,695**	**0.6**	**$20,303,278**	**1.7**
Total	**$255,431,123**	**$155,509,381**	**1.6**	**$67,077,707**	**3.4**

In 2011, LIPA received an $8.3 million in American Recover and Reinvestment Act (ARRA) funds for residential solar installations. LIPA used this grant to fund rebates through its Solar Pioneer program. For purposes of our cost-effectiveness analysis, the evaluation team included these rebates as program expenditures as well as the energy savings and other benefits associated with the installations.

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 $192.26 per kW and $0.039 per kWh — less than the comparable costs of alternative supply side resources and less than the cost of generating the displaced energy.[1] Using these as benchmark values, the Renewable Energy portfolio exceeds the cost of alternative supply options for energy, but is below this level for capacity. 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
CEP Mid Market	$4,552,184	0.047	174.67
Solution Provider	$16,266,471	0.035	158.62
SBDI	$532,586	0.060	221.62
Subtotal Commercial Efficiency Program	**$21,351,241**	**0.038**	**162.97**
Energy Efficient Products	$9,156,325	0.018	138.92
Cool Homes	$5,016,425	0.128	131.62
REAP	$2,706,413	0.240	1,813.01
Home Performance with ENERGY STAR	$3,616,835	0.200	2,110.27
Home Performance Direct	$2,312,526	0.130	1,129.15
Existing Homes Subtotal	*$13,652,200*	*0.176*	*349.56*
Residential New Homes	$2,614,664	0.096	186.36
Subtotal Residential	**$25,423,188**	**0.042**	**213.65**
Subtotal ELI	**$46,774,429**	**0.040**	**187.09**
Solar PV	$28,255,303	0.153	392.34
Solar ARRA Grant	($8,344,500)	--	--
Solar Hot Water	$83,885	0.738	1,912.92
Backyard Wind	$308,590	0.073	705.34
Subtotal Renewables	**$20,303,278**	**0.151**	**395.15**
Total	**$67,077,707**	**0.055**	**233.86**

1.5 Summary of Economic Benefits Results

The evaluation team estimated the expected changes to the region's overall economic output and employment resulting from LIPA's 2011 ELI and Renewables portfolios over the next ten years. Table 1-5 and Table 1-6 present the direct and combined indirect and induced impacts for 2011 and for the ten-year period of 2011 to 2020. To account for expected inflation and the assumed

[1] Typical supply side capacity costs are in the range of $400/kW while energy costs are around $0.08/kWh.

increasing cost of electricity, the tables show the results as net present value using the discount rate used in LIPA's supply side planning and the cost effectiveness analysis.

Over ten years, the 2011 investments in the ELI program are expected to return $71.9 million in total economic benefits to the regional economy (in 2011 dollars), with an employment benefit of 560 new FTEs over that time period.

Table 1-5. Economic Impact of PY3 ELI Program Investments

	2011 Economic Impact	2011-2020 Economic Impact (NPV[2])
Economic Impact		
Total Economic Output (millions)	$61.6	$71.9
Direct Effect	$48.6	$46.0
Indirect & Induced Effect	$13.0	$25.9
Employment (FTE)	445	560
Impact per $1M Investment		
2011 Program Investment (million)	$46.8	$46.8
Total Economic Output in M per $1M investment	$1.3	$1.5
Employment (FTE) per $1M investment	9.5	12.0

[2] Using nominal discount rate of 5.643%, based on LIPA energy supply cost assumptions

Over ten years, the 2011 investments in the Renewables program are expected to return $36.0 million in total economic benefits to the regional economy (in 2011 dollars), with an employment benefit of 278 new FTEs over that time period.

Table 1-6. Economic Impact of PY3 Renewables Program Investments

	2011 Economic Impact	2011-2020 Economic Impact (NPV[3])
Economic Impact		
Total Economic Output (millions)	$23.7	$36.0
Direct Effect	$27.5	$26.0
Indirect & Induced Effect	($3.8)	$10.0,
Employment (FTE)	164	278
Impact per $1M Investment		
2011 Program Investment (including ARRA funding, million)	$28.6	$28.6
Total Economic Output in M per $1M investment	$0..8	$1.3
Employment (FTE) per $1M investment	5.7	9.7

The overall economic impact from LIPA's ELI and Renewables portfolios is similar to those found in comparable studies of energy efficiency and renewables portfolios[4], in terms of impact per million dollars of investment. The FTE results are also similar to rate of one FTE per $92,000 of government spending assumed for ARRA-funded projects.[5]

[3] Using nominal discount rate of 5.643%, based on LIPA energy supply cost assumptions

[4] The evaluation team compared our results to recent reports with similar methodologies in Texas, Oregon, New York, and Maryland.

[5] http://www.whitehouse.gov/assets/documents/Job-Years_Revised5-8.pdf

2. Commercial Efficiency Program

LIPA's Commercial Efficiency Program (CEP) is multi-faceted and comprehensive. It provides incentives to commercial customers with facilities in LIPA's service territory. It caters to all business customers in LIPA's service territory, including small business customers and not-for-profit entities, offers incentives for a variety of energy efficient equipment options, and provides other types of support, such as energy audits and technical assistance studies. In 2011, CEP delivered their program through three distinct entities. Additionally, customers could participate through four avenues. The avenues open for participation were:

- Prescriptive: Offers predefined replacement and retrofit measures that are rebated at set incentive amounts.
- Retrofit Existing: Offers retrofit measures using the specific measures installed in the existing site as the determination of savings. These measures are rebated at set incentive amounts.
- Direct Install: Offers only lighting measures through a turnkey approach and typically to small businesses.
- 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.

The customer may be serviced by three implementation entities: CEP Mid-Market (implemented by National Grid), Solutions Provider (implemented by TRC), and Small Business Direct Install (SBDI, implemented by Lime Energy). Both CEP Mid-Market and Solutions Provider work with customers to obtain savings through the Prescriptive, Retrofit Existing, or Custom components. Customers must work with SBDI to participate through the Direct Install component. However, customers involved with SBDI can also work with CEP Mid-Market or Solutions Provider.

In addition to these core components, LIPA's Commercial Program also offers no-cost energy audits, cost-shared technical assistance studies, building commissioning co-funding, and Leadership in Energy and Environmental Design (LEED) certification incentives.

Overall Impacts for CEP

Table 2-1 provides a comparison of evaluated net savings to ex ante savings for the Commercial Program impacts by implementation entity. Note that evaluated KW savings were set equal to LIPA's ex ante values for all custom measures and prescriptive lighting measures to determine evaluated KW savings for CEP. Combined, these measures account for 52% of evaluated savings for the program. Ex ante values were used for custom measures due to the high relative precision of the evaluated demand savings results (19%) and because the evaluation schedule did not allow sufficient time to conduct metering of custom measures coincident with LIPA's system peak. Ex ante values were used for prescriptive lighting measures because the Seibel tracking system did not include sufficient measure level data to develop evaluated savings estimates using the program deemed savings algorithms.

Table 2-1. Commercial Program Impacts for Goal Comparison

Program Component	Category	Ex Ante		Evaluated		Realization Rate	
		kW	kWh	kW[a]	kWh[b]	kW	kWh
CEP Mid Market	Prescriptive	726	2,836,652	764	2,696,161	105%	95%
	Custom	1,083	4,102,296	1,083	3,803,219	100%	93%
	Retrofit Existing	1,525	5,829,514	1,459	5,632,126	96%	97%
	CEP Subtotal	*3,334*	*12,768,462*	*3,307*	*12,131,506*	*99%*	*95%*
Solution Provider	Prescriptive	2,100	7,945,555	2,211	7,552,036	105%	95%
	Custom	5,945	34,546,164	5,945	32,091,191	100%	93%
	Retrofit Existing	4,946	18,678,772	4,732	18,046,309	96%	97%
	Solution Provider Subtotal	*12,991*	*61,170,492*	*12,889*	*57,689,536*	*99%*	*94%*
Small Business Direct Install		349	971,304	266	266	987,693	76%
Commercial Program Total		**16,674**	**74,910,257**	**16,462**	**70,808,735**	**99%**	**95%**

[a] kW values use ex ante values for all custom projects and all prescriptive lighting projects.
[b] kWh values use ex ante values for all prescriptive lighting projects.

Ex post net savings differ from evaluated net savings in that ex post savings are developed using ex-post NTG factors, where evaluated net savings are based on program planning NTG values. Program planning NTG values differed from evaluated values by program component. The evaluation team used participant survey data and information gleaned from trade allies to calculate a single ex-post NTG factor for the Prescriptive, Custom and Retrofit Existing programs components. We used participant survey data alone to develop the ex-post NTG value for the SBDI program component. The derivation of ex-post NTG values is described in detail below and in Section 13 of this report.

Table 2-2 provides a comparison of ex ante and ex post savings by CEP program component and project category. As noted in Section 1, the evaluation team developed ex post net impact estimates for use in the benefit cost and economic impact assessments.

Table 2-2. Commercial Program Impacts for Cost-Effectiveness

Program Component	Category	Ex Ante		Ex Post		Cost-Effectiveness Realization Rate	
		kW	kWh	kW[a]	kWh[b]	kW	kWh
CEP Mid Market	Prescriptive	726	2,836,652	587	2,171,081	81%	77%
	Custom	1,083	4,102,296	828	2,883,237	76%	70%
	Retrofit Existing	1,525	5,829,514	1,116	4,285,505	73%	74%
	CEP Subtotal	*3,334*	*12,768,462*	*2,532*	*9,339,823*	*76%*	*73%*
Solution Provider	Prescriptive	2,100	7,945,555	1,699	6,081,268	81%	77%
	Custom	5,945	34,546,164	4,580	24,539,529	77%	71%
	Retrofit Existing	4,946	18,678,772	3,621	13,731,501	73%	74%
	Solution Provider Subtotal	*12,991*	*61,170,492*	*9,900*	*44,352,299*	*76%*	*73%*
Small Business Direct Install		349	971,304	232	859,293	66%	88%
Commercial Program Total		**16,674**	**74,910,257**	**12,664**	**54,551,415**	**76%**	**73%**

[a] kW values use ex ante values for all custom projects and all prescriptive lighting projects.
[b] kWh values use ex ante values for all prescriptive lighting projects.

Next, we provide the measure-level information by program component.

Prescriptive Component of Commercial Program

This section provides the results of the evaluation team's analysis of energy and demand savings associated with prescriptive measures installed through the Commercial program by the CEP and Solution Provider implementation entities. We performed our analysis by program component (Prescriptive, Custom, and Retrofit Existing) and not by implementation entity. As such, we aggregated our results for prescriptive measures across implementation entities. For purposes of analysis, we grouped prescriptive measures into nine end-use categories: lighting, performance lighting, motors and drives, compressed air, HVAC, HVAC controls, kitchen equipment, building envelope (i.e., Cool Roofs), and vending machines.

The evaluation of prescriptive measures consisted of several phases. First, analysts obtained the program's savings database, which contained ex ante savings estimates for each individual measure incentivized through the program in 2011. The database also contained information regarding measure characteristics, allowing the evaluation team to tailor the analysis of energy savings to reflect the efficiency standards set by the program over the past year. For example, for HVAC measures, equipment size (in tons), and efficiency (in SEER/EER) was available, and we applied these characteristics to evaluation savings calculations to ensure an apples-to-apples comparison with ex ante estimates presented in the tracking database. The evaluation team used the measure type and characteristic information from the database to derive the impacts as defined in Section 1.1.

Table 2-3 presents evaluated net energy and demand savings associated with the Prescriptive program component by end-use category. As both ex-ante and evaluated net savings values are calculated using program planning NTG factors, the differences expressed through the realization rates represent differences in the ex ante and evaluated gross savings. See the definitions in Section 1.1 for a discussion of the difference between the ex ante and evaluated values.

Table 2-3. Prescriptive Component of CEP: Net Savings for Goal Comparison

Category	Units	Ex-Ante		Evaluated		Realization Rate	
		kW	kWh	kW	kWh	kW	kWh
Lighting	22,341	1,746	6,702,301	1,746	6,702,301	100%	100%
Performance Lighting	41	303	1,323,197	215	816,491	71%	62%
Motors and VFDs	106	38	835,956	53	529,578	139%	63%
Compressed Air	41	90	699,853	39	527,716	43%	75%
HVAC	462	605	1,049,792	881	1,547,122	145%	147%
HVAC Controls	47	0	76,496	0	26,845		35%
Kitchen Equipment	6	5	23,447	4	22,349	95%	95%
Building Envelope	15	74	120,253	74	120,253	100%	100%
Vending Machines	19	0	30,991	0	31,654	100%	102%
Totals	**23,078**	**2,862**	**10,862,284**	**3,013**	**10,324,308**	**105%**	**95%**

The evaluation team identified a number of reasons for discrepancy in gross savings by category as described below.

Reasons for Differences in Impacts

- The program database did not contain sufficient information on installed ***Lighting*** systems to complete a thorough evaluation analysis. Therefore, evaluators have assigned a realization rate of 100% for both energy and demand.
- The database featured more thorough project-specific information for ***Performance Lighting*** projects than was provided in the past. We used program-provided data to calculate energy and demand savings based on project parameters such as facility square footage, installed lighting power density (LPD), code baseline LPD, and building type. Our calculation of savings was 22% (kW) and 37% (kWh) lower than ex ante. Reasons for this are most likely due to a single decimal point data for the LPD, which may have caused our analysis to underestimate or overestimate kW and kWh savings for the sites. In addition, American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE) building types used for analysis may not map directly with LIPA's building types and their code baseline choice. We discussed this possible discrepancy with LIPA prior to use. The choice of baseline values by building type was not included in the data from LIPA and was unknown to the evaluation team.
- For ***Motors and VFDs*** projects, the database featured extensive per-install information. With this useful information, evaluators conducted an accurate analysis, which led to 39% higher ex post demand savings but 37% lower ex post energy savings. Our analysis used the same normalized savings values (i.e., kW/hp or kWh/hp) that LIPA recommends in their program documentation. We multiplied these values by the installed horsepower for each measure provided by LIPA to arrive at our estimated savings. We discussed the differences between our

analysis and LIPA's values with LIPA and were unable to come to a firm conclusion as to why we have a difference.

- The database contained more install-specific information for ***Compressed Air*** projects, leading to lower ex post savings as compared to ex ante, by 56% (demand) and 23% (energy). The air receiver measure drives the finding. This measure provided about two-thirds of the demand savings and one-third of energy savings from compressed air projects. Our analysis for compressed air used similar methods as used throughout the Northeast while the program assigns a saving percentage. We do not know the specifics around how the program percentage is created so cannot state why our values are different. We will propose a savings algorithm based on CFM and other parameters for compressed air projects in the near future.
- For ***HVAC*** measures, evaluators applied a similar analysis strategy as in past evaluations. Measure-specific characteristics such as cooling capacity and efficiency were available in the program database and we used them to characterize the efficient operation of installed equipment. We determined evaluated savings when comparing to a code-standard baseline. Our analysis used normalized savings values (i.e., kW/ton or kWh/ton) based on similar algorithms and assumptions as the program. We multiplied these values by the installed tons for each measure provided by LIPA to arrive at our estimated savings. We do not know the specifics around how the program savings are calculated so cannot state why our values are different.
- For ***HVAC Controls***_measures, evaluators applied a similar analysis strategy as in past evaluations. We had modeled energy savings in our previous evaluations and used that normalized kWh savings/ton value for the few measures in 2011. We multiplied these values by the installed tons for each measure provided by LIPA to arrive at our estimated savings. We do not know the specifics around how the program savings are calculated so cannot state why our values are different. At the time of peak demand, we assume that the HVAC system is running at full capacity and there are not demand savings based on these controls.
- For equipment categories with relatively smaller savings totals, such as ***Kitchen Equipment***, ***Building Envelope***, and ***Vending Machines***, evaluators used install-specific information when available to accurately characterize the incentivized equipment. Building envelope measures are new to the CEP program and we assigned them a temporary realization rate of 100%. These categories featured a total of 40 combined installs in 2011 and account for approximately 3% of total ex post demand savings in the prescriptive sector.

Net impacts indicate the savings off the grid due to program intervention. The ex ante NTG values varied from the ex post NTGR by end use as shown in Table 2-4

Table 2-4. NTGR for Prescriptive Component of CEP

End Use	Ex Ante NTGR[a]	Ex-Post NTGR
Lighting	0.92	0.70
Performance Lighting	0.92	0.70
Motors and VFDs	0.41 or 0.84	0.70
Compressed Air	0.66 to 0.89	0.70
HVAC	0.90	0.70
HVAC Controls	0.60 or 0.95	0.70
Kitchen Equipment	0.75 to 1.10	0.70
Building Envelope	1.00	0.70
Vending Machines	0.99	0.70

[a]Ex ante NTGR values are from LIPA 2009 and 2010 documentation.

Table 2-5 shows a comparison of ex ante to ex post net energy and demand savings associated with the Prescriptive program component by end-use category. See the definitions in Section 1.1 for a discussion of the difference between the ex ante and ex post values. As noted in Section 1, the evaluation team developed ex post net impact estimates for use in the benefit cost and economic impact assessments.

Table 2-5.Prescriptive Component of CEP for Cost-Effectiveness

Category	Units	Ex-Ante		Ex Post		Cost-Effectiveness Realization Rate	
		kW	kWh	kW	kWh	kW	kWh
Lighting	22,341	1,746	6,702,301	1,292	5,092,678	74%	76%
Performance Lighting	41	303	1,323,197	169	636,554	56%	48%
Motors and VFDs	106	38	835,956	81	807,256	214%	97%
Compressed Air	41	90	699,853	33	427,452	36%	61%
HVAC	462	605	1,049,792	685	1,203,317	113%	115%
HVAC Controls	47	0	76,496	0	22,414		29%
Kitchen Equipment	6	5	23,447	3	17,407	73%	74%
Building Envelope	15	74	120,253	52	84,177	70%	70%
Vending Machines	19	0	30,991	0	22,382	100%	72%
Totals	23,078	2,862	10,862,284	2,315	8,313,637	81%	77%

Reasons for Differences

The evaluation team developed an updated NTGR for the CEP and Solution Provider program elements. We calculated ex-post net savings by applying the updated NTGR, 0.70, to evaluated gross savings. In contrast, the program calculates ex ante net savings by assigning multiple deemed net-to-gross ratios based on measure type. These deemed NTGRs varied from 0.41 to 0.95. We did not have sufficient sample size for calculation of measure-specific NTGRs and applied the single value for all prescriptive measures. This value of 0.70 was slightly higher than for motors and lower for other measures.

Retrofit Existing Component of Commercial Efficiency Program

Table 2-6 presents evaluated net energy and demand savings associated with the Retrofit Existing program component by end-use category. As both net savings values are calculated used program planning NTG factors, the differences expressed through the realization rates represent differences in the ex ante and evaluated gross savings. See the definitions in Section 1.1 for a discussion of the difference between the ex ante and evaluated values.

Table 2-6. Retrofit Existing Component of CEP for Goal Comparison

Category	Ex Ante		Evaluated		Realization Rate	
	kW	kWh	kW	kWh	kW	kWh
Lighting	6,443	24,478,082	6,165	23,649,253	96%	97%
HVAC	28	30,204	20	29,105	71%	96%
Total	**6,471**	**24,508,286**	**6,185**	**23,678,358**	**96%**	**97%**

Reasons for Differences in Impacts

We found inconsistencies in the tracked savings (entered from the worksheet summary tab, by measure code), when compared to the savings calculated by tallying individual worksheet measures. These errors were not biased in any one direction, but occurred to create projects with higher than actual and lower than actual savings. We found errors resulting in project-specific realization rates of 20% as well as 400%. We methodically went through the sample frame with an AEG staff member to assure ourselves of the errors.

Table 2-7 shows a comparison of ex ante to ex post net energy and demand savings associated with the Retrofit Existing program component by end-use category. See the definitions in Section 1.1 for a discussion of the difference between the ex ante and ex post values. As noted in Section 1, the evaluation team developed ex post net impact estimates for use in the benefit cost and economic impact assessments.

Table 2-7. Retrofit Existing Component of CEP for Cost-Effectiveness

Category	Ex Ante		Ex Post		Cost-Effectiveness Realization Rate	
	kW	kWh	kW	kWh	kW	kWh
Lighting	6,443	24,478,082	4,722	17,994,370	73%	74%
HVAC	28	30,204	15	22,637	56%	75%
Total	**6,471**	**24,508,286**	**4,737**	**18,017,007**	**73%**	**74%**

Reasons for Differences in Net Impacts

Similar to the Prescriptive Program component, we estimated a single NTGR for the population of measures across the Commercial program. The planning assumption NTG factors are 0.92 for lighting and 0.90 for HVAC. The evaluated NTG factor is 0.70, thus reducing ex post net savings values.

Small Business Direct Install Component of Commercial Efficiency Program

Table 2-8 evaluated net energy and demand savings associated with the SBDI program component by end-use category. As both net savings values are calculated using program planning NTG factors, the differences expressed through the realization rates represent differences in the ex ante and evaluated gross savings. See the definitions in Section 1.1 for a discussion of the difference between the ex ante and evaluated values.

Table 2-8. SBDI Component of CEP Impacts for Goal Comparison

Category	Number of Units	Ex-Ante		Evaluated		Realization Rate	
		kW	kWh	kW	kWh	kW	kWh
T8 28 W 4 foot lamps	1,410	136	358,205	102	358,627	75%	100%
T8 32 W 4 foot lamps	1,300	88	248,656	71	263,949	80%	106%
T5HO	334	67	207,397	56	226,844	84%	109%
LED	444	26	74,749	20	74,822	75%	100%
T8 2 or 3 foot lamps or U-tubes	193	13	34,719	10	37,722	77%	109%
Occ Sensors Existing Fixtures	15	11	27,246	2	5,395	21%	20%
LED Exit Signs	97	4	11,278	3	11,276	75%	100%
CFL	38	3	9,053	2	9,057	75%	100%
SBDI Totals	**3,831**	**349**	**971,304**	**266**	**987,693**	**76%**	**102%**

Reasons for Differences in Impacts

- LIPA's tracking database had a rounding error that applied a coincidence factor of 1.0 instead of the appropriate coincidence factor of 0.75. LIPA has since fixed this small glitch, but the 2011 demand values did not include coincidence factors. Our evaluation values include the 0.75 value. The demand realization rate of 76% combines a few other small issues with the data that caused some measures to be slightly higher than the ex ante value and some to be slightly lower.
- There were a few issues with the occupancy sensor calculation:
  - For occupancy sensors installed on new fixtures, energy and demand savings were not transferred correctly from the project worksheets to the overall program tracking database, so were not tracked. In addition, data from the tracking database indicated a demand savings factor of 0, when 0.3 is a better value. The value of 0.3 comes from the NYSEEPS that specifies demand savings from occupancy sensors. While NYSEEPS does not specify a value for energy savings from occupancy sensors, 0.3 is a reasonable assumption and we have applied it in the evaluation numbers. Application of this factor slightly increases the overall savings for both demand and energy when new fixtures are installed.
  - For occupancy sensors installed on existing fixtures, the tracking database showed energy and demand savings factors of 1.0, instead of the 0.3.. The realization rate indicates our adjustments to the savings factors and the overall savings. However, as noted in the table above, occupancy sensors in existing fixtures are a very small component of the overall savings (.5%) and do not greatly affect the savings.

Additionally, three projects incorrectly transferred measure and savings data from the project worksheets to the tracking database.

Table 2-9 presents net ex post energy and demand savings associated with the small business direct install program component by end-use category. The evaluation team estimated a single NTGR for the SBDI component of the Commercial Program. This NTGR value, 0.87, was lower than the program planning value of 1.0, reducing all values in Table 2-9. See the definitions in Section

1.1 for the difference between the ex ante and ex post values. As noted in Section 1, the evaluation team developed ex post net impact estimates for use in the benefit cost and economic impact assessments.

Table 2-9. SBDI Component of CEP Impacts for Cost-effectiveness

Category	Number of Units	Ex-Ante		Ex Post		Cost-Effectiveness Realization Rate	
		kW	kWh	kW	kWh	kW	kWh
T8 28 W 4 foot lamps	1,410	136	358,205	89	312,006	65%	87%
T8 32 W 4 foot lamps	1,300	88	248,656	62	229,636	70%	92%
T5HO	334	67	207,397	49	197,354	73%	95%
LED	444	26	74,749	17	65,095	65%	87%
T8 2 or 3 foot lamps or U-tubes	193	13	34,719	9	32,818	67%	95%
Occ Sensors Existing Fixtures	15	11	27,246	2	4,693	18%	17%
LED Exit Signs	97	4	11,278	3	9,810	65%	87%
CFL	38	3	9,053	2	7,880	65%	87%
SBDI Totals	**3,831**	**349**	**971,304**	**232**	**859,293**	**66%**	**88%**

Custom Program

We based energy impacts from the Custom program on the evaluation of 23 sites via engineering measurement and verification (M&V).

Custom projects varied from the installation of efficient lighting fixtures with occupancy sensors to a demand-controlled ventilation system in an underground parking garage. To perform custom project analysis, we first determine site-specific realization rates for a stratified random sample of projects. The evaluation team stratified the population of completed projects according to their ex ante energy savings values. The analysis essentially compares the program-estimated savings values to the evaluated values obtained from site M&V for the various projects in our sample. We applied a weighted realization rate from the sample back to the overall program population to obtain program component level impacts. See the definitions in Section 1.1 for the difference between the ex ante and evaluated values.

As discussed in Section 13.2, our analysis of custom measures produced results with a higher relative precision (90 percent confidence, +/- 19% error) than is desired (90 percent confidence, +/- 10% error). The high relative precision is, in part, a result of the sample design for the on-site M&V for custom measures. Based on choices made in conjunction with LIPA early in the evaluation process, the evaluation team designed the sample to include the optimum number of sites to reach 90/10 precision for energy. This sample design was identical to the previous year where our kW precision was 90 percent confidence, +/-12% error, and was selected to be consistent with prior evaluations. The high relative precision is also a result of the high variance between evaluated and ex ante gross savings values. Because the evaluation timeline did not allow the evaluation team to conduct on-site metering during a period coincident with LIPA's system peak demand, LIPA expressed concern that the lack of metering could be the source of some of the variance between evaluated results and ex ante savings estimates. This was particularly the case for custom cooling measures. As such, after conferring with LIPA, the evaluation team used the ex ante savings values for all custom projects to determine evaluated KW savings for the Custom program component. LIPA has directed the evaluation team to develop a sample to provide the desired relative precision for KW and conduct M&V during the summer of 2012 to develop a custom measure realization rate for use on the 2012 Annual Report.

Table 2-10. Custom Program Component for Goal Comparison

Program Component	Category	Ex Ante		Evaluated		Realization Rate	
		kW	kWh	kW	kWh	kW	kWh
Custom	All	7,028	38,648,461	7,028	35,894,410	100%	93%

For the sample of custom measure sites selected for evaluation, our realization rates varied from 8% to 134% for kW and 29% to 150% for kWh. 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. Oftentimes, the applicant included HVAC interactive savings for a lighting retrofit in areas that are not heated or cooled.
- The screening tool's coincidence factor assumption (0.75 for lighting projects, for example) was often not representative of the peak-hour operation determined through on-site metering. Additionally, peak demand savings were claimed at facilities that operate outside of the summer peak period. For example, peak demand savings were claimed for an HVAC project that involved the installation of ground-source heat pumps at a reception hall where the customer indicated operation during nights and weekends only[6]. We recommend assigning more site-specific coincidence factors based on application paperwork, interviews with the customer or contractor, and contractor analysis.
- This evaluation's sample included five projects involving the retrofit of grocery store cooler and freezer fan motors. The ex ante savings calculation methods varied, but each did not account for the cycling and defrost characteristics typical of cooler/freezer fans. This discrepancy resulted in reduced ex post savings as compared to ex ante. Since many of these types of projects are incentivized by LIPA each year, we recommend that the program sponsor the creation of a more extensive application savings tool that incorporates cycling and defrost characteristics in its motor calculations.
- In general, more rigorous technical review and post-inspection would result in more accurate savings claims each year. For example, we visited a facility that had received a LIPA incentive for an energy management system (EMS) and had therefore claimed cooling and fan savings in its application. However, through interviews with site staff, we were notified that the facility is not electrically cooled, but rather receives steam and chilled water from a nearby private tri-generation plant. This negated the cooling savings claims for each of the affected air-handling units. A more thorough technical review and survey of site personnel would have adjusted the claimed savings to more accurately reflect the project's reduction in kW off the grid. We

[6] We plan to measure this site in the summer of 2012 to more fully understand the demand savings if the customer agrees.

recommend additional technical review effort during the incentive approval process for projects with high claimed savings values or complex technologies.

Table 2-11 presents net ex post energy and demand savings associated with the custom program component. See the definitions in Section 1.1 for the difference between the ex ante and ex post values. As noted in Section 1, the evaluation team developed ex post net impact estimates for use in the benefit cost and economic impact assessments.

Table 2-11. Custom Program Component for Cost-Effectiveness

Program Component	Category	Ex Ante		Ex Post		Cost-Effectiveness Realization Rate	
		kW	kWh	kW	kWh	kW	kWh
Custom	All	7,028	38,648,461	5,140	26,028,569	73%	67%

Reasons for Differences in Net Impacts

The evaluation team developed an updated NTGR for the CEP and Solution Provider program elements. We calculated ex-post net savings by applying the updated NTGR, 0.70, to evaluated gross savings. In contrast, the program calculates ex ante net savings using a deemed value that varied slightly by end use, but averaged 0.93.

Net-to-Gross Estimation

LIPA currently uses measure category level deemed net-to-gross ratios (NTGR) for program planning. Planning values were also used in prior evaluation cycles. As part of the 2011 Commercial program evaluation, the evaluation team conducted research to develop the NTG values for LIPA's Commercial Efficiency program. Specifically, we designed our research to develop two separate net-to-gross ratios for the Commercial program: one for the Small Business Direct Install (SBDI) program component and one for Prescriptive, Existing Retrofit, and Custom program components of the CEP program (combined).

The NTG assessment of the Commercial Efficiency program considered participant free ridership and spillover attributed energy efficient equipment installations taking place outside of the program as a result of programmatic activities. Due to multiple factors described below, the evaluation team focused the 2011 NTG analysis on quantifying participant free ridership and identifying *indicators of the presence* of participant and non-participant spillover. We did not quantify savings associated with participant or non-participant spillover and thus spillover is effectively assumed to be zero. In this way, to the extent that LIPA's programs resulted in spillover, the evaluated NTGR understates program attribution. The NTG ratio is calculated as follows:

$$NTGR=(1 - FR + SO)$$

Participant spillover is realized when a program participant takes action to save energy (install energy efficient equipment, implement O&M strategies, etc.) as a result of their prior experience with the program. For participant spillover to occur, research indicated that typically a 6 to 9 month time lag from the customer's participation in the program is required for the participant to make an additional energy efficient equipment investment or otherwise take action that is influenced by their prior participation. Given that the SBDI program component was launched so late in the program year, it is extremely unlikely for participant spillover to have occurred as a result of the program and thus the evaluation team did not attempt to quantify participant spillover for the SBDI program. With respect to the Prescriptive, Existing Retrofit, and Custom components of CEP, accurate quantification participant spillover requires sufficient information regarding the additional action taken outside of the program to develop an engineering estimate of spillover savings along with questions required to establish that the program influenced the action. For example, to calculate savings from program induced equipment installations requires detailed information regarding each measure type installed (size, type, efficiency, control, etc), the measure use and the facility in which the equipment is installed. Given the participant survey was also used to gather process related information and questions to assess free ridership, survey burden was a significant concern. As such, the evaluation team used the survey to assess the degree to which participants took action outside of the program and information about the actions taken with the goal of determining if sufficient potential for participant spillover exists to warrant quantification in future evaluation cycles. Based on a review of evaluations of similar programs conducted in other jurisdictions, with some outliers, participant spillover generally ranges between 0% and 4% of the total evaluated program savings.

Non-participant spillover is realized when non-participating customers take action to save energy as a result of programmatic activities. To increase the likelihood for non-participant spillover in a market, program designs must include a substantial focus on specific and sustained efforts to transform end use markets up stream of end use customers that go well beyond equipment incentives intended to reduce the barrier of the incremental cost of efficiency. Because non-participant spillover is a market level impact, or market effect, its accurate assessment requires specific information regarding indicators or metrics of market transformation that the program is designed to achieve. At the present time, these data are not available for LIPA's programs. As such, while we did conduct contractor interviews to assess the program's influence on practices, we did not have sufficient data to quantify non-participant spillover. The evaluation team will work with LIPA program staff to define the required metrics and develop the required information in future evaluation cycles.

Due to the turnkey nature of the Small Business Direct Install program, estimation of free ridership and the presence of participant spillover relied solely on participant self-reported data. For the Prescriptive, Existing Retrofit, and Custom program components, on the other hand, it was important to expand the research beyond participant self-report to develop a more complete understanding of the customer decision-making processes, to include potential program influence through contractors and other trade allies. As such, the NTG estimation effort involved integrating information from program participants and participating trade allies (including distributors, installation contractors, ESCOs, etc.).

Table 2-12. Overview of NTG Research Scope for the Commercial Efficiency Program

Scope of NTG Research	Free Ridership		Spillover	
	Participant Research	Trade Ally Research	Participant Research	Trade Ally Research
Prescriptive/Existing Retrofit/Custom component	Yes	Yes	Estimation of presence without quantifying	Estimation of program influence on practice w/o quantification
Small Business Direct Install component	Yes	No	Estimation of presence without quantifying	No

Estimation of NTGR is an inexact science as it attempts to assess the counterfactual, what would have occurred in the absence of the program. As such, the free ridership component of the NTGR can be viewed as a measure of naturally occurring energy efficiency that includes efficiency gains associated with market transformation resulting from ongoing program efforts and pure free ridership. When considering the NTGR results presented below note that data are not currently available to determine the percentages of market transformation and free ridership incorporated in the factor.

The table below provides a comparison of the program planning NTG values to the ex-post NTG values.

Table 2-13. Commercial Efficiency Program Deemed and Evaluated Net-to-Gross Values

Program Components	Program Deemed NTGR	2011 Ex-Post NTGR
Prescriptive/Existing Retrofit	0.64-0.95	0.70
Custom	0.93	0.70
Small Business Direct Install	1.00	0.87

The sections below present further details on the NTG values derived as a result of the evaluation. Section 13.2 contains detailed methodology used in the NTG estimation process.

Prescriptive, Existing Retrofit, and Custom Program Components

Free ridership

As previously mentioned, the NTG estimation process for the Prescriptive, Existing Retrofit, and Custom program components of the Commercial Efficiency program drew on two sources – participant survey and in-depth interviews with trade allies.

The participant survey explored absolute and relative importance of the program, as well as the influence of various program components on participant's decisions to install energy efficient equipment. Based on survey data provided by participating customers, the free ridership rate for the Prescriptive, Prescriptive Retrofit, and Custom program components is 0.38. This estimate is based on interviews with 92 program participants who completed a total of 114 unique projects accounting for 13% of total evaluated gross savings from the Prescriptive, Existing Retrofit, and Custom program components.[7]

When estimating the level of program influence, it is possible that participating customers might not fully consider other potential program influencers on the market of which they are unaware. A primary example is the program's potential influence on trade allies. Given certain aspects of the program design, it is possible that CEP program activities will have resulted in trade allies recommending high efficiency equipment more persuasively and aggressively and in a higher percent of sales situations. Similarly, some trade allies may integrate incentives into the overall project costs presented to customers without specifically identifying the LIPA incentive, thus making the CEP offering more competitive to energy efficient equipment offerings from competing contractors and potentially resulting in an under-estimation of program influence participating customers responding to the survey.

As such, the evaluation team performed research with trade allies with a goal of quantifying program influence on associated with contractor sales practices. Based on the participant survey responses, the evaluation team determined the minimum possible free ridership score by setting the free ridership scores of individual respondents who reported being heavily influenced by trade allies to 0. We used the difference in the unadjusted and theoretical minimum free ridership scores as maximum possible program induced influence of trade allies on participant decision making.[8] We conducted interviews with ten participating trade allies of different types, such as energy consultants, ESCOs, equipment distributors, installation contractors, and equipment vendors. Based on the tracking data provided to us, responding trade allies contributed 22% of the total evaluated gross savings. Our trade ally attribution algorithm included information regarding reported level of knowledge about the program, frequency and depth of program interactions, and program influence on business practices. The analysis trade ally survey results yielded a decrease in the participant free ridership factor to 0. 3 (a 0.08 reduction). The final evaluated NTG ratio for the Prescriptive, Existing Retrofit, and Custom program components, as a result is estimated to be 0.70.

Table 2-14 below presents a comparison of program planning NTGR values and the ex-post NTGR for the Prescriptive and Existing Retrofit program components of the CEP program.

Table 2-14. Prescriptive, Prescriptive Retrofit, and Custom Net-to-Gross Values

Program Components	Program Deemed NTGR	2011 Ex-Post NTGR
Prescriptive/Existing Retrofit	0.64-0.95	0.70
Custom	0.93	0.70

[7] Note that the percent of kWh savings in the sample is based on the ex post gross savings present in the sample frame, as opposed to the population of projects.

[8] See section 12 for a detailed description of the method employed to integrate participant and trade ally results in the final NTG ratio.

The final ex-post net-to-gross ratio is consistent with that of similar programs offered in other jurisdictions across the country.[9]

Spillover

Of 92 program participants responding to the survey, 26 report making additional energy efficient improvements outside of the program. We asked these respondents to describe the type of improvement they made and additional questions regarding their reasons for not applying for incentives through the Commercial program, and the degree to which their prior experience with the program influenced the decision to make additional improvements.

- **Lighting.** A total of ten respondents reported installing program-qualifying high efficiency lighting equipment outside of the program. Of those, three indicated that their prior experience with the program had some degree of influence in their decision to make additional energy efficient improvements.[10] Of the three, two reported installing fluorescent lighting, and one reported installing CFLs.
- **Cooling.** A total of three respondents reported installing program qualifying high efficiency cooling equipment outside of the program. Of the three, two respondents indicated that their prior experience with the program had no influence on their decision to make additional cooling upgrades.[11]
- **VFDs.** Only one respondent reported installing program-qualifying variable frequency drives outside of the program. That respondent's prior experience with the program had no influence on their decision to make additional efficiency upgrades at their facility.[12]
- **Commercial Kitchen Equipment.** Only one respondent reported installing commercial kitchen equipment outside of the program. He rated the program of little influence on the purchase and installation decision.[13]
- **Other Equipment.** A total of two respondents reported installing other program-qualifying energy efficient equipment without getting an incentive from LIPA's Commercial program. Of the two, only one rated the program of influence.[14] This installation involved lighting equipment.

Overall, a total of four unique respondents, accounting for six total projects outside of the program, attributed their prior experience with LIPA's CEP program as having some degree of influence on the decision. While these results suggest some evidence of participant spillover, as described above, the evaluation team did not gather the specific data required to quantify savings in this year's evaluation effort. Rather, the evaluation team used the participant survey to assess the degree to which participants took action outside of the program and information about the actions taken with the goal of determining if sufficient potential for participant spillover exists to warrant quantification in future evaluation cycles. We will work with program staff to determine if such an assessment is desired. Based on a review of evaluations of similar programs conducted in other jurisdictions, with some outliers, participant spillover generally ranges between 0% and 4% of the total evaluated program savings.

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[9] Based on the evaluation work that was performed in other jurisdictions, free ridership estimates were as high as 0.41

[10] A rating of 5, 6, or 7 on a 1 to 7 point scale, where 1 is no influence and 7 is great influence.

[11] A rating of 1 on a 1 to 7 point scale, where 1 is no influence and 7 is great influence.

[12] Ibid

[13] A rating of 3 on a 1 to 7 point scale, where 1 is no influence and 7 is great influence.

[14] A rating of 7 on a 1 to 7 point scale, where 1 is no influence and 7 is great influence.

Small Business Direct Install Program (SBDI) Component

Free Ridership

Estimation of free ridership for the Small Business Direct Install program component relied on participant self-report. Similar to the free ridership estimation for the Prescriptive, Existing Retrofit and Custom program components, participant survey explored absolute and relative importance of the program, as well as influence of various program components on the decision to implement high efficiency equipment as opposed to standard efficiency.[15]

We used survey results from interviews with 29 of the 50 program participants accounting for 31 of 54 projects completed in 2011 and 57% of evaluated gross kWh savings to determine the NTGR for the SBDI program. The analysis of the results yielded a free ridership rate of 0.13, which translates into 0.87 NTGR. This compares to the default value of 1.00 currently used for program planning. Table 2-15 summarizes the NTGR results.

Table 2-15. SBDI Net-to-Gross Values

Factor	Program ex ante	2011 Ex-Post
Free Ridership (FR)	0.0	0.13
Spillover (SO)	--	--
Net-to-Gross (1-FR)	1.00	0.87

Participant Spillover

As discussed above, we included a qualitative assessment of participant spillover in our NTG analysis but did not quantify the associated savings. Of the 29 survey respondents, only three reported having installed other energy efficient equipment at one of their facilities after participating in the SBDI program *without* receiving an incentive from LIPA. Of these:

- One respondent reported that the equipment did not qualify for an incentive.
- One respondent reported minimal influence from their participation in the SBDI program on their decision to install this equipment.
- Only one respondent reported that their participation in the SBDI program was important in this additional installation. This respondent reported having installed cooling equipment and not knowing that an incentive was available.

Based on these results, there is some evidence that participant spillover might be present. However, it should be noted that: 1) the actual efficiency level of the additional installed equipment is unknown; it is therefore unclear if that equipment would qualify as spillover in a more rigorous quantitative analysis and 2) the SBDI program only launched in the fall of 2011, leaving little time for additional installations that might qualify as spillover.

[15] See Section 13.2 for a detailed description of the method employed to calculate free-ridership rate.

3. 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 compact fluorescent lamps (CFLs), solid state lighting (LED), ENERGY STAR Televisions, dehumidifiers, refrigerators, and room air conditioners. The program also provides rebates on variable and two-speed pool pumps. EEP includes an appliance-recycling component 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.

Impacts for Goal Comparison

Table 3-1 provides a program level comparison of evaluated net savings to ex ante savings by measure category. See the definitions in Section 1.1 for a discussion of the difference between the ex ante and evaluated values.

Table 3-1. EEP Impacts for Goal Comparison

Category	N[a]	Ex Ante		Evaluated			Realization Rate	
		kW	kWh	N	kW	kWh	kW	kWh
Lighting	1,610,194	7,935	82,020,966	1,609,542	7,477	68,438,068	94%	83%
Refrigerator Recycling	10,936	914	9,744,376	10,936	914	9,744,376	100%	100%
Refrigerators	29,904	414	3,268,419	29,904	414	3,268,419	100%	100%
Televisions	18,342	267	2,367,651	18,342	267	2,367,651	100%	100%
Dehumidifiers	8,365	705	1,189,635	8,365	911	1,540,811	129%	130%
Room AC	21,686	1,146	540,101	21,686	1,136	552,198	99%	102%
Pool Pumps	615	277	528,272	615	277	528,272	100%	100%
Ceiling Fans	398	15	46,743	398	15	46,743	100%	100%
Totals		**11,673**	**99,706,163**		**11,412**	**86,486,538**	**98%**	**87%**

[a] Ex Post impacts have 652 fewer lighting units. The evaluation team could not reconcile this small difference.

Reasons for Differences in Impacts

Lighting: We obtained specific algorithms and inputs for the ex ante estimates for demand impacts and energy. In the ex post analysis, we characterized the pertinent variables as follows:

- *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. LIPA's delta watts value is a static 55 watts while the evaluation team used the installed wattages and a lumen equivalency to obtain a delta watts for this year's mix of bulbs. For 2011, the average incented bulb was 15.5 watts, and the average assumed pre-program wattage was 65.5 watts, for a delta watts of 50.0. (We determined the pre-program wattage based on lumen equivalent bulbs.) Calculating what the program pre-program bulb wattage would be using a static 55 watts gives a value of 70.45 watts. Our pre-program value of 65.5 watts is lower, leading to a lower program per-bulb savings of 50 watts, thus reducing the ex ante demand savings (by 5 watts per bulb or 9% of the ex ante value).
- *Hours of use*. We used a recent residential lighting metering study conducted for a number of Northeast utilities[16], which found daily CFL usage of 2.8 hours/day (or 1,022 hours/year). In 2011, the program assumed 1,168 annual operating hours in its savings estimates (3.2 hours/day), which was changed to 1,022 hours in 2012. Our evaluation applied the metered data hours of use as the study was rigorous with 678 CFLs for summer and 217 CFLs for winter. These homes were similar in latitude to Long Island and thus were determined to be the best set of information available. The metering study information reduced the energy savings for each bulb installed by 146 hours or 12.5% of the ex ante value.
- *Coincidence factor*. There were no differences caused by this factor as both the ex ante and ex-post used 0.11 for demand savings.
- *In-service rates*: The LIPA residential baseline study[17] found 83% of CFLs installed, with 17% in storage. In the 2010 evaluation, we applied this first-year in-service rate of 83% to 2010 program bulbs and have again applied the rate to 2011 program bulbs. Previous studies estimated a trajectory of future installation for stored program bulbs, and found 98% of program bulbs are installed within two years following the program. The study further concluded that customers install 9% of first year bulbs less than a year after purchase and another 6% of first year bulbs within two years. Therefore, we included the savings from 9% of 2010 CFL bulbs to the 2011 totals. We will include the savings from the remaining 6% of 2010 bulbs and 9% of 2011 bulbs in the 2012 evaluation.

Dehumidifiers: The evaluation increased the ex ante savings values for dehumidifiers. The program has improved their tracking on detailed capacity data for 2011 dehumidifiers, allowing the evaluation team to perform analysis based on capacity. This type of analysis provides a higher level of accuracy in our savings. We used information from the ENERGY STAR site to assign per-unit savings by capacity, which is a higher value than used by LIPA. Moving forward, we recommend that the ex ante savings values be increased to match the energy savings values recommended by ENERGY STAR.

Refrigerators: The evaluation team made no changes to the program ex ante values. We looked closely at the savings values for new refrigerators used in the program compared to the ENERGY STAR site and found that the program had accounted for the differences within the refrigerators sold through the program. Additionally, we used the ENERGY STAR site to compare values for

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

[17] *2010 LIPA Residential Baseline Study*. Opinion Dynamics Corporation. June 2011

refrigerator recycling. The program had accurately handled the different types of recycled refrigerators as well.

Televisions: The evaluation team made no changes to the ex ante values for televisions. Similar to refrigerators, we used the ENERGY STAR site to assess the level of savings for these measures. The program values were in line with what we found on ENERGY STAR for the various types of televisions.

Room air conditioners: Evaluators determined slightly lower demand and slightly higher energy savings for room air conditioners as compared with ex ante. The program provides a savings value per installation while the evaluation team uses an algorithm to arrive at savings. We are unable to determine the small differences between the value provided by the program and our values.

Pool Pumps: We found that the savings values were reasonable and made no changes to the ex ante values. However, the savings could be off somewhat simply because the pre-and post conditions of the pumps are not well known. We recommend considering further research to measure the pre- and post conditions to fine tune the savings values used if the measure becomes a larger portion of the program.

Residential Lighting Comparison

In our previous evaluation, we realized that the different residential programs treated the savings from CFLs differently. In retrospect, residential customers most likely use CFL bulbs in the same way regardless of which program they went through. We researched these differences more closely this year and present our findings next.

To determine consistency among residential programs that feature CFLs, we examined each program's ex ante assumptions for pertinent variables involved in the lighting savings calculation. We applied the values in the right-most column (ex post) for EEP.

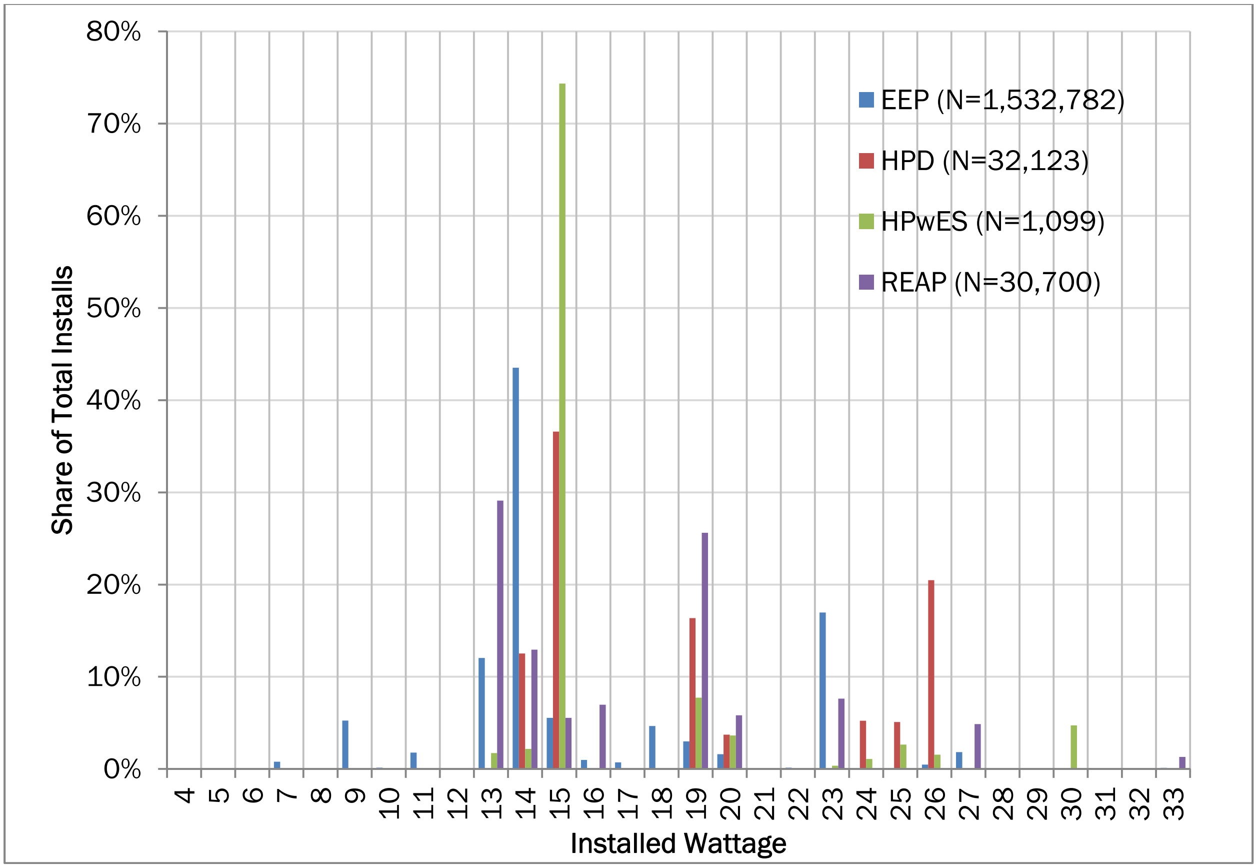
Table 3-2. CFL Ex Ante and Ex Post Parameters by Program

Metric	Ex Ante				Ex Post
	EEP	REAP	HPD	HPwES	
Average preexisting wattage	70.45	68.50	75.54	63.46	65.51
Average installed wattage	15.45	17.44	18.95	16.71	15.45
Average delta watts	55.00	51.06	56.59	46.75	50.06
Annual operating hours	1,168	1,253	1,000	1,000	1,022
Coincidence factor	0.110	0.106	0.152	0.156	0.11
In-service rate[1]	89%	100%	100%	100%	83%
Average kWh savings	64.24	63.97	56.59	46.75	51.16

[1]In-service rate applies to CFLs sold through the EEP program only.

We also examined the makeup of each program's lighting installs by wattage in 2011 to determine if the ex post value was applicable for the other programs. Figure 3-1 shows the share of bulbs installed through the various programs by wattage.

Figure 3-1.Share of CFL Installations by Program



Note: The EEP CFL value includes only bulbs through the buy-down component of EEPs.

As illustrated in the bar graph above, each of the four programs features a majority of installs in the 13-15-watt CFL range. Though each program has a unique makeup, evaluators conclude that the CFL breakdowns are sufficiently similar to allow a consistent ex post recommendation. We have currently applied the ex post delta watts, run hours, and coincidence factor assumptions in Table 3-2 to CFL savings across all residential programs. However, we applied the different in-service rates as shown in Table 3-2, with 100% in-service rate for all programs except EEP, which uses 83%.

Impacts for Cost-Effectiveness

The ex-post NTG factor differed from the ex ante NTG assumption to varying degrees across program measures. Table 3-3 shows the ex ante and ex-post NTG values by measure.

Table 3-3. NTGR for EEP

Program Measures	Ex Ante			Ex Post		
	Free rider	Spillover	NTGR[a]	Free rider	Spillover	NTGR
Refrigerators	20.0%	10.0%	88.0%	20.0%	10.0%	90.0%
Dehumidifier	30.0%	15.0%	80.5%	67.0%	0.0%	33.0%
Room A/C <6kBtuh	30.0%	25.0%	87.5%	30.0%	25.0%	95.0%
Room A/C ≥6kBtuh	30.0%	25.0%	87.5%	30.0%	25.0%	95.0%
CFLs - common	30.0%	4.0%	72.8%	30.0%	4.0%	74.0%
CFLs - specialty	25.0%	20.0%	90.0%	25.0%	20.0%	95.0%
ENERGY STAR SSL	5.0%	25.0%	118.8%	5.0%	25.0%	120.0%
Fixtures	1.7%	3.2%	101.4%	1.7%	3.2%	101.5%
Ceiling Fans	30.0%	0.0%	70.0%	30.0%	0.0%	70.0%
Refrigerator recycle	43.0%	0.0%	57.0%	52.0%	0.0%	48.0%
Pool pumps-two speed	20.0%	10.0%	88.0%	20.0%	10.0%	90.0%
Pool pumps-variable speed	20.0%	10.0%	88.0%	20.0%	10.0%	90.0%
TVs - 30% above ES	20.0%	10.0%	88.0%	20.0%	10.0%	90.0%

[a] The ex ante NTGR for LIPA had been calculated as (1-FR)*(1+SO), an algorithm that we keep here to compare to goals. The ex post values used the algorithm of (1-FR+SO).

Applying the NTG factors in Table 3-3 to evaluated gross savings provides ex post net savings. Table 3-4 provides a category-by-category comparison of ex ante to ex post net savings. See the definitions in Section 1.1 for a discussion of the difference between the ex ante and ex post values. As noted in Section 1, the evaluation team developed ex post net impact estimates for use in the benefit cost and economic impact assessments.

Table 3-4. EEP Net Impacts for Cost-Effectiveness

Category	N[a]	Ex Ante		Ex Post			Cost-Effectiveness Realization Rate	
		kW	kWh	N	kW	kWh	kW	kWh
Lighting	1,610,194	7,935	82,020,966	1,609,542	7,692	70,395,272	97%	86%
Refrigerator Recycling	10,936	914	9,744,376	10,936	770	8,205,790	84%	84%
Refrigerators	29,904	414	3,268,419	29,904	424	3,342,701	102%	102%
Televisions	18,342	267	2,367,651	18,342	273	2,421,462	102%	102%
Dehumidifiers	8,365	705	1,189,635	8,365	374	631,637	53%	53%
Room AC	21,686	1,146	540,101	21,686	1,233	599,529	108%	111%
Pool Pumps	615	277	528,272	615	284	540,278	102%	102%
Ceiling Fans	398	15	46,743	398	15	46,743	100%	100%
Totals	**1,700,440**	**11,673**	**99,706,163**	**1,699,788**	**11,064**	**86,183,412**	**95%**	**86%**

[a] Ex Post impacts have 652 fewer lighting units. The evaluation team could not reconcile this small difference.

Reasons for Differences in Net Cost-Effectiveness Impacts

As stated above, the program uses the following formula to determine net-to-gross impacts for this program:

LIPA's EEP Algorithm for Net Savings

Net Savings = Gross Savings X NTGR [(1-FR)*(1+SO)]

where,

FR = free ridership rate (%)

SO = spillover rate (%)

We kept the ex ante NTGR based on this calculation for purposes of comparison to goal, but have applied the typical algorithm for our ex post NTGR:

Evaluation Team's EEP Algorithm for Net Savings

Net Savings = Gross Savings X NTGR [(1-FR+SO)]

The two algorithms create slight discrepancies when applying same gross savings only when there are spillover savings. The LIPA NTGR values are always lower and range from .1% to 7.5% lower than the NTGR calculated using the evaluation team's algorithm.

The difference in NTGR algorithm accounts for the different realization rates between Table 3-1 and Table 3-4 for lighting, room AC, refrigerators, pumps, and TVs. The realization rates are the same for ceiling fans because there is no assumed spillover for this measure in the ex ante value; hence, the two calculations arrive at the same value. The evaluation team assessed NTG values for refrigerator recycling and dehumidifiers are arrived at lower values than the program planning values. We describe our analysis of the NTGR for these two measures next.

Evaluating Net-to-Gross Estimates

In our 2010 evaluation, we developed NTG values for the Refrigerator Recycling and Dehumidifier programs. As part of the 2011 EEP program evaluation, we conducted additional research to provide revised NTG values for both programs for future planning and evaluation. Like last year, we used a participant self-report method for both program components where we contacted 2011 program participants and asked a battery of questions designed to measure free ridership and spillover.

As part of the 2011 evaluation, the evaluation assessed the assumed NTG value for efficient televisions sold through the EEP program. This assessment included secondary research and a review of a recent comprehensive study of attribution associated with a similar program. The objective of this research was to determine if the current NTG planning value is reasonable considering the current television market place and not include an effort to develop an ex post NTG factor. While we ultimately did not change the program planning NTGR in our assessment of 2011 impacts, the research suggests that the planning value of 88% likely reflects a much higher level of program attribution than is appropriate, and that if the scope of the evaluation did not include quantification of attribution for this measure, selection of an NTG factor for televisions is a policy or program planning decision. Considering the market factors in play, LIPA may wish to adopt a value that falls in the range of 15 to 30%.

We describe the derivation of each evaluated NTGR value below.

Dehumidifiers

For the Dehumidifier program, LIPA uses the deemed ex ante NTG value for planning and evaluation. In 2011, LIPA increased the rebate amount for dehumidifiers from $10 to $20 per unit. The evaluation team had discussed this last year with LIPA and agreed that an increase in rebate could cause people to choose the more efficient (rebated) unit who would have otherwise not bothered to make a change given the smaller rebate. By asking participants the same questions as we did for the 2010 evaluation, we were able to determine whether the increased rebate amount changed the program's free ridership rate, given our data collection instrument.

In our 2011 evaluation, free ridership decreased to 0.67. This is not a statistically significant decrease from the 2010 evaluation value of 0.72 – suggesting that the program's increased rebate may have a slight effect on free ridership, but not to the level that was hoped for with the additional rebate. As in 2010, we did not find evidence of spillover. Since we use the point estimate for our NTGR each year, the dehumidifier NTG value increased slightly from our 2010 evaluation results.

Table 3-5. Dehumidifier Ex Ante, 2010 and 2011 Evaluation Net-to-Gross Values

Factor	Program ex ante	2010 Evaluation (n=69)	2011 Evaluation (n=71)
Free Ridership (FR)	.30	.72	.67
Spillover (SO)	.15	0	0
Net-to-Gross (1-FR+SO)	.81	.28	.33

Refrigerator Recycling

The goal of the free ridership Refrigerator Recycling survey questions was to determine whether and how participants would have disposed of their appliance if the LIPA program had not been available. To better understand the motivating factors behind participants' decisions to dispose of an appliance through the program, we conducted secondary research on alternative appliance disposal options for Long Island residents. Our goal was to understand the variety of disposal options that are available to LIPA customers who want to get rid of a refrigerator or freezer and whether those appliances are put back in use or recycled. The results provide a check on the participant survey responses to ensure that participants give realistic alternative disposal methods. We also used the results to revise the survey instrument.

Opinion Dynamics staff conducted interviews with five local municipalities, seven national and local appliance retailers, and one local appliance recycling operation. We also reviewed online advertisements selling used appliances between February 2 and February 9, 2012.

It is common for municipalities to provide free curbside removal of refrigerators and freezers if the resident can move the appliance to the curb on their own, remove the doors, and notify their local "carter" of the special pickup. Generally, municipalities that did not have trash pickup had local recycling centers that would take used appliances for a nominal $25 dollar disposal fee, provided the resident could bring the used appliance to the recycling center him or herself, or hire someone else to do so.

Most national and local retailers will pick up a used appliance and send it to a recycling facility free of charge with the purchase of a new appliance. Some retailers charge a fee for disposing of the old appliance. We asked retailers whether these appliances were being reconditioned and sold or recycled. None of the retailers reported refurbishing or attempting to resell the used appliances; all stated the appliances were recycled.

Our review of Craigslist, a popular online personal retail site, shows that that there is a lively market for used refrigerators on Long Island. However, most of the appliances for sale were newer than the appliances that would qualify for the LIPA program and were priced at a relatively low cost. A LIPA participant who attempted to sell their used appliance on Craigslist would probably not be able to sell it for much more than the program incentive, and without the certainty of payment that LIPA provides. This suggests that there may not be much of an online retail market for these older appliances, which our interviews with the local municipal and private recycling centers supported.

Overall, we found a number of alternative options for used appliance disposal. If the program did not exist, LIPA customers would still be able to dispose of an older appliance relatively easily, but often at a cost. None of these other options combines the LIPA program's ease of pickup and payment to the customer.

Based on this research, we made some changes to the survey for the 2011 evaluation. Key changes to the free ridership battery include the addition of "consideration of alternatives" questions designed to understand why program participants did not choose other means of disposing of their used refrigerators and freezers. We asked all participants who said they would have gotten rid of the appliance on their own why they did not use that method. Based on these responses, we adjusted the free ridership score if their answer indicated that they would have been very unlikely to use this alternative disposal method. Section 13.2 provides a full description of the free ridership algorithm.

Despite these changes in survey design and analysis, the free ridership rate remained essentially the same as in 2010. As shown in Table 3-6, our 2011 evaluation found that 52% of 2011 participants were free riders compared to 54% in 2010. We found no evidence of spillover, giving the program an overall net-to-gross ratio of .48. This value is lower than the program ex ante value of .57.

Table 3-6. Appliance Recycling Ex Ante, 2010 and 2011 Evaluation Net-to-Gross Values

Factor	Program ex ante	2010 Evaluation (n=70)	2011 Evaluation (n=140)
Free Ridership (FR)	.43	.54	.52
Spillover (SO)	.0	0	0
Net-to-Gross (1-FR+SO)	.57	.46	.48

We surveyed a sufficient number of customers to analyze refrigerators and freezers separately. Participants who recycled refrigerators were more likely to be free riders than were participants who recycled freezers. As Table 3-7 shows, a slight majority of participants recycling refrigerators were free riders whereas the opposite was true of participants who recycled freezers.

Table 3-7. Refrigerator Recycling Free Ridership by Appliance Type

Category	Recycled Refrigerator (n=70)	Recycled Freezer (n=70)
Free Rider (FR)	54%	41%
NTGR	46%	59%

The changes we made to the survey instrument helped to properly classify respondents. We reclassified a number of participants who were originally free riders because they said they would have disposed of their appliance in a manner that took it off the grid if the LIPA program had not been available. However, 12% of these participants had not considered getting rid of their appliance until they learned of the LIPA program, meaning that LIPA most likely helped bring about this choice. We reclassified these respondents so they were not free riders. Similarly, we learned that an additional 12% had not recycled their appliance on their own because it was too much of a hassle and we reclassified them as not being free riders.

We also reclassified respondents who would have had the appliance destroyed on their own but would not have done so for over a year. We consider a year so long in the future that the customer most likely would not have taken the action. We reclassified 11% of such respondents from free riders to not free riders because the program took the appliance off the grid at least a year before the customer would have removed it.

The survey results also help us to understand the free riders. A large number of participants are using the program to dispose of primary refrigerators when they get a new one. When we asked participants who recycled a refrigerator where it was located for the majority of the year prior to its being recycled, 56% of participants said it was located in the kitchen (see Table 3-8). To make sure we understood how customers used the refrigerator before pickup, we asked a follow-up question to confirm that if the appliance was in the kitchen, it had been the main refrigerator in the household for most of the year. Nearly all, 95%, said it had been their primary refrigerator.

Table 3-8. Location of Appliance During Year Prior to Pickup

Location	Refrigerator (n=70)	Freezer (n=70)
Kitchen	56%	4%
Basement	21%	59%
Garage	19%	31%
Laundry Room	0%	3%
Porch/Patio	1%	0%
Other	3%	2%

We note that the location of these same appliances in the program database is somewhat different from the survey results due to the information the pickup team collects (see Table 3-9). The pickup team records the location of the appliance when they come to pick it up and not where the customer uses the appliance for most of the year prior to pickup. The pickup team also uses a combination of room type and floor of the household to indicate location. Their form lists room types of basements, garages, and porches but not kitchens. If a room is not given, the floor on which it was located is given. Because rooms are given for all other rooms but the kitchen, it is likely that a location of the first floor means the appliance was located in a kitchen (although this is somewhat speculative on our part). However, when we compare the survey results with the program database on the same appliances, we find that one-third of the customers reported kitchen refrigerators were moved to the garage prior to pickup.

Table 3-9. Location of Appliance at Time of Pickup
(from Program Tracking database)

Location	Refrigerator (n=70)	Freezer (n=70)
First Floor	30%	7%
Second Floor	1%	0%
Basement	16%	53%
Garage	47%	39%
Porch/Patio	6%	1%

If the program encouraged customers to recycle their old primary refrigerators rather than turning them into secondary appliances, it would still have the intended impact. We asked participants who recycled primary refrigerators if they had ever used the appliance as a spare. Only 3% had done so prior to LIPA picking it up, so it appears the kitchen refrigerators that were picked up in the garage were moved there just for the pickup and not for use as a spare.

Still, the program may have influenced some to recycle their old primary refrigerator before they could turn it into a spare. We asked all respondents what they would have done with their appliance if the LIPA program had not been available (see Table 3-10). Only 20% of participants who recycled a primary refrigerator would have kept the refrigerator and used it, while 73% would have gotten rid of it in a manner that would have destroyed it. This compares to 44% who would have kept and used their spare refrigerator.

Table 3-10. What Would Have Happened to Appliance without LIPA Program

Category	Refrigerator		Freezer
	Spare (n=34)	Primary (n=36)	(n=70)
Kept appliance unused	3%	0%	6%
Kept appliance and used it	44%	20%	36%
Gotten rid of appliance and destroyed it	35%	73%	36%
Gotten rid of appliance but still would have been used	18%	8%	23%

The program is also removing appliances for customers who are replacing their spare refrigerators and freezers so that the total number of appliances in these households remains the same. Forty-one percent of participants who recycled a spare refrigerator replaced it with another refrigerator while 24% replaced their recycled freezers. Combined and weighted to reflect the proportion of refrigerators and freezers in the program, customers replaced 36% of the spare refrigerators and freezers recycled through the program. Overall, when we add in the participants who recycled a primary refrigerator, 63% of program participants replaced the appliance they recycled through the LIPA program with another one. We have not addressed this finding in our research for 2011, but in the future, we should closely consider the ramifications on total energy use when there continue to be multiple appliances in a household.

We explored whether free ridership was different when the program incentive was $50 instead of $35. The relationship was not statistically significant, meaning that there was no difference between the two values.

Our survey results combined with our secondary research suggest that LIPA is removing some old appliances that customers would have had new appliance dealers remove otherwise. Through our interviews with national and local retailers, we learned that most will pick up a used appliance and send it to a recycling facility free of charge with the purchase of a new appliance.[18] Nonetheless, while appliance dealers offer their own removal service, they also promote the LIPA program. One in five participants who replaced the appliance that LIPA recycled learned about the LIPA program through the new appliance dealer, and a considerable share of new appliance purchasers, one-third, would have had their appliance dealer remove their old one if the LIPA program were not available. We asked these participants why they chose the LIPA program over their appliance dealer; 87% said they chose LIPA because of the payment.

Televisions

LIPA's 2011 ENERGY STAR® compliant Television program provides retailers with a $10 monetary incentive for every sale of an ENERGY STAR Version 5.3 compliant television at participating retail outlets on Long Island. The program is designed to accelerate the adoption of more energy efficient television technology in LIPA's service territory.

While the program may have some influence on the proportion of energy efficient televisions sold on Long Island, the dynamics of the television marketplace and the results of a recent evaluation of a similar mid-market program suggest that LIPA's current NTGR assumption for this program is far too high. We did not change the current program planning assumption for the 2011 evaluation, but present our research next to inform future actions that LIPA should consider.

The Northwest Energy Efficiency Alliance (NEEA) recently released the first comprehensive study of a similar incentive program[19]. This study suggests that the overall dynamics of the current television marketplace already drive manufacturers to improve product efficiency levels. Further, the market for televisions in the United States is highly nationalized, with little variation in product lines between localities. The study found four critical factors that appear to be driving the current television market, all of which would continue to exist in absence of utility incentive programs. These factors include:

1. The rapid degree of innovation in energy-efficient display technology, especially the current adoption of LED backlight technology
2. The market shift of sales to large national retailers (including online retailers)
3. The annual product refresh cycle for televisions
4. The strong influence of the federal ENERGY STAR program on manufacturers

We discuss each of these factors in the remainder of this subsection. All four not only suggest low potential for program attribution but also highlight the significant challenge that exists to determining a suitable baseline (a necessary component to the determination of a specific NTG ratio). The information presented throughout this section draws heavily upon the NEEA report cited earlier.

Rapid Degree of Innovation. Current technological innovation rates mean that by the time a highly efficient product is brought to market, the next generation product is already well into development, making it difficult for utility incentives to significantly drive increased efficiency in the consumer electronic market. Perhaps more importantly, innovations that lead to increase

[19] Consumer Electronics Television Initiative Market Progress Report. Prepared for the Northwest Energy Efficiency Alliance (NEEA) by Energy Market Innovations, Inc. November 22, 2011. Report #E11-230

efficiency are most often the byproduct of other efforts. LED backlighting technology, for example, has been widely adopted in the past few years, primarily because of its high quality picture attributes. It also happens to be highly efficient. As manufacturers aim to develop increasingly better picture quality through LEDs, they, by default, develop more and more efficient televisions. Innovation in picture quality, not program incentives, is reported to be the primary driver for the efficiency improvements.

Shift to National Retailers. The effect of the nationalization of the television marketplace also has significant impact on what influence a regional program can have on stocking practices and the sale of high efficiency televisions. National retailers represent over 80% of the commercial television market. Larger retailers, online retailers, and retailers with both a brick and mortar and online presence, have a cost incentive that drives them to offer the same product line at the same price nationally. This reduces local variation and makes altering product lines in response to local utility incentives less attractive. Further, national headquarters collect incentive dollars offered through these programs instead of local retail outlets, resulting in few changes in local stocking practices or salesperson behavior. While incentive programs like LIPA's may incrementally contribute to decisions made about the product mix of these national retailers, it is difficult to parse out the effects of individual programs. Finally, the NEEA study suggests that, *"The large national retailers that now make up well over 80% of the consumer retail market do not typically vary their product mix on a local or regional level… it is difficult to parse out the effect of the NEEA Initiative from among all of these market forces."*

Annual Product Refresh Cycle. Television manufacturers, like automobile producers, have yearly models that are replaced on an annual basis. Each spring, older models are heavily discounted to clear inventory for new models. Because of this yearly refresh, the market share of new energy efficient products can change rapidly over the three-month refresh period and then remain mostly static for the rest of the year. To truly influence what is on the shelf at retailers, utility programs would need to finalize their incentive criteria at the same time manufacturers are developing the next year's product offering, which can be up to 18 months in advance of product rollout. Without that advanced involvement, there is little possibility that these programs are actually influencing manufacturing and/or purchasing at the corporate level. Even with advance notice, manufacturers suggest that other factors (such as price and features) are what drive their manufacturing decisions, not energy efficiency.

Influence of EPA ENERGY STAR Guidelines. Manufacturers report that the primary "outside" influence on their decision-making is the US Environmental Protection Agency's ENERGY STAR program guidelines. The EPA has responded to the changing technology of the television market by continually increasing the stringency of their requirements. In turn, manufacturers have sought to build products with these increasing efficiency requirements in mind. While manufacturers note that they pay attention to ENERGY STAR guidelines and prefer to have their televisions meet the criteria, there are many other factors in play.

The NEEA report presents two findings that are particularly important to consider. First, they report that retailers and manufacturers do not consider utility incentives to be a leading factor in discussions between national buyers and international sellers. Such negotiations tend to focus on features and price, though the availability of utility incentives can serve as a "tie-breaker" between two similar products. Second, manufacturers report that the large gains in efficiency have not only already been made but were primarily the result of technological advances made for other purposes (e.g., LED backlighting used to achieve better picture quality). Most important, these manufacturers report that opportunities for new efficiency gains are modest.

In addition to these factors, it is notable that the NEEA report was unable to determine a program attribution rate, primarily because they were unable – given the rapid technological advances in the television market – to determine what the U.S. television market would have looked like in the absence of utility incentives (i.e., they were unable to determine a credible baseline). That said, the report strongly infers that given the known factors affecting this market, the probability of achieving quantifiable impacts is low. Simply stated, the report strongly infers that the designers of such programs (starting in California and moving to the Pacific Northwest) may not have fully understood current (and likely) advances in television technology and, given this, the incremental influence utility-specific and regional programs might have on the market. The NEEA report suggests that NEEA consider a "codes and standards" approach to future program design. This suggestion – due to concerns about program cost-effectiveness – includes eliminating incentives and, instead, working with EPA to continue the advance in ENERGY STAR qualifying criteria.

Moving Forward with Televisions

With respect to attribution, the LIPA television incentive program's effect, taken in combination with other similar initiatives conducted by utilities and energy efficiency organizations around the country, *may* have some influence on the proportion of televisions sold that are highly energy efficient. However, the most reasonable conclusion (based primarily on findings from the NEEA study) is that because of the timing of product development, the non energy features that drive efficiency, the nationalization of purchasing and pricing decisions by big box retailers, and the influence of ENERGY STAR specifications on manufacturer decisions regarding product efficiency, consumers would likely purchase highly efficient televisions even in the absence of LIPA's incentive. As a result, the program is likely having a more marginal impact than the current net-to-gross number of 88% suggests. Considering the market factors in play, and given we cannot provide quantifiable evidence of any one-point value over another, a reasonable policy decision regarding attribution at this point might be to assume it falls in the range of 15 to 30%.

Most importantly, the NEEA study would appear to suggest that LIPA should seriously consider eliminating incentives for televisions. Given the above information, it would appear that LIPA must seriously scrutinize the ability to achieve cost-effective savings through this effort in the future.

4. 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 including 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.

Impacts for Goal Comparison

Table 4-1 provides a program level comparison of evaluated net savings to ex ante savings by measure category. As both ex-ante and evaluated net savings values are calculated using program planning NTG factors, the differences expressed through the realization rates represent differences in the ex ante and evaluated gross savings. See the definitions in Section 1.1 for a discussion of the difference between the ex ante and evaluated values.

Table 4-1. Cool Homes Net Impacts for Goal Comparison

Category	Installs	Ex Ante		Evaluated		Realization Rate	
		kW	kWh	kW	kWh	kW	kWh
Central Air Conditioner	3,592	4,900	2,936,705	3,124	2,389,975	64%	81%
Air Source Heat Pump	329	453	952,254	265	505,938	59%	53%
Ductless Mini-Split	983	266	931,459	218	806,457	82%	87%
Geothermal Heat Pump	344	344	870,141	418	912,329	121%	105%
Furnace Fan	370	52	171,827	57	154,075	111%	90%
Total	**5,618**	**6,014**	**5,862,386**	**4,082**	**4,768,773**	**68%**	**81%**

The Cool Homes program updated savings algorithms used to determine ex ante gross savings for a number of measure categories in 2011. The evaluation team discussed these updated algorithms with the implementation team and made adjustments to ex post recommendations as a result. The primary update for this evaluation cycle is the incorporation of a quality install (QI) savings factor for air-source heat pump and central air conditioner installs. The latest Technical Resource Manual (TRM) iteration (Version 2012-01) contains further information on the updated algorithms and assumptions.

Reasons for Differences in Impacts

Recommended algorithms incorporated input values for average installed size and efficiency for each measure, as determined through examination of the program install database. Normalized ex post savings-per-ton values were multiplied with total installed capacity in 2011 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 4-2, the evaluation team has the following category-specific comments:

- **Central air conditioner** units featured lower ex post savings primarily due to differences in baseline efficiency assumptions between ex ante and ex post calculations. The program currently assigns degradation factors to nameplate equipment efficiencies to attempt to capture actual performance (through an operating efficiency) versus theoretical performance. Using an operating efficiency (which is lower than the nameplate efficiency) leads to somewhat higher savings. We examined the possible reasons for using the program degradation factor and an operating efficiency, but felt that the evidence did not support the use of this value for the following reasons:

  - The implementation team had previously adopted EER degradation factors to characterize the actual performance of residential HVAC units compared to nameplate (theoretical) performance. The degradation factors were supported by a different utility study that involved the analysis of over 12,000 residential units. As a result, the implementation team applied an average 24% degradation to the nameplate EER for preexisting equipment and a reduction of 1.0 EER for new units. The evaluation team believes that this data is from a specific program where the data are not long term operating data. These are spot measurements, and are not indicative of long-term performance, which may vary. We also do not have any information in this data extract about the SEER, tons, and conditions under which testing took place, nor how the EER values were calculated and adjusted for weather conditions.
  - The evaluation team agrees that HVAC units—especially those designated for early replacement—typically operate sub-optimally due to a number of factors: accumulation of particulates on condenser coils, low refrigerant levels, etc. However, evaluators have concerns with the use of unverifiable data for the degradation of existing system EERs and the use of an arbitrary 1.0 reduction of new system EERs. Additionally, though the implementer documentation cites two utilities that apply the EER degradation factors in savings calculations, an overwhelming majority of nationwide utilities use the difference in nameplate EER instead. In fact, NYSERDA residential programs, which provide the most appropriate comparison with the Cool Homes program, use nameplate EERs as recommended in the New York State EEPS manual.

  As such, the evaluation savings uses nameplate efficiency data, causing our savings values to be lower than the ex ante values. In addition, the program estimated 3,000 kWh annual consumption for all units, which corresponds to run hours of about 1,270 hours. The evaluation team uses the agreed 630 effective full load hours for central air conditioners. These differences further reduce the savings compared to the program values.

- **Air-source heat pumps** featured lower savings for both demand and energy primarily due to the program's use of degradation factors to nameplate equipment efficiencies as described in central air conditioners. The differences between the program and evaluation values are increased for air source heat pumps due to the heating run hours. We used the agreed 630 hours for cooling and 934 hours for heating for air-source heat pumps. However, we cannot determine the specific heating hours used by the program to indicate how different the total run hour may be.

- **Ductless mini-split systems** feature demand and energy realization rates of 82% and 87%, respectively. Based on our calculations, the existing program algorithm assigns quality install savings for ductless systems. This is most likely a vestige of previous choices as the evaluation team discussed this with LIPA and there was agreement to not include QI savings to ductless mini-split systems. We agree that QI savings are appropriate if a ductless system is installed to replace a central air conditioner system. There is no information in the tracking system for us to determine the previous system. From our experience with residential programs, these replacements are rare and so we did not include any QI savings to these systems.

- **Geothermal heat pumps** featured evaluation savings that were higher than the ex ante values for demand and energy. The differences are due to baseline efficiency assumptions between ex ante and evaluated. The program estimates used a static difference in efficiency to calculate savings while we used average installed and preexisting efficiency data (which we had for over 90% of the data) to most accurately calculate savings. The program efficiency difference was close to 6 EER while using the specific information from the program tracking database saw an average delta efficiency of 11 EER.
- **Furnace fans** with electronically commutated motors (ECMs) featured higher ex post savings for demand (111% realization rate), but lower for energy (90%). As updated per discussion with program implementers, evaluators have accounted for the percentage of furnace fans that share a common duct with central air conditioner units (65%). This change increased the demand savings as the summer period now occurs for a portion of the fans, bringing about higher demand savings than expected. Our cooling and heating run times differ from the program values. We applied cooling run hours of 630 hours and heating run hours of 934 for a total of 1,564 hours. This is slightly lower than the program value of 466 cooling and 1,491 heating run hours (totaling 1,957 hours), leading to reduced energy savings.

Impacts for Cost-Effectiveness Calculations

The cost-effectiveness calculations are based on ex post net savings estimates. As discussed in Section 1, ex post net savings are calculated using NTG factors developed by the evaluation team, For this analysis, the evaluation team used developed an ex post NTGR value for CAC measures only and applied program assumptions for all other measures incented through the Cool Homes program. The ex post NTG factor for CAC was derived from extensive research with participating and non participating customers as well as HVAC market actors, including contractors and equipment distributors (as described below). Table 4-2 shows a categorical breakdown of ex post savings compared with tracked program savings (ex ante) for air conditioners, heat pumps, ductless systems, and furnace fans rebated by the program. See the definitions in Section 1.1 for the difference between the ex ante and ex post values.

Table 4-2. Cool Homes Net Impacts for Cost-Effectiveness

Category	Installs	Ex Ante		Ex Post		Cost-Effectiveness Realization Rate	
		kW	kWh	kW	kWh	kW	kWh
Central A/C	3,592	4,900	2,936,705	2,853	1,573,444	58%	54%
Air Source Heat Pump	329	453	952,254	287	506,729	63%	53%
Ductless Mini-Split	983	266	931,459	218	804,728	82%	86%
Geothermal Heat Pump	344	344	870,141	418	910,373	121%	105%
Furnace Fan	370	52	171,827	57	153,745	111%	89%
Total	5,618	6,014	5,862,386	3,833	3,949,019	64%	67%

The program applies planning NTGR factors of between .84 and .98 for each program measure category. Additionally, the program NTGR value differs for energy and demand. The evaluation team developed an updated NTGR for central air conditioner (CAC) installations only, including separate factors for savings associated with Quality Installation practices and equipment efficiency. We applied the program planning values for all other measures. The evaluated NTGR for CAC installations included participant free ridership and program spillover. Table 4-3 shows the NTGR values for the Cool Homes program.

Table 4-3. Cool Homes Net-to-Gross Ratios

Measure	Ex Ante kW	Ex Ante kWh	Ex Post kW	Ex Post kWh
Central Air Conditioner	0.92	0.98	0.84	0.65
Air Source Heap Pump	0.92	0.98	0.92	0.98
Ductless Mini-Split	0.92	0.98	0.92	0.98
Geothermal Heat Pump	0.92	0.98	0.92	0.98
Furnace Fan	0.84	0.90	0.84	0.90
Program Level	0.92	0.98	0.86	0.81

Note: Program planning assumptions use the same NTG factor for KW and kWh. The evaluation team calculated the effective NTG factors by measure based on the information included in program tracking data.

Next, we provide a detailed description of how we estimated the NTGR values.

Cool Homes Net-to-Gross Data Collection

At the direction of LIPA, the evaluation team took a comprehensive approach to exploring the function of the residential CAC market on Long Island to understand the program's influence on equipment purchase and installation practices and update the Cool Homes program NTG assumption for CAC measures. As we limited our research to the CAC market, this evaluation provides an updated NTG factor for CAC measures only; we used current program NTG assumptions to determine evaluated net savings for all other measures offered through the program (as shown in Table 4-3).

The research effort began with two focus groups, held in early October 2011, which used the Delphi method[20] of data collection to help better understand the impact of the Cool Homes program on the Long Island residential cooling market. In addition to the two group efforts, the assessment of the 2011 program included:

- *Contractor Survey.* The survey of 32 Cool Homes contractors was designed to understand residential installation practices as well as the number and efficiency level of central cooling units sold, both within and outside of the Cool Homes program.
- *Distributor Interviews.* The interviews with five distributors were designed to help understand the overall Long Island market, with particular emphasis on sales of 16+ SEER units[21]. The interviews also pursued LIPA's impact on distributor-stocking practices as well as distributors' perception of LIPA's impact on manufacturing decisions.
- *Customer Cognitive Interviews.* Through 10 in-depth interviews, the research team asked a battery of program attribution questions and then explored how customers processed and

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[20] The Delphi method of data collection is more structured than the method employed in a typical focus group. While the focus group method explores a specific topic in a somewhat open-ended manner, the Delphi method purposefully requests specific information from the group and attempts to reach consensus around the information gathered.

[21] LIPA identified 16 unique HVAC distributors familiar with the Cool Homes program and active on Long Island. Accurate contact information was not available for 3, and 3 refused to participate in the research. The evaluation team made multiple attempts to speak with the remaining 10 contractors and ultimately completed 5 interviews.

understood the questions. The ultimate goal was to assess whether respondents understand attribution questions (used in the participant survey) and whether the attribution questions accurately capture each respondent's decision-making process.

- *Participating Customer Survey.* The survey of 142 customers who participated in the program in 2011 serves as the primary measure of program impacts (i.e., free ridership and net-to-gross ratio). We performed the survey after the cognitive interviews.
- *Nonparticipating Customer Survey.* The survey of 70 nonparticipants was designed to understand installation decisions in general and energy efficiency purchase decisions in particular. We compared and contrasted this data with the information gathered through the participant survey to assess whether program participants differ significantly from other (nonparticipating) customers.

Collectively, these additional activities provided clarity regarding the extent to which high-efficiency CAC equipment (particularly 16+ SEER units) are being purchased on Long Island and who and/or what is influencing those purchase decisions. Given the complexities of market dynamics, it is important to understand the role and perspectives of all types of market actors when assessing the effect of programmatic efforts on market activity and assessing program attribution (NTGR). As such, this effort involved the integration of information from customers (participants and nonparticipants), Cool Homes contractors (via the focus group and survey), and HVAC distributors to arrive at a more complete understanding of the market in which the Cool Homes program operates. In this process, no one perspective was omitted or used at the exclusion of others; rather the data were considered relative to and with the context provided by all of the available data.

The discussion that follows draws upon all of the research activities to provide a comprehensive and integrated assessment of the overall impact of the 2011 Cool Homes program.

Cool Homes Net-to-Gross Estimation

Our NTG assessment of the Cool Homes program considered participant free ridership and spillover attributed to programmatic efforts including contractor training regarding QI installation practices and the long-term influence of the Cool Homes program in the CAC market. The NTG ratio is calculated as:

$$NTGR = (1 - FR + SO)$$

The NTGR includes both free ridership, a measure of the energy savings that would have occurred in the absence of the program, and spillover, a measure of additional energy savings that occurred outside of the program as a result of programmatic efforts. Estimation of NTGR is an inexact science as it attempts to assess the counterfactual, what would have occurred in the absence of the program. Because our data collection for free ridership occurs at a single period in time, we cannot tease out the influence that years of program efforts may have had on customers in moving them to want to perform a high efficiency upgrade on their own (i.e., without the current program incentive). The customer provided free ridership component of the NTGR most likely includes some portion of naturally occurring energy efficiency associated with ongoing program efforts. Similarly, our estimated spillover from contractors likely includes an equal measure of efficiency gains that may not be attributable to the program. When considering the NTGR results presented below, note that data are not available to determine the exact percentage of the NTGR caused by long-term intervention in the market by the Cool Homes program.

As noted above, we applied a multi-faceted approach to the NTG research. The overwhelming consensus of findings from these research efforts indicates that the Cool Homes program has a modest impact on the efficiency level of the central cooling equipment installed by program participants, but a substantial influence on contractors' adoption of QI practices. Changes in efficiency garner larger savings than application of QI. As such, we must adjust the NTGR to account for these influences separately.

The evaluation team used the participant self-report approach as the primary method for determining the NTGR for equipment efficiency savings. However, we analyzed participant survey data with the full consideration of data obtained from contractors, distributors, and non-participating customers regarding the function of the CAC market, the influence of LIPA's programmatic activity on the market, and factors considered in customer purchase decisions. For example, we used interviews with contractors and distributors to assess the program's influence on the equipment market and measure participant/nonparticipant spillover. Further, we performed cognitive testing of the NTG questions included in the participant survey with customers to ensure the validity of the survey findings. The results indicate that the questions appropriately capture the respondents' perspective. Respondents understood the focus and intent of the questions and possessed sufficient context and information to answer the questions. Therefore, individual NTG results, or "scores," for each respondent are supported by other qualitative information they provided regarding their purchase decision. Based on these findings, and considering all the data available to the evaluation team, we are confident that the self-reported data provide an accurate portrayal of the program attribution.

Next, we summarize the relevant information used to determine the NTGR for equipment efficiency savings.

Cool Homes Contractors – Efficiency Findings

There was clear consensus among contractors participating in the focus groups that program rebates are not the driver of consumers' decisions to install energy efficient equipment. Contractors explained that due to the low incremental cost to move from standard efficiency and SEER 14-15 units to SEER 16 units, there is increased customer adoption of the higher SEER equipment. Contractors suggested that the minimal cost increase and the relative affluence of the LIPA's service territory allows for a customer base more inclined to select higher quality, more efficient equipment and reluctant to settle for base/standard options when making purchase decisions. Contractor survey results corroborate this finding as Cool Homes contractors report that 60% of the CAC units they install outside of the program are program compliant (SEER 14.5 or higher) with 34% of installations outside of the program involving SEER 16 units.

While contractors clearly indicate there is a market for high SEER equipment on Long Island that exists outside of the Cool Homes program, focus group participants struggled to extrapolate their experience to quantify the total market share for high efficiency units and thus there was far less consensus among them regarding such estimates. Further, contractors generally agreed that the Cool Homes program has influenced the market for efficient CAC equipment to some degree, but found it difficult to quantify the impact. Contractors participating in the Delphi focus groups estimate that 33% of all CAC units installed in LIPA territory are SEER 16 (average estimate). These contractors also estimated that the market share of SEER 16 units would drop to 12% if the Cool Homes program had never existed. Considering these estimates in absence of other relevant market data implies that 36% of the SEER 16 installations currently taking place would have occurred if the Cool Homes program never existed (12% market share in the absence of the program / 33% current market share = 36% market share retained in the absence of the program).

The contractor focus group was the primary source of market share and program influence information from contractors. From the contractor's perspective and using a simple mid-point of responses from the group, the free ridership for high efficiency units may be around 36%. However, due to the qualitative nature of focus groups and contractors' clear difficulties estimating program influence at the market level and providing market share information, the evaluation team included the perspectives of contractors in our assessment of NTG but viewed these data as directional information regarding the level of program free ridership. This direction of a moderate influence is consistent with information gathered from other sources.

Equipment Distributors – Efficiency Findings

Given the challenges contractors faced extrapolating the share of their business' sales of high efficiency equipment to market level estimates, the evaluation team conducted interviews with CAC equipment distributors to gather market share information and to assess the impact of the Cool Homes program on market share and distributor stocking practices. While unable to reference specific sales statistics, distributors estimate that SEER 16+ equipment currently accounts for approximately 30-40% of the residential CAC market on Long Island. While the majority of the market remains base efficiency equipment, distributors indicate that the market for SEER 14 or 15 units is limited, as it is very easy to combine condensers and air handlers to achieve 16 SEER at a marginal incremental cost.

When asked, two distributors were able to compare the Long Island market to other regions. One distributor indicated that the market share for SEER 16+ on Long Island was currently higher than the rest of the Tri-State area because the economy on Long Island was stronger. The second distributor indicated that the market share for SEER 16+ was definitely lower as compared to New Jersey and credited a larger contractor base more equipped to sell high efficiency and high-end equipment for the difference.

There is a consensus among distributors that the Cool Homes program has influenced the high SEER CAC market in Long Island to some degree but the impact is limited. All distributors indicated that the limited influence is due in part to the limited number of program contractors and thus the low volume of program-incentivized installations. Distributors also cited the low incremental cost associated with increasing to SEER 16 equipment. Distributors estimate that the current market share of SEER 16 units (30-40% by distributors estimates) would drop 10-20% (to 24-27% or 32-36% market share) if the Cool Homes program had never existed. Considering these estimates in absence of other relevant market data implies that as much as 80% of the SEER 16 installations currently taking place would have occurred if the Cool Homes program never existed (32% market share in the absence of the program/40% current market share = 80% market share retained in the absence of the program). This data from the distributors indicate that the free ridership may be as high as 80% – a value that is higher than found by customers and contractors. We also asked distributors about the influence of the Cool Homes program on distributor stocking practices as a possible indicator of spillover. Distributors generally agreed that utility rebates in aggregate across North America have an effect on decisions made by HVAC manufacturers, and thus distributors, to some degree; however, they could not isolate the impact of the Cool Homes program specifically. The overarching sentiment was that the program reach was too small relative to the overall market on Long Island to have an influence on distributor practices.

Customers – Efficiency Findings

The use of participant self-reported information to estimate NTGR introduces the possibility that customers do not really understand what is being asked in the survey. This may lead customers to overstate their likelihood to invest in energy efficient equipment in the absence of the program leading to a potential overstatement of participant free ridership. Further, the participating customer perspective may not effectively consider other program influences on the market of which the customer may be unaware. To address these concerns, the evaluation team gathered information regarding market function and factors that may drive investment in energy efficient CAC equipment from a range of sources, as described above. In addition, we performed cognitive testing of the NTG questions included in the participant survey with customers. We did this to ensure respondents understood the focus and intent of the questions and possessed sufficient context and information to answer the questions such that the individual NTG results, or "scores," for each respondent were supported by other qualitative information they provided regarding their purchase decision.

The results from our cognitive interviews with customers allowed us to adjust our NTG battery to ensure the survey produced a valid measure of attribution. The survey included questions designed to assess the influence of various program components on customer purchase decisions which, when combined, provide an index of participant free ridership. Our analysis of participant survey data yields a free ridership factor of .48 for CAC savings associated with equipment efficiency, indicating that the program has a modest impact on the efficiency level of equipment installed by program participants. We weighted the results by demand savings to calculate the average free ridership factors for CAC participants in the existing equipment and early retirement components of the program. Table 4-4. presents the free ridership factors for each type of CAC participant based on participant survey results.

Table 4-4. Free Ridership Factors by CAC Participant Type

CAC Participant Type	Free Ridership Factor
Early Retirement	0.44
Existing Equipment Replacement	0.58
Weighted Average	0.48

The overall survey results indicate higher free ridership than was qualitatively estimated by participating contractors but lower than suggested by estimates provided by equipment distributors. The evaluation team found the CAC equipment efficiency free ridership factor derived from participant survey data likely represents the most reliable estimate of participant free ridership considering all available data, an estimate generally corroborated by information obtained from contractors and distributors, and an estimate in line with similar programs offered in other jurisdictions. As noted elsewhere in this report, the evaluation team was unable to gather the data necessary to determine the extent to which this estimate includes naturally occurring energy efficiency that may have resulted from any possible market transformation associated with LIPA's long-term efforts in the residential HVAC equipment market.

While our collective research efforts suggest that the Cool Homes program has influenced the market for high-efficiency CAC equipment on Long Island to some degree, they did not produce sufficient evidence or information to quantify the effect. As such, we cannot confirm the presence of or estimate nonparticipant spillover associated with programmatic efforts with respect to equipment efficiency and, thus, our assessment assumes a spillover factor of zero. Combining these factors yields an NTGR of .52 (1 - .48 + 0 = .52) for CAC savings associated with equipment efficiency.

To determine the NTGR associated with QI savings, the evaluation team primarily used information gathered from contractors, during the focus groups and through the contractor survey effort, but also considered information provided by equipment distributors. We summarize the relevant information used to determine the NTGR for QI savings next.

Equipment Distributors – QI Findings

As noted above, we conducted research with equipment distributors to gain insight into overall CAC market dynamics, gather information regarding the relative market shares of energy efficient and base efficiency equipment, and assess the Cool Home programs impact at the market level. With respect to quality installation practices, two distributors indicated that some CAC equipment manufacturers, through distributors, require contractors to obtain relevant technical certifications and attend training on QI practices to gain access to manufacturer incentives on certain high efficiency equipment. As we were unable to determine the number of contractors exposed to this training or the number or amount of incentives paid, we were unable to quantify the impact of these efforts in terms of changing contractor installation practices.

Distributors also indicated that the rigorous training and paperwork requirements associated with the QI process is time consuming and costly. Distributors repeatedly cited this as a barrier to contractor participation in the Cool Homes program and a factor that limits the reach of the program and its influence on the CAC equipment market. These results strongly suggest that many contractors would not have adopted QI practices in the absence of the program.

Cool Homes Contractors – QI Findings

There was strong consensus among contractors participating in the focus groups that LIPA had significantly influenced their adoption of QI installation practices. Contractors further indicated that they have carried forward the change in their installation practices to the work they do outside of the program. Based on this finding, the evaluation team used the survey of participating contractors to gather information regarding the percentage of CAC installations completed by participating contractors for which LIPA paid an incentive and the percentage that occurred outside of the program. In addition, we determined the percentage of CAC installations, through and outside of the Cool Homes program, for which the contractor followed QI installation practices.

Our analysis of contractor survey data in combination with information gathered through our contractor focus groups and interviews with distributors yields a free ridership factor of zero for savings associated with the implementation of QI installation practices. Although the distributor interviews indicated that performance of QI practices are time consuming, the contractors we interviewed indicate that they completed an estimated 1,867 CAC installations outside of the Cool Homes program using QI installation practices. Using this data, the evaluation team quantified these savings through applying the average QI kW and kWh savings associated with CAC systems installed through the program to the 1,867 CAC installations completed by participating contractors outside of the Cool Homes program using QI installation practices. This yields a QI spillover factor of .49 for kW and .41 for kWh. Combining these factors yields an NTGR of 1.49 (1 - 0 + .49 = 1.49) for kW savings associated with QI installation practices and 1.41 (1 - 0 + .41 = 1.41) for kWh savings associated with QI.

As noted above, the evaluation team limited the evaluation of NTGR for the Cool Homes program to CAC measures only. The evaluation used program planning NTGR values for all other program measures to determine program level ex post net savings. Table 4-5 presents the NTGR for the CAC measure.

Table 4-5.Cool Homes NTGR for CAC

Program Component	Free Ridership	Spillover	NTGR
CAC Equipment Efficiency	0.48	0	0.52
CAC QI (kW)	0.00	.49	1.49
CAC QI (kWh)	0.00	.41	1.41
CAC Total (kW)			0.84
CAC Total (kWh)			0.65

We derived the CAC total NTGR for kW and kWh as follows:

$$Total\ Savings\ NTGR = \frac{Ex\ Post\ Savings_e * NTGR_e + Ex\ Post\ Savings_{QI} * NTGR_{QI}}{Ex\ Ante\ Savings}$$

Where:

Ex Ante Savings = net savings from LIPA

Ex Post $Savings_e$ = the portion of savings (kW or kWh) based on equipment efficiency

Ex Post $Savings_{QI}$ = the portion of savings (kW or kWh) based on QI

$NTGR_e$ = 0.52

$NTGR_{QI}$= 1.49 for kW and 1.41 for kWh

The QI affects a small portion of energy savings compared to demand, so the overall NTGR for energy is lower than for demand.

5. HOME PERFORMANCE WITH ENERGY STAR

The Home Performance with ENERGY STAR® (HPwES) and Home Performance Direct (HPD) programs, which have received awards from the US EPA, 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. 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.[22]

Impacts for Goal Comparison

Table 5-1 provides a category-by-category review of impacts for the program in 2011. See the definitions in Section 1.1 for the difference between the ex ante and evaluated values.

Table 5-1. Home Performance with ENERGY STAR Impacts for Goal Comparison

Measure Category	N	Ex Ante		Evaluated		Realization Rate	
		kW	kWh	kW	kWh	kW	kWh
Insulation	1,781,644	115	1,137,215	109.2	1,931,150	95%	170%
Air Sealing	6,548	20	320,005	19.6	320,005	100%	100%
HVAC	91,132	105	112,672	104.5	112,672	100%	100%
Lighting	1,139	10	57,078	7.0	63,240	70%	111%
Hot Water	192	1.19	2,376	0.38	14,053	32%	591%
Door/Window	2	0.14	70	0.002	25	2%	35%
Totals	**1,880,656**	**250**	**1,629,416**	**241**	**2,441,146**	**96%**	**150%**

Reasons for Differences in Impacts

The reasons provided here are identical to the information in the HPD section as we analyzed the data at the same time.

The evaluation team conducted an engineering review of the savings algorithms and deemed savings values for each program measure. There were fluctuations in realization rates among measure categories for each program, with our analysis indicating differences from the planning estimates from 30% to 300%. However, as is typical for this type of assessment, the overall realization rate was not as extreme. We have highlighted the primary reasons for measure-level discrepancy:

Across all **Lighting** measures, both programs featured ex post energy savings slightly less than ex ante, but demand savings 36% less than ex ante. The information in Table 3-2 shows that our analysis reduced the per-unit kWh savings as well as the per-unit demand savings. Additionally, the difference in ex ante and ex post coincidence factors exacerbates the discrepancy for demand.

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

For **Air Sealing** and **HVAC** measures, no information was available on algorithm inputs. We examined the program savings algorithm in previous years and determined it was reasonable based on engineering judgment. To remain consistent with last year, we are again assigning 100% realization rates for these measures.

For **Hot Water** measures, the program's tracked data was not sufficiently detailed to ensure an apples-to-apples comparison with evaluated savings. For example, current tracked savings do not indicate the length of insulation installed per line item. The evaluation team relied on secondary sources for inputs to our savings algorithms. The largest saver for hot water measure is pipe insulation. For this measure, we used DOE 3E-Plus software to analyze heat loss from insulated and un-insulated pipes and determine ex post savings per linear foot of pipe insulation. We then applied the average length of pipe wrap to a per-foot savings to arrive at our demand and energy savings. We have no knowledge of how the program calculates savings for any of the hot water measures. Given the very small savings of this end use, we did not delve further into the reasons for the discrepancies. The evaluation team recommends additions to the program's tracking database to capture additional per-install details such as length of hot water pipe and hot water pipe diameter for pipe insulation measures and geometry of the tank for tank wrap measures.

Impacts for Cost-Effectiveness

As part of the 2011 Home Performance evaluation, the evaluation team again collected data to update the NTG factors applied to gross savings associated with the HPwES program overall. The new estimates from the surveys are presented in Table 5-2 along with the LIPA program planning values used to develop the ex ante savings estimates. The cost-effectiveness calculations use NTGR values we estimated from customer survey research. Similar to our previous evaluation, the free ridership values for the lighting measures was .28 (compared to .26 from the 2010 evaluation). Also, like last year, the program saw a small level of spillover – constituting 1.9% of kW and 2.8% of kWh.

Table 5-2. Home Performance with ENERGY STAR Net-to-Gross Values

Components	Ex Ante	2010 Evaluation	2011 Evaluation
Free Ridership	0.00	0.26	0.28
Spillover (kW)	0.00	0.004	0.02
NTGR	1.00	0.74	0.74

Table 5-3 provides a categorical breakdown of net impacts, using the NTG adjustments shown in Table 5-2. See the definitions in Section 1.1 for the difference between the ex ante and ex post values.

Table 5-3. Home Performance with ENERGY STAR Impacts for Cost-Effectiveness

Measure Category	N	Ex Ante		Ex Post		Cost-effectiveness Realization Rate	
		kW	kWh	kW	kWh	kW	kWh
Insulation	1,781,644	115	1,137,215	79	1,390,428.1	69%	122%
Air Sealing	6,548	20	320,005	14	230,404	72%	72%
HVAC	91,132	105	112,672	75	81,123.9	72%	72%
Lighting	1,139	10	57,078	5	45,533.1	50%	80%
Hot Water	192	1.19	2,376	0.3	10,118.20	23%	426%
Door/Window	2	0.14	70	0.002	17.806	1%	25%
Spillover	-	0.00	0	5	68,260	-	-
Totals	**1,880,656**	**250**	**1,629,416**	**178**	**1,825,885**	**71%**	**112%**

6. HOME PERFORMANCE DIRECT

The Home Performance Direct (HPD) and Home Performance with ENERGY STAR® (HPwES) 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.[23]

Impacts for Goal Comparison

Table 6-1 provides a category-by-category review of impacts for the program in 2011. See the definitions in Section 1.1 for the difference between the ex ante and evaluated values.

Table 6-1. Home Performance Direct Net Impacts for Goal Comparison

Measure Category	N	Ex Ante		Evaluated		Realization Rate	
		kW	kWh	kW	kWh	kW	kWh
Lighting	32,143	304	1,947,742	195	1,760,845	64%	90%
HVAC	4,406	224	419,235	224	419,235	100%	100%
Air Sealing	1,759	5	84,006	5	84,006	100%	100%
Hot Water	118	6	12,379	2	16,550	30%	134%
Totals	**38,427**	**539**	**2,463,362**	**425**	**2,280,636**	**79%**	**93%**

Reasons for Differences in Impacts for Goal Comparison

The reasons provided here are identical to the information in the HPwES section as we analyzed the data at the same time.

The evaluation team conducted an engineering review of the savings algorithms and deemed savings values for each program measure. There were fluctuations in realization rates among measure categories for each program, with our analysis indicating differences from the planning estimates from 30% to 300%. However, as is typical for this type of assessment, the overall realization rate was not as extreme. We have highlighted the primary reasons for measure-level discrepancy:

Across all **Lighting** measures, both programs featured ex post energy savings slightly less than ex ante, but demand savings 36% less than ex ante. The information in Table 3-2 shows that our analysis reduced the per-unit kWh savings as well as the per-unit demand savings. Additionally, the difference in ex ante and ex post coincidence factors exacerbates the discrepancy for demand.

For **Air Sealing** and **HVAC** measures, no information was available on algorithm inputs. We examined the program savings algorithm in previous years and determined it was reasonable

[23] 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.

based on engineering judgment. To remain consistent with last year, we are again assigning 100% realization rates for these measures.

For **Hot Water** measures, the program's tracked data was not sufficiently detailed to ensure an apples-to-apples comparison with evaluated savings. For example, current tracked savings do not indicate the length of insulation installed per line item. The evaluation team relied on secondary sources for inputs to our savings algorithms. The largest saver for hot water measure is pipe insulation. For this measure, we used DOE 3E-Plus software to analyze heat loss from insulated and un-insulated pipes and determine ex post savings per linear foot of pipe insulation. We then applied the average length of pipe wrap to a per-foot savings to arrive at our demand and energy savings. We have no knowledge of how the program calculates savings for any of the hot water measures. Given the very small savings of this end use, we did not delve further into the reasons for the discrepancies. The evaluation team recommends additions to the program's tracking database to capture additional per-install details such as length of hot water pipe and hot water pipe diameter for pipe insulation measures and geometry of the tank for tank wrap measures.

Impacts for Cost-Effectiveness Calculations

The cost-effectiveness calculations use NTGR values we estimated from customer survey research. The HPD participant surveys contained a battery of questions designed to measure free ridership at the measure category level and spillover at the program level. Similar to our previous evaluation, the free ridership values for the lighting measures was .51 (compared to .47 from the 2010 evaluation). Also, like last year, the program saw a small level of spillover – constituting 1.7% of kW and 6.6% of kWh.

Table 6-2 provides a categorical breakdown of net evaluated savings using the evaluation team estimated NTGR. See the definitions in Section 1.1 for the difference between the ex ante and ex post values.

Table 6-2. Home Performance Direct Net Impacts for Cost-Effectiveness

Measure Category	N	Ex Ante		Ex Post		Cost-Effectiveness Realization Rate	
		kW	kWh	kW	kWh	kW	kWh
Lighting	32,143	304	1,947,742	96	862,814	31%	44%
HVAC	4,406	224	419,235	224	419,235	100%	100%
Air Sealing	1,759	5	84,006	5	84,006	100%	100%
Hot Water	118	6	12,379	2	16,550	30%	134%
Spillover	-	0	0	16	272,176	-	-
Totals	**38,427**	**539**	**2,463,362**	**342**	**1,654,781**	**63%**	**67%**

The only measure with a different value between the gross and net impacts is the lighting measure where our evaluation found that close to half of the participants in the program stated they would have installed CFLs without the intervention of the program. In addition, a 2.6% demand and 6.6% energy spillover factor was applied to the program overall.

7. 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. Households must meet specific income requirements to be eligible for the REAP program.

Impacts for Comparison to Goal and Cost-Effectiveness

The evaluation team used two methodologies to estimate ex post savings for the REAP program, including engineering review and billing analysis. Because the billing analysis uses actual customer usage to estimate savings, and thus is more robust than engineering estimates, we based the savings from the program on the results of the billing analysis. We show the results in Table 7-1.

Table 7-1. REAP Net Impacts for Comparison to Goal

Measure Category	N	Ex Ante		Ex Post		Cost-Effectiveness Realization Rate	
		kW	kWh	kW	kWh	kW	kWh
All	34,622	497	4,071,384	237	1,791,401	48%	44%

Our analysis used a comparison group to reflect what would have occurred absent the program. As such, the results from a billing analysis are implicitly the net savings, that is, these results already incorporate the gross realization rate and NTG adjustments that an engineering approach uses to obtain net savings. The results are applicable to both the comparison to goal and the cost-effectiveness calculation.

Billing Analysis

The evaluation design included a comparison group of customers who participated in the program year of 2011. This model allows us to compare the post-installation billing records of the first group to its own pre-participation records and to the first-year (i.e., 2009) billing records of the second. Those two periods (pre for participants and 2009 for later participants) are contemporaneous. Best practices in using billing analysis to determine impacts means that we must have at least 12 months of data after installation of measures. As such, the results of our billing analysis show the savings from the 2010 participants. There were slight differences in specific number of measures between the 2010 and 2011 program years (as shown in Table 7-2), but no substantive change in program design across the two years. As such, we have applied the program level realization rate of this analysis to the program planning estimates for 2011.

Table 7-2. REAP Installations by Program Year

Category	Installs by program year	
	2010	2011
Lighting	33,737	33,033
Refrigerator	1,215	963
HVAC	253	400
Hot Water	282	226

Selecting a comparison group of later participants means that they are the types of customers who are oriented to participating in an energy efficiency program. This customer orientation (propensity to participate) is often difficult to measure or control for because most variables at our disposal that we might use to control statistically for differences between treatment and comparison groups might not capture the largely unobservable factors that drive people to participate, or to be interested in energy efficiency. Using a comparison group of future participants addresses this problem to a very large degree.

The model we used was a fixed-effects panel model. This type of model allows all household factors that do not vary over time to be absorbed by (and therefore controlled for) the constant term in the equation. This would include such things as square footage, appliance stock, habitual behaviors, household size, and many other factors. Of course, any of these factors can change during the evaluation period and, in that case, the effects of those changes would be confounded with the program effects, either artificially increasing or decreasing them. However, these effects are likely to be quite infrequent and would probably be a wash over the sample. The critical things to include in these models are the time-varying factors including weather.

Table 7-3 presents the end use and overall program savings for the 2010 participants. As described above, we have applied the realization rate of the overall program to the 2011 program.

Please see Section 13.2 for a more detailed discussion of the billing analysis method and our model specification.

Table 7-3. Savings from Billing Analysis Compared to Savings Expected from Program Planning Estimates

End Use	N (households)	Program Planning Savings			Observed Savings			
		Weighted Average Household Daily Savings	Annual Average savings (kWh)	Total Annual Savings (kWh)	Weighted Average Household Daily Savings	Annual Average savings (kWh)	Total Annual Savings (kWh)	Realization Rate
Lighting	1420	2.181	796	1,204,524	0.705	257	389,570	0.32
Refrigerators	581	1.095	399	604,436	0.662	242	365,470	0.60
HVAC	39	0.021	8	11,738	0.013	5	7,146	0.61
DHW	40	0.016	6	8,781	0.075	27	41,418	4.72
Overall Program	2080	3.313	1,209	1,829,479	1.455	531	803,605	0.44
Total 2010 Participants in analysis = 1513								

Net Impacts Using Engineering Approach

Given that REAP is a direct installation 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. We used a net-to-gross factor of 1.0, which is typical for low-income programs. As such, the gross and net impacts are identical.

Table 7-4 provides a category-by-category review of impacts for the program in 2011 based on an engineering estimate of savings. See the definitions in Section 1.1 for the difference between the ex ante and ex post values.

Table 7-4. REAP Measure Specific Net Impacts – Engineering Approach

Measure Category	N	Ex Ante		Ex Post		Realization Rate	
		kW	kWh	kW	kWh	kW	kWh
Lighting	33,033	258	2,843,310	200	1,809,601	78%	64%
Refrigerator	963	179	1,159,503	85	722,900	47%	62%
Hot Water	400	7	30,501	2	3,793	24%	12%
HVAC	226	54	38,069	54	38,069	100%	100%
Totals	**34,622**	**497**	**4,071,384**	**341**	**2,574,362**	**68%**	**63%**

Reasons for Differences in Engineering Impacts

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 a different coincidence factor (0.15) was used to estimate ex ante demand savings. Discussions with LIPA indicated that these direct install lights were strategically placed in areas of high use, thus potentially leading to a higher than typical coincidence factor. We researched this and found that the bulbs were placed in areas similar to other programs and did not apply the higher factor[24]. The differences between the coincidence factor accounts for the difference between ex ante and ex post demand savings. In terms of energy savings, we believe the program used an annual operating hours estimate of 1,253[25]; however, when estimating savings, we used an annual operating hours value of 1,022 to align with the EEP recommendation in Table 3-2.

Refrigerators: For Refrigerator measures, the program used a value of about 600 kWh for removed refrigerators and a value of about 1,000 kWh for replaced refrigerators. A removed refrigerator typically saves more energy than a refrigerator that is being replaced, so we went to a different source for these values. The evaluation team used ENERGY STAR recommended values of 1,460 for removed refrigerators and 700 for replaced refrigerators, thus reducing the demand and energy impacts compared to the program values.

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[24] We had a half-year of data with complete information on where the program placed the bulbs. From that information, about half of the bulbs installed were in high-traffic areas such as kitchens while half were in low-traffic areas such as bedrooms and bathrooms.

[25] The specific hours of operation applied to lights for this program were not specified, but we back-calculated them based on other information.

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. However, 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, showerhead, and temperature reset measures account for the domestic hot water (DHW) savings attributable to the REAP program. The evaluation team found that deemed savings value and the algorithm used to estimate ex ante energy and demand savings are not well documented. As such, we used DOE 3E-Plus software to analyze heat loss from insulated and un-insulated pipes and determine ex post savings per linear foot of pipe insulation. 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 pertinent variables such as the coincidence factor, annual operating hours, and hot water temperature.

8. 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 rating 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.

Impacts for Comparison to Goal and Cost-Effectiveness

Table 8-1 shows the net evaluated savings compared with tracked program savings. See the definitions in Section 1.1 for the difference between the ex ante and evaluated values.

Table 8-1. Residential New Construction Net Impacts for Comparison to Goal and Cost-Effectiveness

Category	Ex Ante			Evaluated		Realization Rate	
	N	kW	kWh	kW	kWh	kW	kWh
Residential New Construction	680	1,188	2,309,000	1,188	2,309,000	100%	100%

Note: the evaluated value for this program is also the ex post value as the NTGR is 1.0 in both cases. We used this same information in the cost-effectiveness analysis.

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. As such, 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 understand that these values can change from year to year and recommend that LIPA consider updating its rating system and minimum requirements to be consistent with the updated national protocols.

9. 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. LIPA had successfully bid for and received federal funding through the American Reinvestment and Recovery Act (ARRA). LIPA used these funds to reimburse themselves for residential PV installations up to the limit of the funding[26]. The program did not treat sites receiving reimbursement differently as the determination of which residential participant would be included for reimbursement was determined after the installation of panels.

Impacts for Goal Comparison

Values in Table 9-1 show the savings by category. See the definitions in Section 1.1 for the difference between the ex ante and evaluated values.

Table 9-1. Solar Residential and Nonresidential Net Impacts for Goal Comparison

Category	N	Ex Ante		Evaluated		Realization Rate	
		kW	kWh	kW	kWh	kW	kWh
Residential – Not ARRA	264	1,056	2,205,327	734	1,916,716	69%	87%
Residential - ARRA	671	3,093	6,441,702	2,149	5,598,676	69%	87%
Residential Total	*935*	*4,148*	*8,647,029*	*2,883*	*7,515,392*	*69%*	*87%*
Commercial	124	1,984	4,033,908	1,378	3,505,990	69%	87%
Municipal	101	1,703	3,421,391	1,183	2,973,634	69%	87%
Total	**1,160**	**7,835**	**16,102,327**	**5,444**	**13,995,016**	**69%**	**87%**

[a] The ARRA funded sites are included in these values.

The realization rates for both demand and energy were determined from a 2010 evaluation analysis of interval data from approximately 50 PV meters deployed throughout LIPA territory. This data set has not changed since last year, and evaluators have therefore adopted identical realization rates from 2010. Further information on this evaluation analysis is available in the 2010 evaluation report.

Impacts for Cost-Effectiveness

Similar to the Cool Homes program, the evaluation team conducted research across several areas to assess the NTGR for this program. Ultimately, we found that the program had substantially influenced the market for solar, and the evaluated NTGR was set to 1.0 (equal to the program planning value).

[26] LIPA received $8,344,400 in grant funds through ARRA, which funded approximately 670 residential participants.

Values in Table 9-2 show the savings by category for the cost-effectiveness calculations. Since the NTGR for both the ex ante and ex post are the same value, this table is identical to Table 9-1. See the definitions in Section 1.1 for the difference between the ex ante and ex post values.

Table 9-2. Solar Residential and Nonresidential Net Impacts for Cost-Effectiveness

Category	N	Ex Ante		Ex Post		Cost-Effectiveness Realization Rate	
		kW	kWh	kW	kWh	kW	kWh
Residential	935	4,148	8,647,029	2,883	7,515,392	69%	87%
Commercial	124	1,984	4,033,908	1,378	3,505,990	69%	87%
Municipal	101	1,703	3,421,391	1,183	2,973,634	69%	87%
Total	**1,160**	**7,835**	**16,102,327**	**5,444**	**13,995,016**	**69%**	**87%**

[a] The ARRA-funded sites are included in these values.

Net-to-Gross Estimation

To assess the Solar PV program's net-to-gross ratio, the evaluation team conducted a mix of primary and secondary research to characterize the effect of LIPA incentives on PV installations over the past decade. Data collection activities included:

- Review of the Solar PV market and incentive programs in New York State, in LIPA territory, and in non-LIPA territory on Long Island.
- In-depth phone interviews with 14 of the largest and most active PV installers on Long Island. The contractors ranged from large regional installers who covered regions outside of LIPA territory and New York State, to contractors who worked exclusively in Suffolk and Nassau counties.
- A focus group with 10 PV contractors using the Delphi method of data collection to help better understand the impact of the LIPA program on the Long Island residential and non-residential PV markets.

A summary of these efforts follows.

Review of the Solar PV market in non-LIPA territory on Long Island.

To isolate the actual monetary incentive from the developed solar contractor base on Long Island, we examined the prevalence of PV systems in three non-LIPA communities that offer no incentives for PV systems. The communities of Freeport and Rockville Centre in Nassau County and Greenport in Suffolk County all feature municipally run electric utilities. All three municipalities are separate from the LIPA grid and are therefore ineligible for LIPA efficiency program incentives.

Assuming differences in latitude, typical cloudiness, eligible roof square footage, municipal code requirements, per capita income, and solar contractor base between LIPA and these non-LIPA communities are not significant, these municipalities can provide a baseline comparison with surrounding communities that are eligible for LIPA incentives. Therefore, this analysis assumes that the major difference between LIPA communities and these non-LIPA communities is the monetary incentive for installing PV systems.

We investigated the extent of solar PV installations among the three communities by conducting phone interviews with representatives of each community's electric and buildings divisions and by reviewing publically available historical data on municipal PV permits. We learned that these communities together have realized only a handful of installs primarily resulting from a one-time grant implemented by Freeport Electric, the division of Freeport that runs the city-owned utility. No

PV installations have been implemented in the communities of Rockville Centre and Greenport since LIPA solar programs were created in 2000.

Though the sample size is small, this comparison provides convincing anecdotal evidence that LIPA's outreach, incentives, and developed contractor base are driving PV installations on Long Island.

In-depth interviews with PV installers

To further characterize the PV market on Long Island, the team administered a telephone interview specifically targeted to the largest and most active PV installers in Long Island. The interviews were designed to assess the effect of LIPA's solar infrastructure and incentives on the Long Island PV market and contractor base. We asked additional questions regarding the state of the market if LIPA hypothetically provided no PV support and gave no incentives.

Over the course of two weeks, we completed a total of 14 phone interviews. Participants ranged from large regional installers who covered regions outside of LIPA territory and New York State, to contractors who worked exclusively in Suffolk and Nassau counties

According to some of the most active solar contractors on Long Island, last year's PV market without LIPA support would have featured an estimated 2% of actual 2011 installs. Ten of the fourteen survey respondents indicated that they believed there would be no PV installations on Long Island without LIPA incentives. Additionally, many contractors indicated that the PV incentives from LIPA were the sole force driving the market and making customer participation possible, even with the lower incentive rebate amounts that began in 2011. In fact, one contractor provided anecdotal evidence of a Long Island resident who lived in a non-LIPA community that, upon learning he was not eligible for incentives, abandoned the rooftop PV project.

Focus group with PV contractors

To support the findings of the contractor interviews, the evaluation team conducted a focus group with Long Island solar PV contractors who are among the most active in the program. The consensus among group participants was that there would be virtually no PV market on Long Island in the absence of LIPA's program. While contractors acknowledged the importance of state and federal tax credits as both substantial and meaningful, they noted that they would not be enough, on their own, to influence many customers to invest in solar PV systems. Contractors stated that the LIPA incentives are critical to nearly every customer's decision to install a PV system.

Summary of findings

Based on the research described above, the team concluded that the program exhibits low levels of free ridership. The team also found some evidence of spillover in the program tracking database, consisting of installations where the installed wattage exceeds the program's kW cap (10 kW for Solar Pioneer and 50 kW for Solar Entrepreneur). Given the relatively equal and low levels of free ridership and spillover, we have set a net-to-gross ratio of 1.0 for the Solar Pioneer and Solar Entrepreneur programs.

10. SOLAR HOT WATER

The LIPA Solar Hot Water program is an incentive program that offers rebates to approved residential customers to defray a portion of the cost of installing solar hot water systems. The customer must have electric hot water heating to participate in this program. The program provides financial support that encourages the market penetration of solar water heating, helping customers gain better control over their electric bills and reduce their carbon footprint as well as offsetting LIPA's energy and capacity requirements.

Impacts for Goal Comparison and Cost-Effectiveness

Values in Table 10-1 show the savings both for comparison to goal and our cost-effectiveness calculations. See the definitions in Section 1.1 for the difference between the ex ante and evaluated values.

Table 10-1. Solar Thermal Net Impacts for Goal Comparison

Category	N	Ex Ante		Evaluated		Realization Rate	
		kW	kWh	kW	kWh	kW	kWh
Solar Thermal	3	3.71	9,620	3.71	9,620	100%	100%

Note: the evaluated value for this program is also the ex post value as the NTGR is 1.0 in both cases. We used this same information in the cost-effectiveness analysis.

In its second year, the Solar Hot Water program funded three projects in 2011. These projects feature ex ante energy savings that amount to approximately 0.1% of total renewable portfolio savings. Therefore, we did not assess any component of this program, but assigned a realization rate of 100% for both energy and demand as well as applied the program planning NTGR of 1.0. As the program grows and funds more installations, we will more closely examine program processes and impact calculations.

11. BACKYARD WIND

The Backyard Wind program (also called Small Wind) 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.

Impacts for Goal Comparison and Cost-Effectiveness

Table 11-1 shows the impacts from this program used for both comparison to goal and our cost-effectiveness. We assessed the gross impact, but not the net impact. As such, we applied the program planning NTGR of 1.0, meaning the impacts for comparison to goal and our ex post impacts are identical. See the definitions in Section 1.1 for the difference between the ex ante and evaluated values.

Table 11-1. Backyard Wind - Net Impacts for Goal Comparison and Cost-Effectiveness

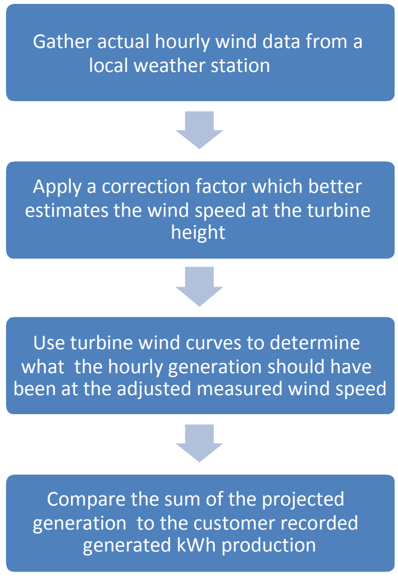
Category	N		Ex Ante		Evaluation		Realization Rate	
	2010[1]	2011[2]	kW	kWh	kW	kWh	kW	kWh
Residential [3]	2	0	-	1,799	-	2,645.6	191%	147%
Commercial	4	2	17	215,709	33	317,225	191%	147%
Municipal	0	0	-	-	-	-	N/A	N/A
Total	**6**	**2**	**17**	**217,508**	**33**	**319,870**	**191%**	**147%**

[1] The program claims a 35% carryover of energy savings from 2010 projects.
[2] The program claims 65% of energy savings from 2011 projects.
[3] Note that one residential install from 2010 did not meet its year-two performance and was therefore disqualified from the 35% energy carryover.
Note: the evaluated value for this program is also the ex post value as the NTGR is 1.0 in both cases. We used this same information in the cost-effectiveness analysis.

Estimation of Savings

To determine ex post gross 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 funded two wind turbine installations in 2011, but interval performance data was not available for either system. As such, we based our impact evaluation on the performance of five 2010 installs for which 2011 interval data was available.

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 [Typical Meteorological Year] 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.

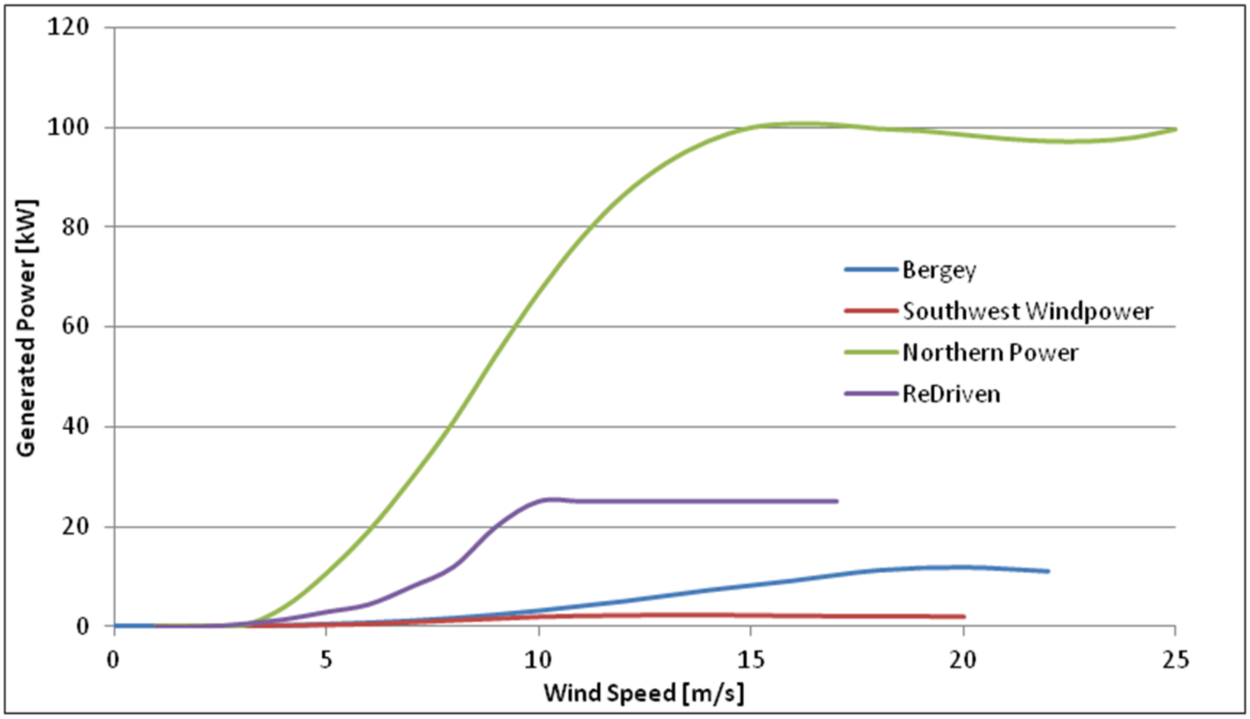
We acquired the turbine power curves for each turbine installed and used these to calculate the predicted generation for each hour, based on actual wind conditions. The turbine efficiency is the sum of the actual production of the turbine recorded by the owner divided by the sum of the predicted performance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

The ex post gross energy savings for any one project is the product of the generation projected using TMY wind data (this is equal to the ex ante savings estimates) and the turbine efficiency[27].

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 11-1, to determine ex post demand savings.

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

Figure 11-1.Power Curves by Turbine Type



The evaluation team determined that the installed turbines delivered higher energy and demand generation than was reported in the program tracking system. Table 11-1 and Table 11-2. 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.

Note that the program does not claim full first-year savings although the site expected annual production values in Table 11-2 are for the full year while the site ex ante values in Table 11-1 are not (i.e., Site Ex Ante kWh = Expected Annual Production * 0.65). This difference means that the totals between the two tables do not match.

Table 11-2. 2011 Site Level Results (at Customer Meter)

N	Type	Installed kW	Technology	2011 On-Line Date	Expected Annual Production	RR on Expected Production	Ex Ante kWh	Ex Post kWh	RR on Ex Ante kWh
1	Commercial	100	Northern	December	185,380	96%	120,497	177,205	147%
2	Commercial	20	Aurora	April	45,830	96%	29,790	43,809	147%

Reasons for Differences in Impacts

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 accounts for the realization rates over 100%. Nonetheless, based on our evaluation, we provide the following recommendations:

- The repeated observation of inoperable units across 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 sufficient shakedown period should occur before considering a unit online and counting the energy generated at the site. The existing data set across the three years (i.e., 11 turbines) included in our analysis 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. 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.

12. PROCESS FINDINGS

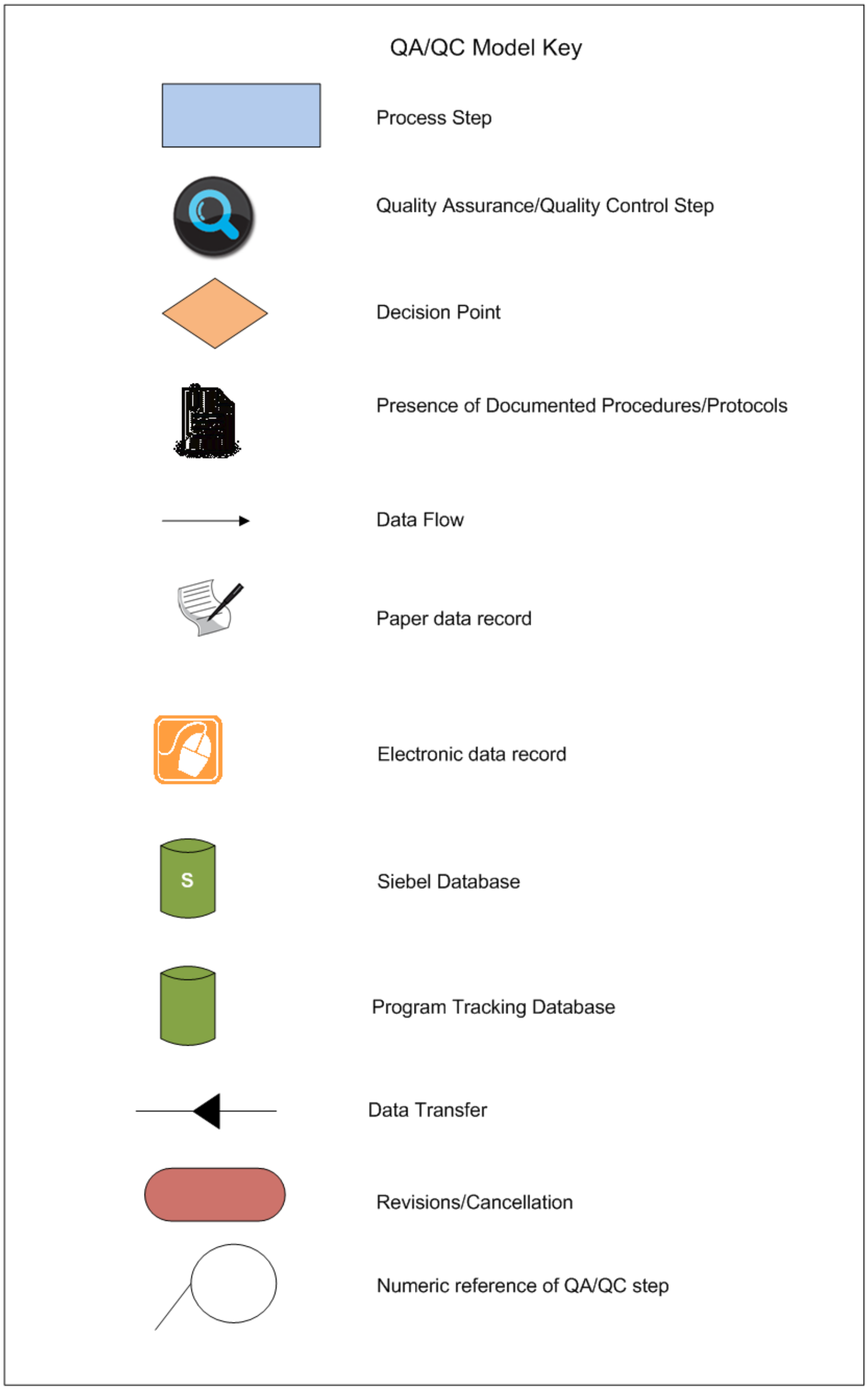
In terms of process evaluation, LIPA chose to pursue a slightly different avenue this program year, as they were interested in learning about the quality assurance/quality control (QA/QC) processes in place for each of the programs. Therefore, rather than the typical process evaluation, we worked with LIPA and structured our assessment to review all program efforts to create and manage data. We used a standardized evaluation approach for every energy efficiency and renewable energy program to provide information on what occurs within each program as well as analyze the current processes in place.

More specifically, as part of the 2011 process evaluation, the evaluation team conducted analysis of quality control and quality assurance (QA/QC) procedures and protocols that are currently in place for LIPA's ELI programs. Based on our review of program materials and interviews with program staff, we developed flowcharts documenting quality assurance, data entry and data transfer steps. The flowcharts also contain indicators of presence of documented protocols for each of the steps. For each of the flowcharts, we summarize the respective program or program component's QA/QC procedures and protocols. Within these summaries, we identify what QA/QC activities take place at each stage of data transfer, what entity is responsible for conducting the transfer and the QA/QC procedure, and whether or not the step is documented by any of the entities involved in implementation.

The figure below contains the legend defining the symbols and icons within the flowcharts. The icons are meant to illustrate if QA/QC occurs at that point of data transfer, if that step is documented, in what form the data exist at that stage, and exactly when the format of the data changes. The data transfer stages we included are those where an error in data could potentially occur. The numeric references alongside each of the QA/QC stages link to the numbering in the description that follows the respective chart.

Please note that for the Commercial program, process evaluation spanned beyond QA/QC assessment and included exploration of other process related topics, such as program marketing, trade ally relations and interactions, etc.

Figure 12-1. QA/QC Model Key



12.1 Commercial Efficiency Program

In 2011, the Commercial Efficiency program saw multiple changes to its design structure and implementation processes. The most considerable ones included:

- **Full transition of program tracking to Siebel.** In 2011, LIPA Commercial Efficiency program fully transitioned its data generation, data management, and program tracking into Siebel. Siebel is an Oracle-based relational database with a wide array of data storage and data manipulation capabilities. Throughout 2011, LIPA Commercial Efficiency program staff worked with the Siebel team to configure Siebel to support program tracking and reporting needs. The work on fine-tuning continues, including the ability to extract data, the ability to enter additional data, and expanded access to Siebel by program implementers (primarily TRC, APT, and Lime Energy).[28]
- **Program implementation across two implementation contractors.** In 2011, program implementation among large accounts (both unmanaged and managed) was fully transitioned to TRC, LIPA's Commercial Efficiency program Solution Provider. National Grid continued implementing the "mid-market" program among all medium and small accounts, and was also charged with overseeing the Solution Provider through using a dedicated program manager.
- **Launch of the Small Business Direct Install program component.** In the fall of 2011, LIPA launched the Small Business Direct Install (SBDI) program, hiring Lime Energy as their implementation contractor. This component is very focused. Business customers qualifying for this component have been pre-selected based on load pockets by circuit (LIPA selected anyone with a loading of 80% or more in their circuit as qualifying business customers for SBDI).[29] Program design includes a no-cost assessment, and an installation of energy efficient lighting improvements. LIPA covers 70% of the total project cost, and customers are responsible for the remaining 30%.

Throughout 2011, the program also saw changes to its incentive structures and a variety of incented energy efficiency measures. In 2012, LIPA is continuing to work toward streamlining the process by giving project managers more responsibility and ownership of a project from start to finish.

Figure 12-2 below depicts general program implementation structure.

[28] TRC is the Solution Provider implementing the Commercial Efficiency program among large unmanaged and managed accounts, APT is the entity responsible for conducting post-inspections for TRC, and Lime Energy is the implementation contractor of LIPA's Small Business Direct Install program.

[29] This was the definition of the customer base qualifying for the Small Business Direct Install program component in 2011.

Figure 12-2. General CEP Program Implementation Structure

Sections below present findings resulting from the process-related research efforts that included interviews with program staff, program participants, and trade allies. The results are presented separately for the Small Business Direct Install program component due to inherent differences in the component's design and implementation structure.

Prescriptive, Existing Building, and Custom Program Components

Participation Overview

From 2010, participation in the program increased from a total of 1,065 to 1,636 projects (not including Small Business Direct Install projects). The table below presents 2011 participation rates in each of the program components in terms of the number of completed projects.

Table 12-1. Participation by Program Component

Program Component	Number of Applications	% of Applications
Prescriptive*	495	30%
Existing Retrofit	787	48%
Custom **	354	22%
Total	**1,636**	**100%**

*Also includes projects labeled as lighting stimulus in the program tracking database
** Also includes projects labeled as whole building in the program tracking database

Participating customers represented a variety of sectors, including manufacturing (20%), retail (18%), education (9%), healthcare (7%), office (7%), and warehouse (7%), among other business types. Over six in ten participants (67%) report less than 50 employees working at the facility where LIPA-incented energy efficient improvements were performed.

Fifty-five percent of participating customers report owning their facility, while 40% lease the facility where the energy efficient project was performed. Participating facility age ranges from new to older buildings. Over a quarter of program participants (28%) report the facility where energy efficient improvements were made to be 50 years and older, and another 28% say that the facility age was between 30 and 49 years old.

Based on the program tracking data, 17% of the projects completed in 2011 were completed for not-for-profit entities.

Aside from offering incentives for installation of energy efficient equipment, LIPA's Commercial Efficiency program offered energy audits and consults, as well as technical assistance studies. Program tracking data did not contain information on customer participation in audits and technical assistance studies offered by LIPA, but based on the survey results, 38% of program participants reported doing a technical assistance through LIPA, and 39% reported having an audit performed at their facility prior to starting their 2011 project(s).

Application Process

In 2011, the Commercial Efficiency program transitioned from one comprehensive Prescriptive application form to separate application forms split by end use. Equipment worksheets within each of these applications were tailored to each individual end use, while contact information and program requirement sections were consistent across the applications.[30]

Overall, 43% of program participants filled out at least parts of the application forms for their energy efficiency projects in 2011. When participants did not fill out program application forms, in the majority of cases (57%), they report their contractors filling out the form for them.

In cases where participants filled out application forms themselves, nearly half obtained them from a LIPA representative (49%), 29% got them from their contractor, and 17% found them on LIPA's website, among other places. As expected, since they are larger customers, participants whose projects were processed by the Solution Provider are more likely to receive an application from a program representative, whereas participants whose projects were processed by National Grid are more likely to get program application forms from the contractors.

Overall, program participants find application processes easy. Difficulties with the application process stem from inability to provide responses to technical questions and application forms being confusing and not user-friendly. Prescriptive and Existing Retrofit program participants are more likely than Custom program participants to rate the application process as easy, which is not surprising, considering the more complex nature of Custom projects and therefore application process. Rating of the ease of the application process overall remained unchanged as compared to 2010 (59% vs. 57%).[31] Notably, participants did not experience any difficulties finding the proper entity to submit the program application to.

Trade allies are generally also satisfied with the application process as well. However, a couple cited lengthy process.

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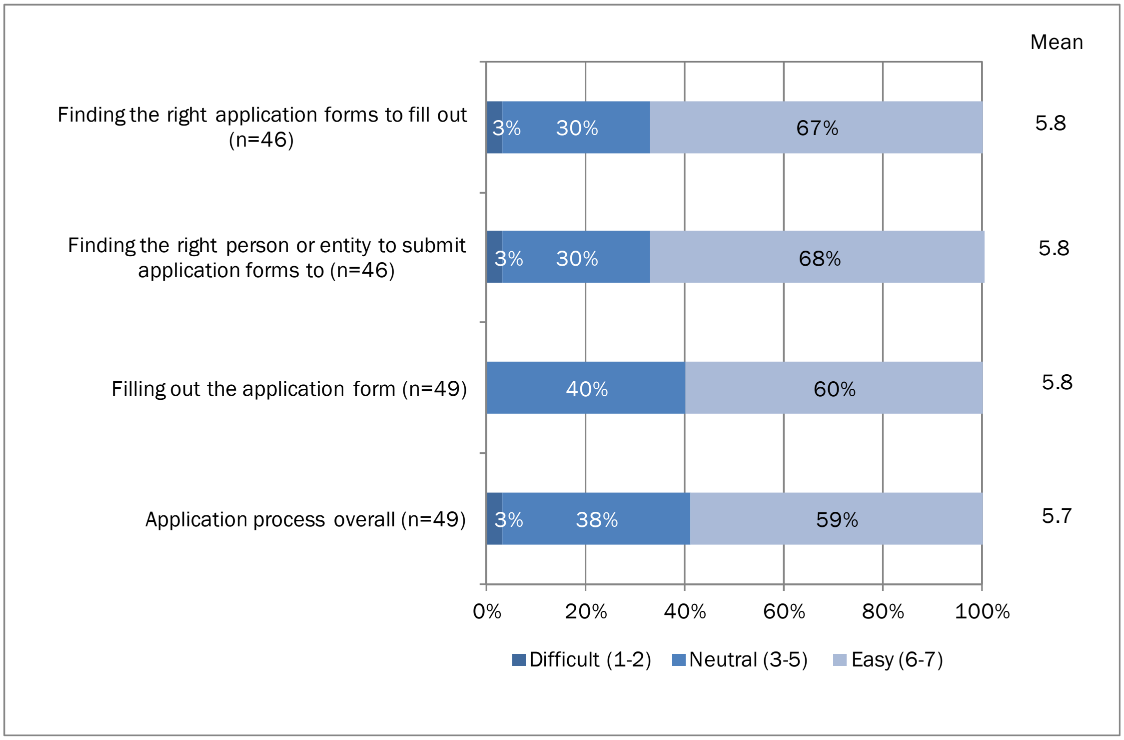
[30] For program year 2012, additional changes were made to the application forms, including detailed information about program participation steps, as well as a list of required documents to process an incentive, and who generates those documents. In 2012, all applications are available both as printable documents as well as excel worksheets.

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

Figure 12-3. Participant Reported Ease of Program Application Process



Pre-approval, Post-Inspections, and Incentive Processing

Pre-Approvals and Pre-Inspections: In 2011, all Custom and Existing Retrofit projects needed to undergo pre-approval and pre-inspection. Prescriptive projects did not have to be pre-approved, unless specifically requested by the customer. The purpose of pre-approvals and pre-inspections is to confirm that existing conditions and measures are the same as what has been communicated to LIPA. Pre-approvals in 2011 were issued by the rebate processing team.[32] Pre-inspection can be performed by project managers at National Grid or Solution Provider, Major Account Executives, or Commercial Efficiency Consultants.[33]

Overall, 64% of participants report that their projects were pre-approved. This could be because the person we talked to as part of the survey effort was not involved in the pre-approval process. Through a portion of 2011, LIPA offered customers and trade allies the opportunity to expedite the pre-approval process by hosting "Open House" meetings every Friday, where participants and trade allies could bring all necessary documentation and get their projects pre-approved instantly. Five percent of program participants report pre-approving their projects during one of the "Open House" meetings.

For those who remembered going through the pre-approval process, the majority (69%) had their projects pre-approved within five weeks. Almost a quarter of participants, however, report that the pre-approval process took two months or longer. Overall, 69% of customers were satisfied with the

[32] In 2012, project managers, both at National Grid and the Solution Provider, can issue pre-approval letters, as part of the streamlined program delivery process

[33] Commercial Efficiency Consultants are individuals involved in marketing the program to enduse customers.

amount of time the pre-approval process took, and 70% are satisfied with the pre-approval process overall.[34] Those who were dissatisfied cite lengthy and confusing processes as the reasons for low satisfaction ratings.[35]

Post-Inspections: As part of the Commercial Efficiency program implementation process, post-inspections were required for all Custom projects and for all Prescriptive and Existing Retrofit projects with incentives of $10,000 or more. A random 10% of Prescriptive and Existing Retrofit projects with incentives of less than $10,000 were required to undergo post-inspections as well. For projects completed at National Grid, project managers, Major Account Executives, and Commercial Efficiency Consultants are permitted to post-inspect projects. For projects completed by the Solution Provider, LIPA requires that post-inspections be performed by APT, a third party contractor.

Overall, 80% of participants say their projects were post-inspected. Nearly all participants who completed Custom projects (95%) report their projects undergoing post-inspection. In the overwhelming majority of cases (84%), projects were post-inspected within five weeks or less upon submission of final project paperwork. Satisfaction with the amount of time within which the post-inspection process took place is generally high, with 73% of participants saying they are satisfied with how long it took LIPA to schedule and conduct post-inspection.[36] Furthermore, 81% of participants are satisfied with the post-inspection process overall.[37] The few participants who reported dissatisfaction with the process cite lengthy process and issues with communication with LIPA as the reasons.[38]

Incentive Processing: Sixty-nine percent of program participants report receiving incentive checks within eight weeks of submitting final project documentation. Participants are generally satisfied with the time it took them to receive their incentive (63%).[39]

The tables below present participant-reported timelines associated with the three core project milestones – pre-approval, post-inspection, and incentive processing, as well as satisfaction ratings associated with each of the categories. Based on the participant feedback, six weeks or less seems the maximum time for the various program components to maintain satisfaction.

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

[35] In 2012, all projects, with the exception of the Prescriptive New Construction projects are required to be pre-approved. While this step ensures quality of the data, it might also result in participation burden as well as increased implementation resources. Program staff we interviewed as part of the evaluation also expressed concerns with the resources required to implement this step.

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

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

[38] In 2012, all projects, regardless of their type, are required to be post-inspected. Similar to pre-approvals, while this program requirement will ensure quality of data, it might cause unnecessary burden to participants and result in additional implementation costs.

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

Table 12-2. Participant Reported Project Milestone Timelines and Satisfaction Ratings (Pre-Approval and Post-Inspection)

	Pre-Approval		Post-Inspection	
	% Participants	% Satisfied*	% Participants	% Satisfied*
Less than 2 weeks	26%	100%	41%	86%
2-3 weeks	18%	71%	24%	77%
4-5 weeks	25%	70%	19%	70%
6-7 weeks	8%	33%	0%	0%
8-11 weeks	12%	60%	4%	0%
12+ weeks	11%	40%	12%	57%

*A rating of 6 or 7 on a scale from 1 to 7, where 1 is not at all satisfied and 7 is very satisfied with the time it took LIPA to complete the respective process.

Table 12-3. Participant-Reported Project Milestone Timelines and Satisfaction Ratings (Incentive Processing)

	Incentive Processing**	
	% Participants	% Satisfied*
Less than 4 weeks	19%	100%
4-6 weeks	35%	79%
6-8 weeks	15%	46%
8-10 weeks	9%	33%
10-12 weeks	8%	67%
More than 12 weeks	14%	10%

*A rating of 6 or 7 on a scale from 1 to 7, where 1 is not at all satisfied and 7 is very satisfied with the time it took LIPA to complete the respective process.
**Note that 7 participants reported that they never received payment.

Trade allies that we interviewed are generally happy with the timing of various program components. A few, however, mentioned that incentive processing took too long to complete. One trade ally specifically mentioned that LIPA struggles to process incentives and issues checks in less than six weeks. Among the trade allies that we interviewed, few integrate program incentives into project costs to reduce customer upfront investment and make their project proposal more appealing. Delays with LIPA processing incentives, therefore, directly influence trade allies, as they need incentives to meet their profit margins as well as pay distributors or vendors for the installed equipment.

Satisfaction with Program Components

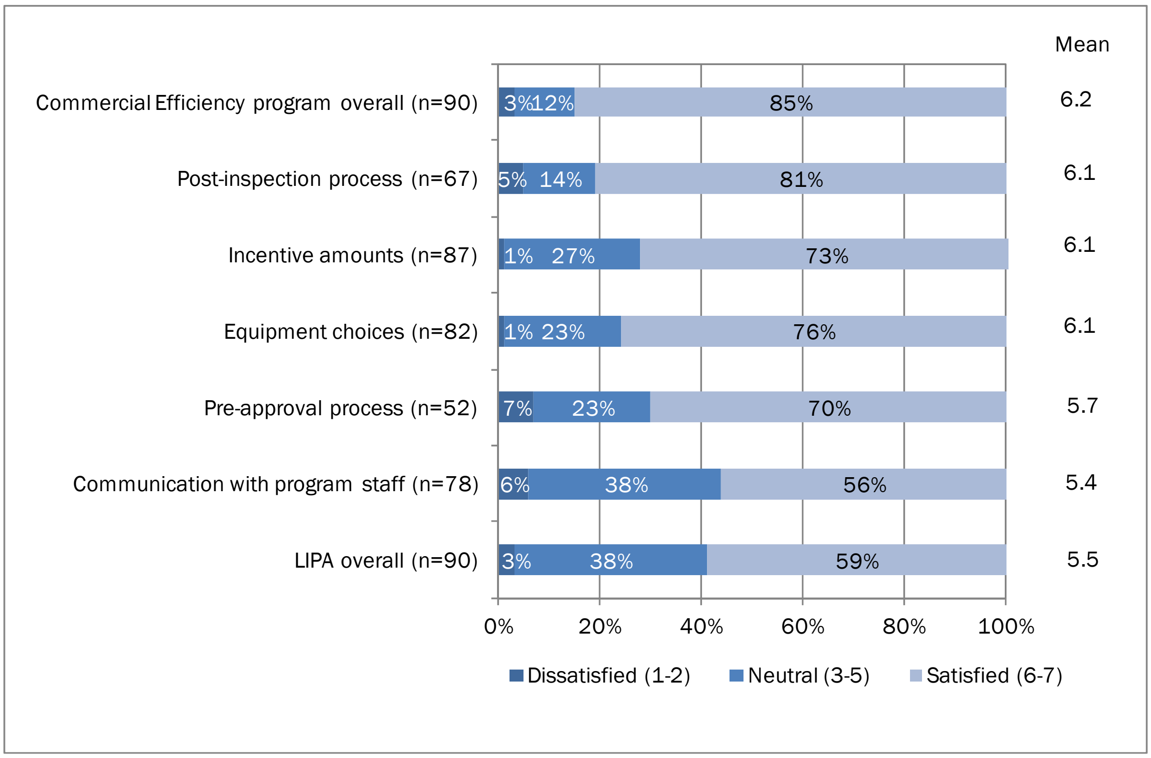
Over a half of program participants (65%) say that program requirements were easy to understand, with 45% saying that program requirements were extremely easy to understand. Participants cited frequent changes to the program, technical issues, lack of detailed explanations, and complicated paperwork as obstacles to better understanding program requirements.

Telephone surveys with program participants and trade ally in-depth interviews also explored participant satisfaction with a variety of program aspects, as well as overall satisfaction with the Commercial Efficiency program and with LIPA. Figure 12-4 presents participant survey results, and these results are consistent with the 2010 levels. As seen in the figure, participants report generally high levels of satisfaction across all program areas. Communication with program staff appears to be an area lagging in satisfaction as compared to other components that we explored. Reasons for dissatisfaction voiced by program participants include too many people being involved in the process, length of the process, and drops in communication.

Trade allies also report generally high levels of satisfaction with the program participation process. Satisfaction ratings generally range from five to seven. Only one contractor gave the program a low rating (a rating of two), the reason for that being a large discrepancy in the initial incentive promised through the program to the customer and then assigned to the trade ally and the final incentive that the trade ally received. Areas of program concern by some trade allies include the need for better communication and coordination across the implementation contractors and a more clear definition of how to contact the correct entity for project coordination.

Finally, program staff that we interviewed acknowledged room for improvement in the coordination of program implementation process in terms of directing applications to the proper implementation contractor, customers and market actors could have been communicated with more often, and there were bottlenecks in the process. Program staff are working on addressing these issue in 2012 and the issues should resolve within the calendar year.

Figure 12-4. Participant Satisfaction with Program Components

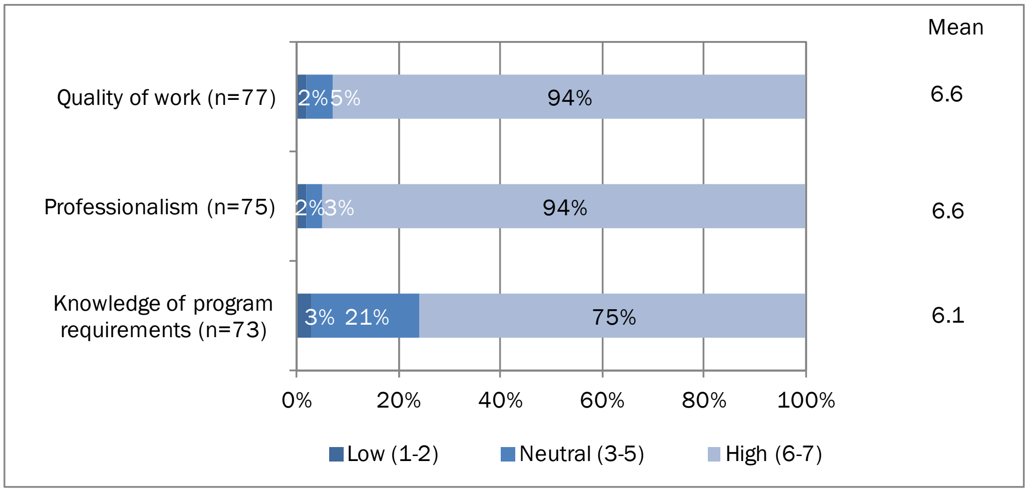


Consistent with high satisfaction levels, program participants report high likelihood of repeat program participation – 61% say they are likely to participate in the program again within the next year.[40] Those unlikely to participate report having exhausted the need for any further improvements.

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

The participant telephone survey also explored participant use of and satisfaction with contractors and vendors. The majority of participants (85%) used a contractor for their projects. Of those, over half (54%) had a prior working relationship with their contractor. Overwhelmingly, program participants give high ratings to the contractors they worked with, which is consistent with 2010 evaluation results.

Figure 12-5. Participant Ratings of Contractor Performance

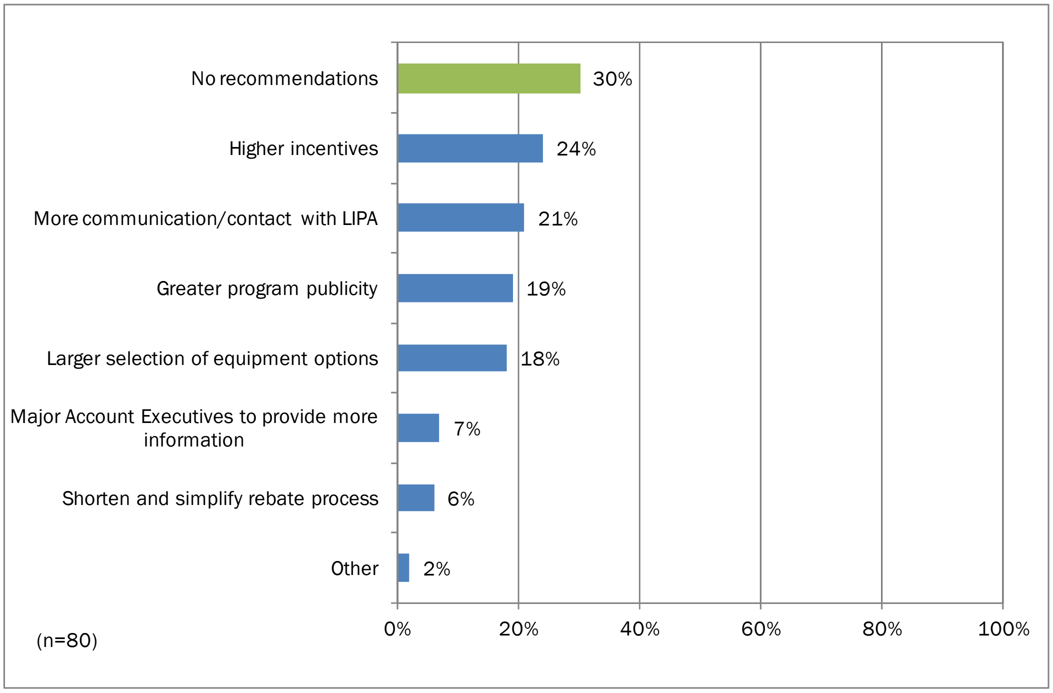


Participant Noted Areas for Improvement

Programs undergoing significant change, such as CEP did in 2011, invariably have many small issues to work through as processes are implemented. As such, to help LIPA understand the potential customer and trade ally pain points in 2011, we asked participants and trade allies about desired improvements to the program.

Over a quarter of participants do not have any suggestions, a quarter would like to see an increase in incentives, and 21% would like to see better communication with LIPA and greater availability of the program staff to answer participant questions.

Figure 12-6. Participant Cited Areas for Program Improvement*



**Multiple response question. Responses of less than 4% are not shown.*

Trade ally responses concerning future program improvements mimicked those of participants. Trade allies recommend increasing program incentives, communicating program changes (such as changes in incentive structures and rebated measures) more regularly and effectively, keeping trade allies informed about roles and responsibilities of the program implementation entities, being more accessible and responsive to trade ally inquiries, and increasing training and educational efforts, specifically as it pertains to specific measures and their energy and non-energy benefits. One trade ally specifically recommended offering financing options to qualifying customers.

Many of these issues will most likely be resolved during 2012, as we understand that LIPA has already made enhancements to some of the program areas or is facilitating change. For example, in 2012, LIPA is becoming even more aggressive in their outreach to trade allies. Some of the outreach tactics employed in 2012 will include another contractor bonus program, more aggressive in-person outreach, and a greater variety of educational opportunities.

In 2012, LIPA launched a Program Partner Network, where trade allies can register and receive the following benefits:

- Trade ally listing on LIPA's website
- Training on new energy efficiency technologies and techniques
- Recognition and reward programs for achievement
- Marketing and application materials

To qualify as a program partner, trade allies have to submit an application and three references. To retain a standing with the program as partners, trade allies have to submit a minimum of 20 applications throughout 2012.

As part of these enhancements to trade ally engagement structure, in 2012, LIPA developed and launched a trade ally web page. Tools available on this web page include:

- Trade guidelines, codes, and handbook
- Online learning center that offers links to training sessions and webinars
- Trade news updates
- Trade ally (program partner) listings for customer use

We see these as positive program enhancements.

Small Business Direct Install Program Component

LIPA launched the SBDI program in the fall of 2011. During 2011, 50 customers completed 54 SBDI projects. Given the recent launch of the component, many program processes are still being fine-tuned.

The SBDI program offers a variety of lighting retrofits to small customers in certain capacity-constrained areas. The participation process includes an Energy Survey that identifies recommended updates, the installation of lighting upgrades by a qualified program contractor, and a closeout visit.

Energy Survey and Equipment Installation

SBDI participants do not have any difficulty scheduling the Energy Survey and the equipment installation: Only 1 of the 29 interviewed participants had difficulty scheduling the Energy Survey with Lime Energy, and only 2 of the 29 interviewed participants had difficulty scheduling the equipment installation.

Eight in ten program participants (83%) say that information provided in the Energy Survey Report was easy to understand.[41] In addition, over three quarters (82%) of participants find the information useful.[42] None of the participants find the information difficult to understand or not useful.

Participants generally install all of the recommended measures: Only 1 of the 29 interviewed participants reported not making all of the recommended installations.

As the Small Business Direct Install program implementer, Lime Energy relies on an outside contractor force to conduct installations as part of this program component. Based on the interviews with the program staff, the process of selecting installation contractors is rigorous. The SBDI participant survey explored participant satisfaction with the contractors who performed the lighting installations in their businesses. Participants are satisfied with all aspects about which they were asked: the quality of work (90%), the contractor overall (83%), and the contractor's professionalism (79%).[43]

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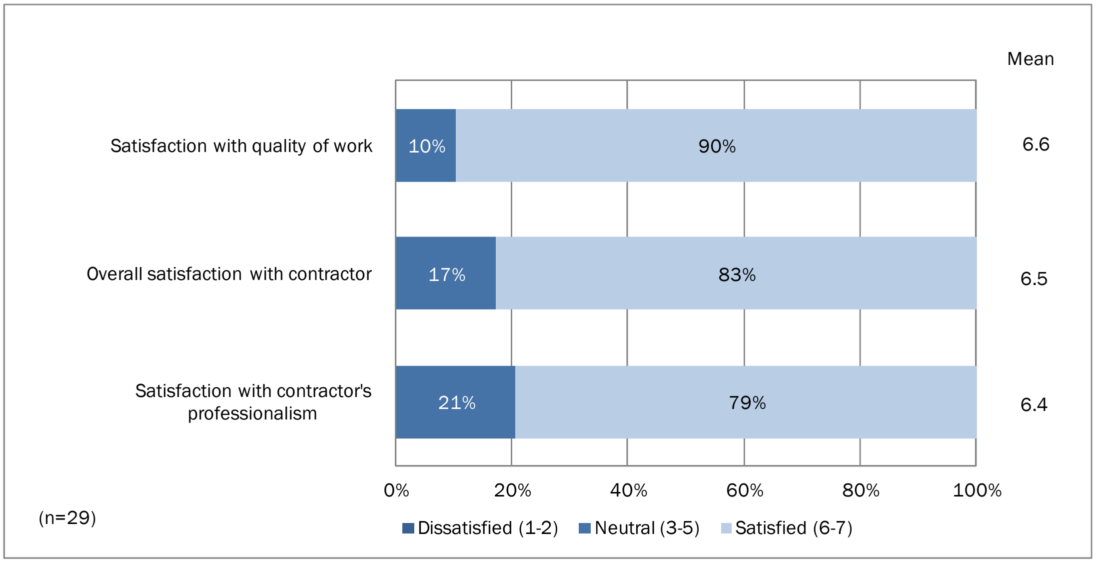
[41] Easy is a rating of 6 and 7 on a scale from 1 to 7 where 1 is "not at all easy" and 7 is "very easy."

[42] Useful is 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."

[43] Satisfied is a rating of 6 or 7 or a scale of 1 to 7; dissatisfied is a rating of 1 or 2.

Figure 12-7. SBDI Participant Ratings of Contractor Performance



Potential for Channeling

Most SBDI program participants are either not at all familiar (38%) or not very familiar (35%) with other energy efficiency opportunities offered by LIPA through the Commercial Efficiency program, and only 7% had participated in the program in the past.

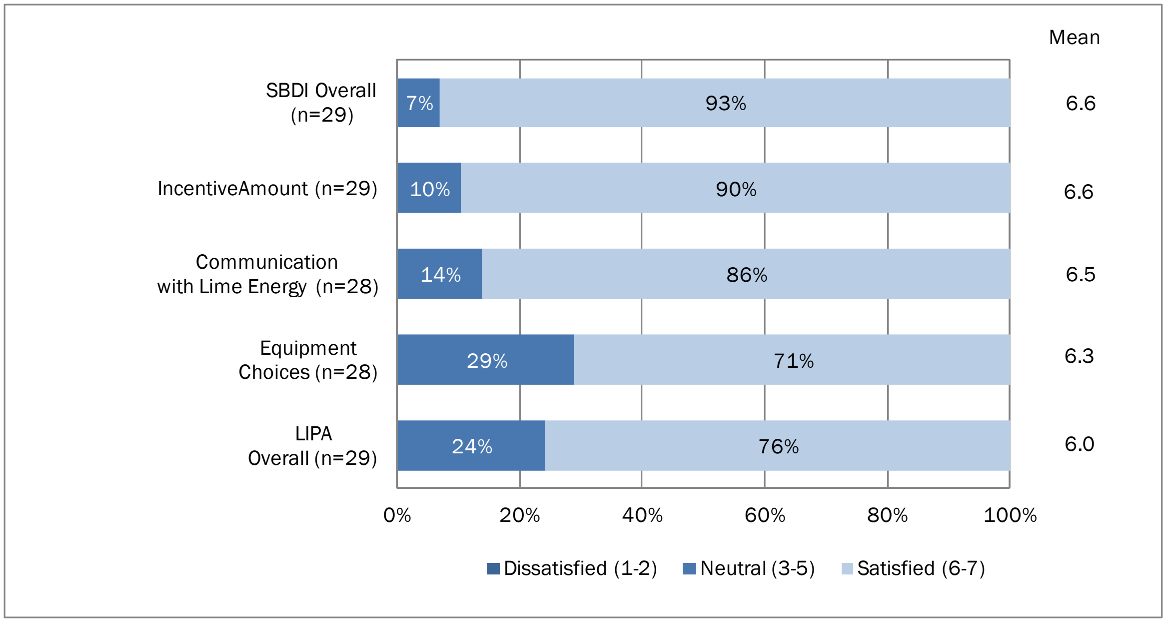
Over eight in ten participants (86%) said that they did not receive any information about LIPA's Commercial Efficiency program during their participation in the SBDI program. The direct installation process provides an ideal opportunity to inform customers about the Commercial Efficiency program, but it appears that this opportunity is currently missed. The program might wish to consider including information about the Commercial Efficiency program in its installation contractor training, providing the installation contractors with program marketing materials, and stipulating that they talk to the customer about the available incentives.

Despite the lack of information, SBDI participants are interested in participating in LIPA's Commercial Efficiency program in the future: 46% plan to participate and another 46% said they might.

Participant Satisfaction and Recommendations for Improvement

The survey with SBDI program participants also explored satisfaction with a variety of program components, as well as overall satisfaction with the SBDI program and with LIPA. Participants are generally satisfied with various components. None of these program components were rated as being dissatisfactory by any of the interviewed participants.

Figure 12-8. SBDI Participant Satisfaction with Program Components



When asked about what improvements to the SBDI program they would like to see, many participants did not have any recommendations, which reflects the high satisfaction rating. About a quarter of the participants (26%) would like to see more measures offered, 17% would like to see better publicity of the program, and 9% would like to see higher incentives.

Program Marketing and Outreach

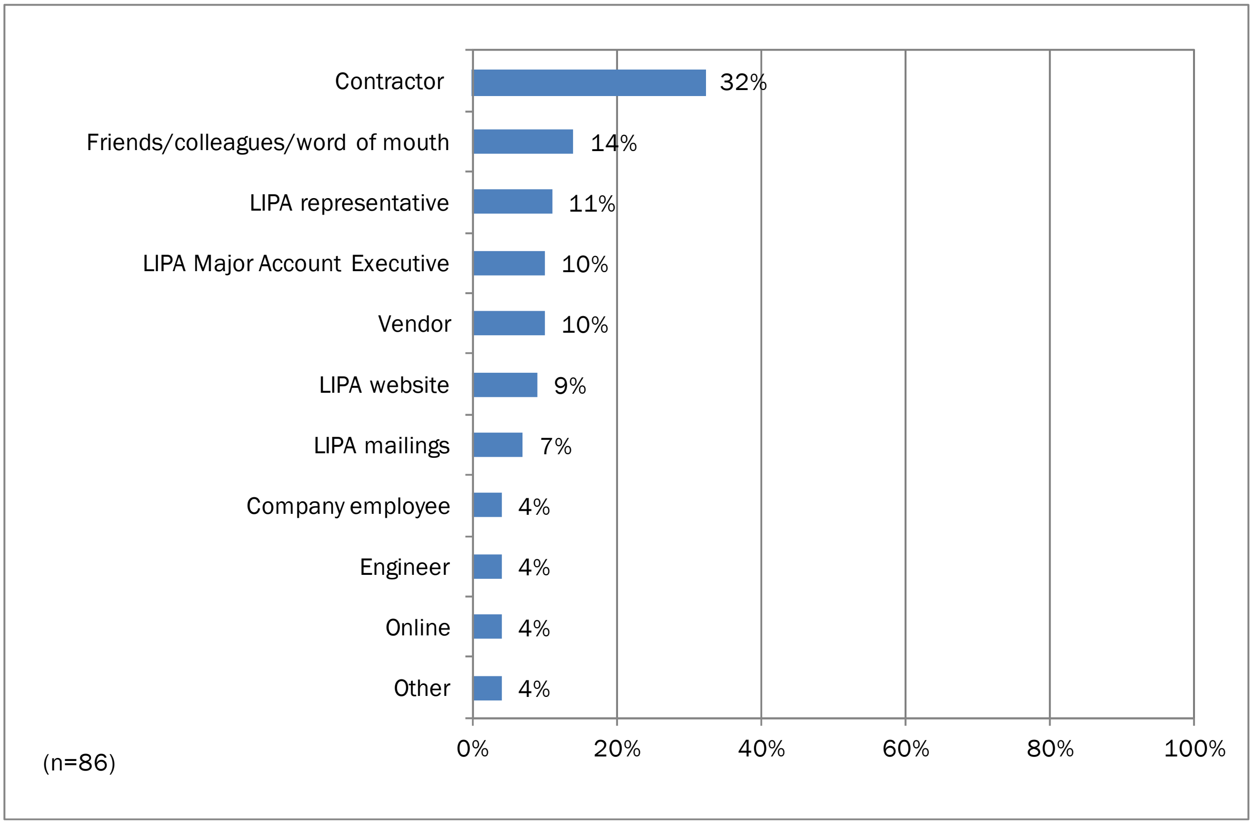
The Commercial Efficiency program marketing was more versatile than in 2010 and included outreach to customers as well as trade allies. Based on the interviews with the program staff, direct contact with customers was at the core of 2011 marketing and outreach and included a dedicated force of four National Grid Commercial Efficiency Consultants reaching out to small and medium customers directly, educating them about the program, and promoting program participation. Marketing to customers also included the use of more traditional venues, such as radio and print advertising, print mailers, and LIPA's website. On the large business side, Major Account Executives were involved in marketing the program in 2011.

As for marketing and outreach to trade allies, according to the interviews with the program staff, 2011 program activities included two contractor breakfasts, weekly "Open House" meetings, and four informational seminars. In addition, LIPA developed program display stands at supply houses across Long Island. Furthermore, LIPA's Commercial Efficiency program conducted in-person outreach to trade allies. LIPA utilized two circuit riders in 2011 to reach out to contractors. Additional outreach to trade allies was performed by the Solution Provider, who used its internal resources to establish and maintain communications with the trade allies.

Between October 2011 and the end of the year, the program offered bonus incentives to trade allies for bringing in and completing projects. Trade allies who brought three or more projects by 2012 (with a minimum of $500 in customer rebates per project) qualified for a bonus of 10% of customer rebate (up to $100,000). Three trade allies we spoke with reported participating in the trade ally bonus program, yet none of them received a bonus incentive as of the time the interviews were conducted in March. This was a particular area of dissatisfaction, as two of the three trade allies used bonuses to at least partially cover and therefore reduce project costs.

A third of program participants (32%) learned about the program through contractors. This represents an increase from 2010, where 17% of participants learned about the program through contractors. This is indicative of the program success with educating trade allies about and engaging them with the program. Prescriptive and Existing Retrofit program participants as well as participants whose projects were completed by National Grid are more likely to report learning about the program through contractors than their respective counterparts. This finding is also consistent with the trade ally outreach tactics employed in 2011.

Figure 12-9. Participant-Reported Sources of Information about the Program*



**Multiple response question. Responses of less than 4% are not shown.*

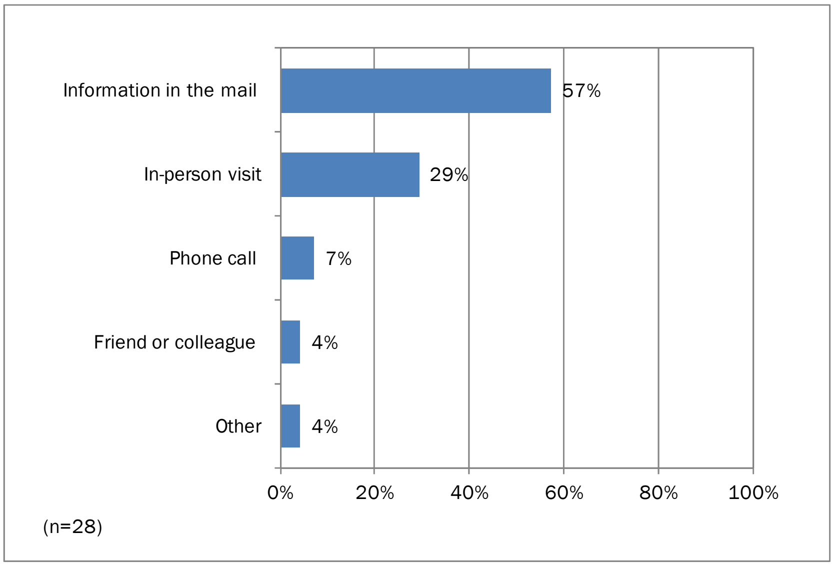
Trade allies we interviewed reported varying degrees of customer knowledge about LIPA's Commercial Efficiency program, with percentages ranging from 15% to 60%. Nearly all of the trade allies, however, said they educated customers about the program and its various components, as well as assisted customers through the participation process. Not all trade allies received marketing materials from the program or attended seminars or other events facilitated by LIPA. Trade allies also reported varying degrees of interactions with the program, ranging from daily to several times a year. Not surprisingly, the reported level of interactions with the program depends on the number of projects trade allies completed in conjunction with the program in 2011, with more projects driving the frequency of communication and interactions with LIPA.

Marketing efforts for the Small Business Direct Install component consisted of several targeted efforts. Customers received mailers inviting them to participate. Initial mailers were followed by targeted door-to-door sweeps in neighborhoods with a high concentration of qualifying businesses.

As part of the marketing and outreach for the program, "by invitation only" breakfast meetings with interested business customers were also hosted.

More than half (55%) of SBDI participants first learned about the program through information they received in the mail, and over a quarter of participants (28%) learned about the program when a program representative visited their businesses.

Figure 12-10. SBDI Participant Sources of Program Information



SBDI program participants generally prefer to receive information about energy efficiency opportunities through the mail, either as a separate mailing (36%) or with their utility bill (17%). Other good ways of reaching customers are email (21%) and in-person visits (14%).

Analysis of Data Tracking Practices as Pertaining to Evaluation Needs

LIPA's Commercial Efficiency program fully utilizes the Siebel database for project data entry and tracking purposes. Siebel is an Oracle-based relational database with a wide array of data storage and data manipulation capabilities. Throughout 2011, LIPA Commercial Efficiency program staff worked with the Siebel team to configure Siebel to support program tracking and reporting needs. The work on fine-tuning continues to this day, including the ability to extract data, the ability to enter additional data, and expanded access to Siebel by program implementers (primarily TRC, APT, and Lime Energy).

Protocols and procedures related to data entry and data management are outlined across a variety of documents. For example, a document called "*Siebel Opportunity Requirements Regarding Attachments and Required Fields"* instructs which Siebel fields to populate and how to name attachments before uploading them into Siebel. Additionally, program staff has developed a set of Siebel automation procedures that not only help eliminate errors associated with data entry, but also automate some of the activities in Siebel (e.g., project status/stage update, automated approval notification process, etc.).

To support Evaluation, Measurement, and Verification (EM&V) activities, a list of critical data fields needs to be present and accessible to the evaluation team.[44] The table below shows whether critical data is currently present in Siebel and the source/format of the data. Note that there is currently no data dictionary with a comprehensive list of Siebel data fields and their definitions. Therefore, we based the information in the table below on the data that we were able to obtain and review.

Table 12-4. Critical Data Presence and Format

	Prescriptive	Existing Retrofit	Custom	SBDI
Participant Account Number	S	S	S	S
Rate Plan	CAS	CAS	CAS	CAS
Participant Company Name	CAS	CAS	CAS	CAS
Participant Address (Street, City, Zip Code and State)	CAS	CAS	CAS	CAS
Participant Contact Name (First and Last)	S	S	S	S
Participant Phone Number	S	S	S	S
Lead Partner Company Name	S	S	S	S
Lead Partner Contact Name	N	N	N	N
Lead Partner Phone Number	CAS	CAS	CAS	CAS
Measure Description (e.g., Technology Type, Product Type, etc.)	S	S	S	S
Measure quantity	S	S	S	S
Measure Attributes (e.g., wattage, horsepower, EER, SEER, etc.)	S	A	A	A
kWh Savings	S	S	S	S
kW Savings	S	S	S	S
Incentive Amount	S	S	S	S
Project Completion Date	S	S	S	S
Legend: **S** – data is present as a variable in Siebel and is hand-entered **CAS** – data is present as a variable in Siebel but is imported from CAS system **A** – data is present in attachments **N** – data is not present				

As seen in the table above, Siebel currently stores most of the critical data fields, either in the form of an attachment or an extractable data field. In the course of our evaluation, however, we identified the following challenges related to the data:

- **CAS and Project Reported Data Inconsistency.** To the best of our knowledge, participant company name and participant company address data fields are imported from the Customer Account System (CAS) and are not entered in Siebel from the paper application form. The content of the CAS-imported data fields is such that it requires significant cleaning of the data to be used for survey purposes, which makes the sampling process

[44] We define critical data fields as data fields that identify participants and allow for verification of energy savings. Since a great deal of evaluation research consists of contractor/trade ally research, contractor information is also included as part of the critical data field set.

time-consuming. Furthermore, when reviewing the data, we came across instances where CAS-imported company name and address did not match participant company name.

- **Presence of Data.** Program protocols stipulate that *"…For any project where a Lead Partner is identified, the Lead Partner field(s) must be completed. For all projects, Contact fields must be completed with customer contact information. Vendor (Partner) information may be entered here as well (in addition to the Lead Partner field). Customer contact information must be entered…"* When developing the sample for our participant survey, we encountered multiple cases where participant and lead partner contact information was either not entered or not valid.[45] The presence of missing or invalid data can be explained by protocols still under development and program tracking data being in transition from the CEP database into Siebel in 2011. However, this data is critical to our ability to perform evaluation research among participants and trade allies and should be recorded in 100% of cases.

- **Data Extraction Capabilities.** There is currently no reporting system in place to facilitate data extraction for evaluation purposes. It should be noted, however, that LIPA is working on addressing this issue, and we anticipate having an evaluation dashboard and data queries developed at some point in 2012. As part of the 2011 evaluation, we obtained multiple files containing partial data that we then had to spend a considerable amount of time manipulating and supplementing to support evaluation tasks. Absence of the data dictionary further hindered this process.

- **Data Access Capabilities.** Currently, some of the implementation entities do not have the desired degree of access to Siebel. Therefore, they have to perform certain data entries manually, which can cause errors and delays. One of the examples is lack of access to Siebel by APT. APT is the entity that performs post-inspections for TRC. Because of limited access, requests for post-inspections have to be sent via email (as opposed to automatic Siebel notifications), and post-inspection reports have to be emailed to TRC once they are complete (as opposed to APT uploading them into Siebel).

In addition to tracking critical data, Siebel currently contains data fields that allow the recording of additional valuable information. These data fields include:

- Partner Type (examples of data entries include ESCO, Contractor, Builder, Manufacturer)
- Contact Type/Contact Role (examples of data entries include applicant, customer, owner, temporary)
- Job Title (examples of data entries include architect, CFO, chief engineer, etc.)
- Participant and Partner email address

Currently, these data fields are not consistently populated. While these data fields are not critical for the EM&V needs, having them fully populated will provide additional insight into the participant and trade ally populations and allow for enhanced research and analytical capabilities.

Commercial efficiency projects start and end in Siebel – there are currently no data imports or transfers that would warrant additional data QA/QC checks.

[45] For example, company names were entered instead of participant names. Data also contained such entries as "XXX" or "n/a."

Quality Assurance and Quality Control

Small Business Direct Install Component

Throughout the implementation process of the SBDI program component, quality assurance is performed at seven points.

(1) Review of Proposed Improvements. The first QA/QC step is performed after completion of the Energy Survey and prior to the development of a formal written project proposal that is presented to the customer. Once the Energy Survey is performed, Lime Energy program staff checks the survey results to ensure that there are no anomalies or data inconsistencies and that recommended lighting improvements qualify for the SBDI program incentives. According to program staff, there is a set of documented protocols that should be followed when developing a proposal.[46] Every project undergoes this QA/QC step.

(2) Validation of Project Documentation. The second QA/QC step occurs after the customer signs the proposal agreeing to some or all of the recommended improvements. Program staff verifies the presence of needed paperwork and customer signatures based on an internal checklist developed for this purpose.[47] Every project undergoes this QA/QC step.

(3) Closeout Visit. After the lighting equipment is installed, program staff schedules and performs a so-called "closeout" visit. This visit includes a walk-through of the customer's facility and verification of equipment installation and operation. As part of the closeout visit, the customer signs a closeout document (called Program Completion Agreement). Every project undergoes this QA/QC step. There is no documentation with guidelines on how to perform a closeout visit.

(4) Final Validation of Project Documentation (Lime). Following the closeout visit, Lime Energy staff reviews and validates project documentation for completeness and updates the Siebel database with the necessary information (including filling out Siebel data fields and uploading project documentation as attachments). "*Naming Conventions*" document outlines quality assurance protocols for this step. Every project undergoes this QA/QC step.

(5) Final Validation of Project Documentation (National Grid). In addition to the documentation review by Lime Energy, the SBDI Program Manager at National Grid performs additional validation. National Grid validation is triggered when the project is transferred into the payment processing stage in Siebel and includes verification of the presence of required project documentation, such as before and after pictures of the customer's facility, the Program Participation Agreement, the Program Completion Agreement, etc.[48] According to the program staff, a checklist of documents required for validation is under development. Every project completed in 2011 underwent this QA/QC step. It is unclear however, that this will be a required QA/QC step in 2012 and beyond. It is also important to note that this step can take place at any time after the project enters into the payment processing stage.

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[46] The evaluation team requested, but did not receive, these documents.

[47] The evaluation team requested, but did not receive, this checklist.

[48] Currently, all projects in Siebel need to have a project status (Sales Stage) associated with them. The status designation can be one of the following: 1) Lead, 2) Qualifying, 3) Installation, 4) Payment Processing, and 5) Closed Won.

(6) Post-Inspection (National Grid). For projects completed in 2011, the National Grid Program Manager also performed post-inspections of a portion of projects to verify equipment installation and operation. Documentation that guides the post-inspection process consists of post-inspection forms and guidelines developed by LIPA. LIPA anticipates that this QA/QC step will continue in 2012 and beyond; however, the percentage of projects that needs to be post-inspected is still to be determined.[49] It is also important to note that this step can take place at any time after the project enters into the payment processing stage. Most of the post-inspections for 2011 projects occurred in 2012.

(7) Invoice Validation. National Grid performs the last quality control step. This step consists of a review of invoices submitted by Lime Energy and verification of billed amounts, before the invoices are sent to LIPA. Every invoice submitted by Lime Energy undergoes this QA/QC step. No documented protocols guide this QA/QC step.

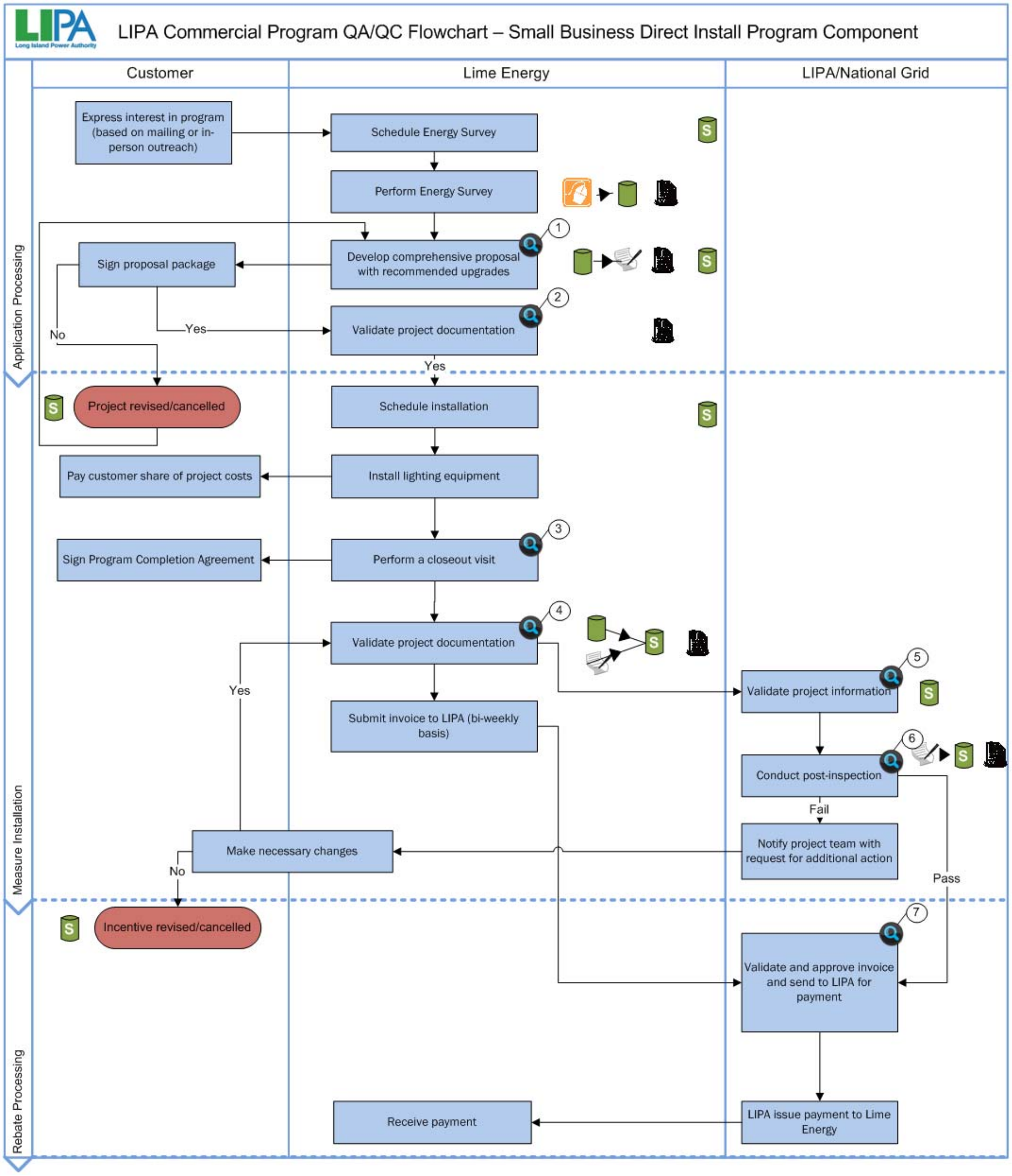
Throughout the project implementation process, in cases when required project information was not gathered (e.g., pre-installation equipment pictures), or any other modifications are needed to the "business as usual" project delivery, LIPA requires that a *"Policy Decision"* memo be filled out, approved by appropriate LIPA representatives, and uploaded in Siebel project folders.

No timelines are set for any of the SBDI program delivery steps.

The SBDI program component uses two databases – IPLAN and Siebel. IPLAN is software proprietary to Lime Energy and is used to schedule and administer energy surveys and prepare proposals for energy efficiency improvements. Siebel is LIPA's program tracking database that is designed to serve as a repository of customer leads, project documentation, and any activities associated with projects. At the initial stages of any project, core project information is entered into Siebel (e.g., account number, application ID, sales stage). All project-related data is stored in IPLAN or in paper format until the project is ready to enter the payment processing stage, at which point Lime Energy uploads all of the required project documentation into Siebel and manually enters installed product information and savings information. Prior to payment processing, Lime Energy only updates the project status in Siebel.

[49] Based on interviews with program staff, the number of 2012 post-inspections will be based on the quality of projects completed in 2011. That is, if satisfaction with post-inspection results is high, a lower percentage of projects will be post-inspected moving forward.

Figure 12-11. LIPA CEP QA/QC Flowchart – Small Business Direct Install



Custom Component among Large and Managed Accounts

Throughout the implementation process of the Custom component of the Commercial Efficiency program as pertaining to TRC – LIPA's Commercial Efficiency program Solution Provider – quality assurance is performed at 16 points.

(1) Pre-Inspection. The first quality assurance step – pre-inspection – occurs once the customer expresses interest in the program. This can be manifested either through the initial application form or through a phone call on behalf of a customer or a Major Account Executive. TRC program staff schedule and conduct pre-inspection during which they record existing building conditions and explore additional energy saving opportunities. During 2011, LIPA developed and implemented a new inspection form as well as documents called "*Pre-Inspection Procedure*" and "*Policy – Pre and Post Inspections,*" which describe desired protocols as related to pre-inspections and tighten requirements around what data need to be recorded during pre-inspection. Every project needs to undergo a pre-inspection. Completed pre-inspection forms are uploaded into Siebel as part of the project folder, and project status is updated to reflect project progress. It is our understanding that LIPA is working to further refine the set of guidelines around pre-inspections.

Based on the staff interviews, in some cases pre-inspections can be performed before project initiation. One example includes cases when a customer files a complaint about high energy costs. In other cases, an energy audit or consult can count as pre-inspection, if existing building characteristics are collected and recorded to a sufficient degree.

All pre-inspections are recorded as an activity in Siebel. The activity contains the name of the person who entered it, the result, and the time stamp.

(2) Review of Initial Project Documentation. Initial project documentation, such as initial application, statement of work, project cost estimates, etc., can arrive at different times during the project inception process. A customer can submit all needed documentation prior to pre-inspection, or such documentation can arrive once pre-inspection is complete and the project is ready to move into the energy analysis and savings estimation phase. TRC program staff has to verify presence of the needed documents before energy analysis is performed. The staff is guided by a checklist that contains required documentation at each step of the project implementation process. In 2012, this checklist also became a part of program application forms. This QA/QC step has to be performed for each custom project, but is not consistently recorded in the Siebel database.

(3) Engineering Review. The third QA/QC step takes place after the TRC engineering team has performed energy calculations based on the results of a pre-inspection and proposed equipment options and determined or confirmed vendor-calculated energy savings and incentives for a project. Senior engineers or technical pipeline managers perform this quality control step, which includes a review and approval of the "*Energy Analysis*" and "*Screening Tool*" documents. Based on our interviews with the program staff, every custom project's energy analysis and screening tool needs to be approved by a senior engineer or a pipeline manager at TRC. However, no documented protocols describe what data checks this quality assurance step includes. It is our understanding that this quality assurance step is not recorded in Siebel.

(4) Technical Review Team Review and Approval. Having undergone the TRC manager's approval, the "*Screening Tool*" document undergoes yet another approval at National Grid by the technical review team. When reviewing and approving the "*Screening Tool*," the technical review team at National Grid relies on the "*Custom/Whole Building Tech Review Check Sheet,*" which contains step-by-step instructions on how to ensure equipment eligibility and presence of necessary project documentation. Every project undergoes this quality assurance step. All energy analysis and

screening tool approvals are recorded as an activity in Siebel. The activity contains the name of the person who entered it, the result, and the time stamp.

(5) Planning Contractor Review and Approval. Project screening tool and savings calculations are also reviewed by AEG, LIPA's planning contractor. This review takes place simultaneously with the review performed by the technical review team at National Grid. Every project needs to undergo this quality assurance step. There are no written guidelines explaining what data needs to be checked and how it is checked. AEG approval is recorded as an activity in Siebel. The activity contains the name of the person who entered it, the result of the activity, and the time stamp.

(6) Program Manager Review and Approval (National Grid). Once the technical review team and AEG approve the project, the Solution Provider dedicated program manager at National Grid performs yet another check of the project documentation. The purpose of this check is to ensure presence of the required documents (screening tool, etc.), as well as to review the screening tool for any anomalies (e.g., zero kW savings). Every project undergoes this step. The program manager verifies the presence of information for expected kW and kWh savings, expected rebate amount, and maximum rebate amount data fields in Siebel. It is our understanding that there is currently no documentation that accompanies this step. Program manager approval is recorded as an activity in Siebel. The activity contains the name of the person who entered it, the result of the activity, and the time stamp.

(7) Rebate Processing Team Review and Approval. Similar to the Program Manager approval, before a pre-approval letter is generated, the rebate processing manager checks the project documentation for completeness, confirming presence of the required documents and reviewing the screening tool for any anomalies. Every project undergoes this step. It is our understanding that there is currently no documentation that accompanies this step. Rebate processing manager approval is recorded as an activity in Siebel. The activity contains the name of the person who entered it, the result of the activity, and the time stamp.

(8) Final Review of Project Documentation. The next quality assurance step takes place once the customer installs equipment and submits final project documentation, such as itemized equipment invoices and schedules. TRC program staff reviews project documentation for completeness and updates Siebel with additional information (which includes uploading project documentation as attachments in Siebel). This QA/QC step is guided by the *"CEP Checklist"* document, which contains a checklist of required documents for a project to move forward. Every project undergoes this QA/QC step.

(9) Post-Inspection. Once TRC program staff checks project documentation for completeness, it emails project documentation to APT, notifying them that the project is ready for post-inspection.[50] APT field staff schedules a visit with the facility contact, conducts a walk-through of the facility, and verifies equipment installation and proper operation. Every post-inspection should be conducted in accordance with the guidelines outlined in the "*Post Inspection – Third Party*" document and "*Policy – Pre and Post Inspections*" document. APT should fill out the "*Inspection Guide*" document for each custom project. Post-inspection is recorded as an activity in Siebel. The activity contains the name of the person who entered it (TRC staff member), the result of the activity, and the time stamp.

Currently, Siebel capabilities limit automation of the post-inspection process. TRC staff has to alert APT staff of a need for post-inspection outside of Siebel, and APT has to email post-inspection

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[50] APT (Applied Proactive Technologies) is a contractor recruited by LIPA to conduct post inspection for Commercial program projects that are implemented by TRC.

reports back to TRC (as opposed to being able to upload them in Siebel and automatically notify TRC staff of the completion of post-inspection). LIPA is currently working on automating this step.

(10) Review of Post-Inspection Reports. Completed post-inspection reports are sent back to TRC, at which point TRC program staff conducts yet another quality check of the data collected in the report to ensure that the invoices, costs, and project scope previously developed correspond with the results of the post-inspection. TRC staff is also responsible for uploading the post-inspection documentation into Siebel. This QA/QC step is performed for every project. There is no documentation to guide the program staff through this QA/QC step. Aside from updating post-inspection as "approved," this QA/QC step is not recorded in Siebel.

(11) Program Manager Review (TRC). TRC's program manager further ensures data quality through a periodic review of custom projects. Not all projects are checked for quality, and there are no written guidelines as to what information program managers check and what projects (as well as the quantity of the projects) should undergo this QA/QC step. Based on the interviews with the program staff, usually more complex, bigger projects undergo this quality assurance step. This QA/QC step is not recorded in Siebel.

(12) Program Manager Review (National Grid). Periodically, the TRC dedicated program manager at National Grid also conducts quality assurance of projects that are in the "Payment Processing" stage through a review of Siebel-generated reports. Based on our interviews with program staff, this quality assurance step involves checking that the project status and anticipated project close date are up to date, that core data inputs do not contain anomalies (e.g., zero kW savings), and that the projects are correctly assigned to the program implementer based on rate codes. Not all projects are checked for quality, and there are no written guidelines as to what information program managers check and what projects (as well as the quantity of the projects) should undergo this QA/QC step. This step is not recorded in Siebel.

(13) Rebate Processing Review and Approval. Once the final project documentation is received and uploaded in Siebel and post inspections are performed and checked for quality, the rebate processing team at National Grid reviews the application documentation for each project for presence and completeness, substantiates Siebel entries for installed equipment, and updates project status in Seibel. This step is performed for each project. The rebate processing team uses the "*CEP Checklist*" document to ensure presence of the needed documentation. Aside from this, there are no protocols to provide directions to the rebate processing team. Based on our interviews with the rebate processing staff, these documents are in the process of being developed.

Results of the rebate processing review and approval are recorded as an activity in Siebel. The activity contains the name of the person who entered it, the result of the activity, and the time stamp.

(14) Rebate Processing Program Manager Review and Approval. Depending on the final rebate amount, there might be additional QA/QC steps involved. If the project incentive amount does not exceed $10,000, the rebate processing clerk issues an Accounts Payable memo, at which point the project is considered paid and closed. If the rebate amount is $10,000 or more, the project incentive needs to undergo an approval by the rebate processing manager. Results of this quality check step and approval are recorded as an activity in Siebel. The activity contains the name of the person who entered it, the result of the activity, and the time stamp. It is our understanding that the protocols for what information to check are currently not documented.

(15) ELI Manager Review and Approval. Projects with rebates of $100,000 or more, in addition to being reviewed and approved by the rebate processing manager, need to undergo the approval of the National Grid Energy Efficiency Program Manager for payment. Results of this quality check step and approval are recorded as an activity in Siebel. The activity contains the name of the

person who entered it, the result of the activity, and the time stamp. It is our understanding that the protocols for what information to check are currently not documented.

(16) AP Reconciliation Report. The final QA/QC step consists of running an accounts payable reconciliation report, which compares project information on the rebates paid to the rebates issued by the accounts payable department. This step is performed on a monthly basis by the rebate processing program manager. All discrepancies are directed to the accounts payable department for correction.

Throughout the participation process, whenever the customer drops out from the participation process, the records are updated in Siebel. Program staff is required to indicate the reason why the customer did not continue to participate in the program.

A variety of additional documents not mentioned above that have been finalized (or are in the process of being finalized) guide the TRC and National Grid's project teams. The "*Custom Retrofit Clarification, Update & Interpretation"* document is designed to guide program staff on how to determine project eligibility for custom incentives; the "*Siebel Opportunity Requirements Regarding Attachments and Required Fields"* document is designed to ensure consistency in naming conventions when uploading attachments into Siebel.

Furthermore, if changes or deviations from the standard program processes are needed, TRC is required to formally file a request and obtain an approval through LIPA and National Grid. There is a list of documented guidelines that govern how deviations from the required protocols need to be processed and filed. Such documents include "*LIPA CEP Waiver Request – Large Businesses," "LIPA CEP Policy Decision Memo Large Business," and "LIPA CEP Policy Decision Process – Managed Accounts."* Examples of deviations from standard program protocols include waiver of pre-approval, uncertainties about equipment eligibility, etc.

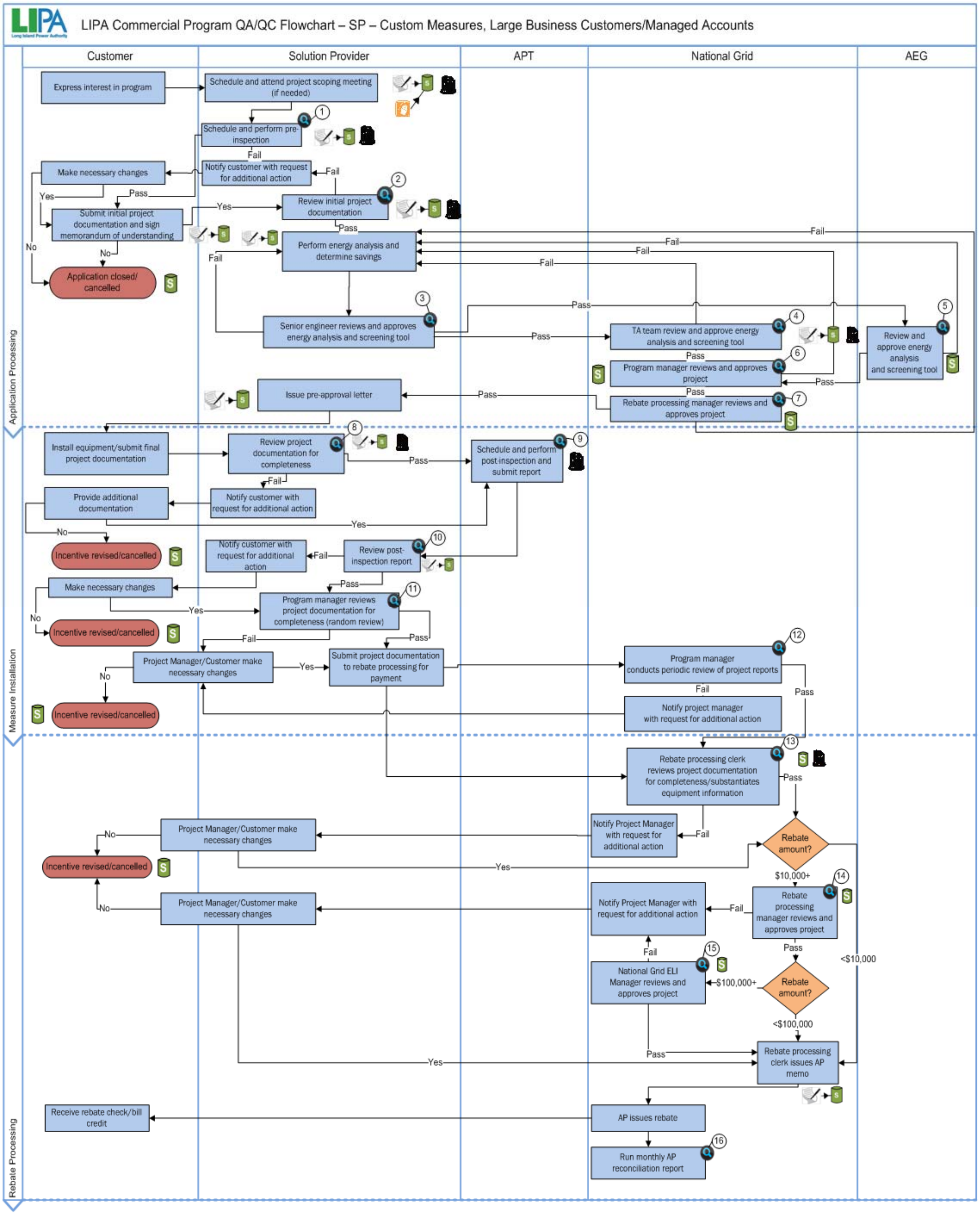
As described above, project data and documentation resides in Siebel from project inception to project completion. There are no data transfers from other program tracking databases. Project staff manually populates critical data fields in Siebel (e.g., savings information, incentive amounts, product/measure specifics, customer and lead partner contact information, etc.). LIPA and the Siebel team are working on automating some of the processes and importing some of the critical data fields into Siebel to eliminate data entry errors and further improve data quality.

Conceptually, the program participation process consists of three stages:

- Application Processing
- Measure Installation
- Rebate Processing

As discussed earlier, data quality assurance and quality control steps are performed at each of the stages. However, only a few timelines have been specified. Based on the interviews with program staff, LIPA and its Commercial program implementation contractors are currently developing reasonable timelines around various project steps.

Figure 12-12. LIPA CEP QA/QC Flowchart – SP – Custom Measures, Large Business Customers/Managed Accounts



Custom Component among Small, Medium, and Large Unmanaged Accounts

Throughout the implementation process of the Custom component of the Commercial Efficiency program as pertaining to National Grid, quality assurance is performed at 12 points.

(1) Pre-Inspection. The first quality assurance step – pre-inspection – occurs once the customer expresses interest in the program. This can be manifested either through the initial application form or through a phone call on behalf of a customer or a Major Account Executive. National Grid project managers or senior territory managers schedule and conduct pre-inspection during which they record existing building conditions and explore additional energy saving opportunities. During 2011, LIPA developed and implemented a new inspection form as well as documents called *"Pre-Inspection Procedure"* and *"Policy – Pre and Post Inspections,"* which describe desired protocols as related to pre-inspections and tighten requirements around what data need to be recorded during pre-inspection. Every custom project needs to undergo a pre-inspection. Completed pre-inspection forms are uploaded into Siebel as part of the project folder, and project activity status is updated to reflect project progress. The pre-inspection activity update contains the name of the person who entered it, the outcome, and the time stamp.

Based on the staff interviews, in some cases pre-inspections can be performed before project initiation. One example includes cases when a customer files a complaint about high energy costs. In other cases, an energy audit or consult can count as pre-inspection, if existing building characteristics are collected and recorded to a sufficient degree.

(2) Review of Initial Project Documentation. Initial project documentation, such as initial application, statement of work, project cost estimates, etc., can arrive at different times during the project inception process. A customer can submit all needed documentation prior to pre-inspection, or such documentation can arrive once pre-inspection is complete and the project is ready to move into the energy analysis and savings estimation phase. Project managers at National Grid have to verify presence of the needed documents before energy analysis is performed. They are guided by a checklist that contains required documentation at each step of the project implementation process. In 2012, this checklist also became a part of program application forms. This QA/QC step has to be performed for each custom project, but is not consistently recorded in the Siebel database.

(3) Technical Review Team Review and Approval. The technical review team generally performs energy analysis for projects under the purview of National Grid. In those cases, energy analysis and the screening tool do not undergo any additional QA/QC checks at this stage in the implementation process. Project managers, however, often perform lighting project energy analyses. The technical review team checks those analyses for quality. The technical review team relies on the *"Custom/Whole Building Tech Review Check Sheet,"* which contains step-by-step instructions on how to ensure equipment eligibility and presence of necessary project documentation. Every project where energy analysis and the screening tool are prepared by project managers has to undergo the approval of the technical review team. When this QA/QC step takes place, it is recorded by a technical review team representative as an activity in Siebel with outcome and date stamp.

(4) Program Manager Review and Approval. Once the technical review team approves the project, the program manager at National Grid dedicated to small and medium customers performs yet another check of the project documentation to ensure the required documents (screening tool, etc.) are present, and also reviews the screening tool for any anomalies (e.g., zero kW savings). The program manager verifies the presence of information for expected kW and kWh savings, as well as expected rebate amount and maximum rebate amount data fields in Siebel. Every project has to undergo this step. Program manager approval is recorded as an activity in Siebel. The

activity contains the name of the person who entered it, the result of the activity, and the time stamp.

(5) Rebate Processing Team Review and Approval. Similar to the program manager's approval, before a pre-approval letter is generated, the rebate processing manager checks the project documentation for completeness, confirming presence of the required documents and reviewing the screening tool for any anomalies. Every project has to undergo this step. Rebate processing manager approval is recorded as an activity in Siebel. The activity contains the name of the person who entered it, the result of the activity, and the time stamp.

(6) Final Review of Project Documentation. The next quality assurance step takes place once the customer installs equipment and submits final project documentation, such as itemized equipment invoices and schedules. Project managers review project documentation for completeness and update Siebel with additional information (which includes uploading project documentation as attachments in Siebel). This QA/QC step is guided by the "*CEP Checklist"* document, which contains a checklist of required documents for a project to move forward. Every project undergoes this QA/QC step. The results of this step are not consistently recorded in Siebel.[51]

(7) Post-Inspection. Once National Grid's project managers check project documentation for completeness, they schedule post-inspection of the facility where the equipment was installed. Either National Grid project managers or senior territory managers perform post-inspection, which includes verification of equipment installation and proper operation. Every post-inspection should be conducted in accordance with the guidelines outlined in the "*Post Inspection – Third Party"* document and "*Policy – Pre and Post Inspections"* document. The "*Inspection Guide"* document should be filled out for each project that undergoes post-inspection. Every project has to undergo post-inspections. Post-inspections are recorded as an activity in Siebel and contain the name of the person who entered it, the result of the activity, and the time stamp. Post-inspection forms should be uploaded into Siebel as attachments.

(8) Program Manager Review. Data quality is further ensured through a periodic (daily) review of Prescriptive and Existing Retrofit project reports by the program manager at National Grid dedicated to small and medium customers. Based on our interviews with the program staff, this quality assurance step involves checking that the project status and anticipated project close date are up to date, that core data inputs do not contain anomalies (e.g., zero kW savings), and that the projects are correctly assigned to the program implementer based on rate codes. Not all projects are checked for quality, and there are no written guidelines as to what information program managers check and what projects (as well as the quantity of the projects) should undergo this QA/QC step. This step is not reflected in Siebel.

(9) Rebate Processing Review and Approval. Once project managers verify the presence of required documentation and the project passes post-inspection, the project is sent to the rebate processing team for payment. For every project, the rebate processing team at National Grid reviews the application documentation for presence and completeness, substantiates Siebel entries for installed equipment, and updates project status in Seibel. This constitutes the next quality assurance step. The rebate processing team uses the "*CEP Checklist"* document to ensure presence of the needed documentation. Aside from this, there are no protocols to provide directions on what data to check. Based on our interviews with the rebate processing staff, these documents are in the process of being developed.

[51] Based on the interviews with program staff, project managers are encouraged to record this QA/QC step as an activity in Siebel.

Results of the rebate processing review and approval are recorded as an activity in Siebel. The activity contains the name of the person who entered it, the result of the activity, and the time stamp.

(10) Rebate Processing Program Manager Review and Approval. Depending on the final rebate amount, there might be additional QA/QC steps involved. If the project incentive amount does not exceed $10,000, the rebate processing clerk issues an Accounts Payable memo, at which point the project is considered paid and closed. If the rebate amount is $10,000 or more, the project incentive needs to undergo an approval by the rebate processing manager. Results of this quality check step and approval are recorded as an activity in Siebel. The activity contains the name of the person who entered it, the result of the activity, and the time stamp. It is our understanding that the protocols for what information to check are currently not documented.

(11) ELI Manager Review and Approval. Projects with rebates of $100,000 or more, in addition to being reviewed and approved by the rebate processing manager, need to undergo the approval of the National Grid Energy Efficiency Program Manager for payment. Results of this quality check step and approval are recorded as an activity in Siebel. The activity contains the name of the person who entered it, the result of the activity, and the time stamp. It is our understanding that the protocols for what information to check are currently not documented.

(12) AP Reconciliation Report. The final QA/QC step consists of running an accounts payable reconciliation report, which compares project information on the rebates paid to the rebates issued by the accounts payable department. This step is performed on a monthly basis by the rebate processing program manager. All discrepancies are directed to the accounts payable department for correction.

Throughout the participation process, whenever the customer drops out from the participation process, the records are updated in Siebel. Program staff is required to indicate the reason why the customer did not continue to participate in the program.

A variety of additional documents not mentioned above that have been finalized (or are in the process of being finalized) guide the National Grid's project team. One of them is *"Siebel Opportunity Requirements Regarding Attachments and Required Fields,"* which is designed to ensure consistency in naming conventions when uploading attachments into Siebel.

Furthermore, if changes or deviations from the standard program processes are needed, National Grid is required to formally file a request and get an approval through LIPA. There is a list of documented guidelines that govern how deviations from the required protocols need to be processed and filed. Such documents include *"LIPA CEP Policy Decision Memo – Small Business," "LIPA CEP Waiver Request – Small Business," "LIPA CEP Waiver Request – Small and Medium Business - Process,"* and *"LIPA Policy Decision Process – Small Business."* Examples of deviations from standard program protocols include waiver of pre-approval, uncertainties about equipment eligibility, etc.

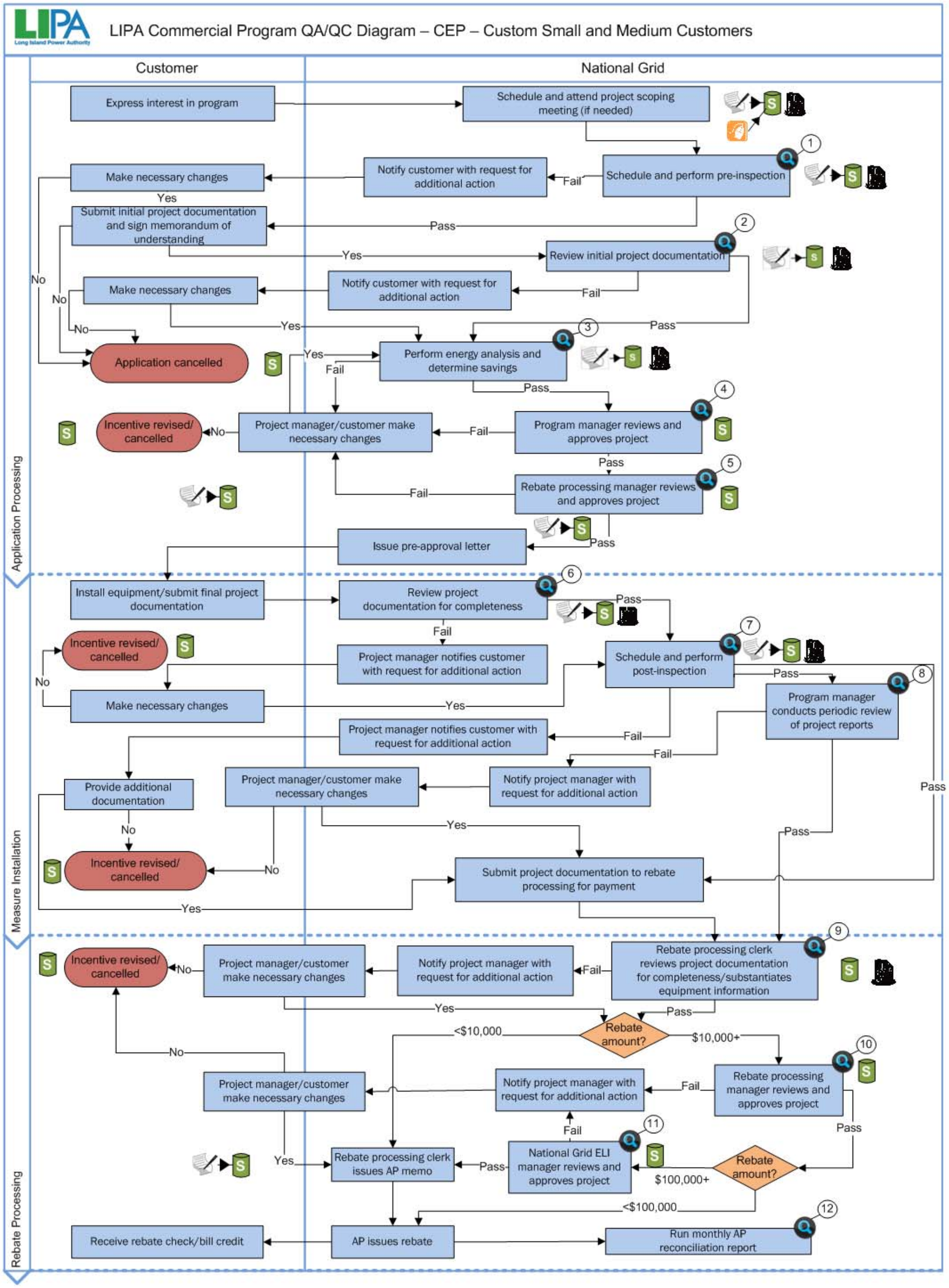
As described above, project data and documentation resides in Siebel from project inception to project completion. There are no data transfers from or to other program tracking databases. Project staff manually populates critical data fields in Siebel (e.g., savings information, incentive amounts, product/measure specifics, customer and lead partner contact information, etc.). LIPA and the Siebel team are working on automating some of the processes and importing some of the critical data fields into Siebel to eliminate data entry errors and further improve data quality.

Conceptually, the program participation process consists of three stages:

- Application Processing
- Measure Installation
- Rebate Processing

As discussed earlier, data quality assurance and quality control steps are performed at each of the stages. However, timelines associated with each of the stages in the participation process are limited. Based on the interviews with program staff, LIPA and its Commercial program implementation contractors are currently developing reasonable timelines around various project steps.

Figure 12-13. LIPA CEP QA/QC Flowchart – CEP – Custom Small and Medium Customers



Prescriptive and Existing Retrofit Component among Large and Managed Accounts

Throughout the implementation process of the Prescriptive and Existing Retrofit component of the Commercial Efficiency program as pertaining to Solution Provider, quality assurance is performed at 11 points.

(1) Application Review. The first quality assurance step occurs when a customer submits initial project documentation. This includes the completed customer information section of the application form and appropriate equipment worksheets. TRC staff reviews project documentation for completeness, starts a new opportunity in Siebel, uploads received project documentation into Siebel and populates proposed product data fields and customer information data fields in Siebel. Every Prescriptive project needs to undergo this step. A checklist that contains required documentation at each step of the project implementation process guides TRC program staff. In 2012, this checklist also became a part of program application forms.

(2) Pre-Inspection. Pre-inspections follow the review of initial program documentation and constitute the second QA/QC step. Only existing retrofit projects and major gut rehabilitation projects are subject to pre-inspections. Pre-inspections are not required for new construction projects. The pre-inspection process includes a walk-through of a customer's facility during which existing building conditions are recorded and additional energy saving opportunities are explored. TRC program staff performs pre-inspections. During 2011, LIPA developed and implemented a new inspection form as well as documents called "*Pre-Inspection Procedure*" and "*Policy – Pre and Post Inspections,*" which describe desired protocols as related to pre-inspections and tighten requirements around what data need to be recorded during pre-inspection. Every existing retrofit or gut rehabilitation project needs to undergo a pre-inspection. Completed pre-inspection forms are uploaded into Siebel as part of the project folder, and project activity status is updated to reflect pre-inspection outcome. Pre-inspection activity update contains the name of the person who entered it, the result, and the time stamp.

Based on the staff interviews, in some cases pre-inspections can be performed before project initiation. One example includes cases when a customer files a complaint about high energy costs. In other cases, an energy audit or consult can count as pre-inspection, if existing building characteristics are collected and recorded to a sufficient degree.

(3) Final Review of Project Documentation. The next quality assurance step takes place once the customer installs equipment and submits final project documentation, such as itemized equipment invoices and schedules. TRC program staff reviews project documentation for completeness and updates Siebel with additional information (which includes uploading project documentation as attachments in Siebel). This QA/QC step is guided by the "*CEP Checklist*" document, which contains a checklist of required documents for a project to move forward. Every project undergoes this QA/QC step.

(4) Post-Inspection. Once TRC program staff checks project documentation for completeness, they email project documentation to APT and notify them that the project is ready for post-inspection.[52] APT field staff schedules a visit with the facility contact, conducts a walk-through of the facility, and verifies equipment installation and proper operation. Every post-inspection should be conducted in accordance with the guidelines outlined in the "*Post Inspection – Third Party*" document and "*Policy – Pre and Post Inspections*" document. APT should fill out the "*Inspection Guide*" document for each Prescriptive or Existing Retrofit project. Every project has to undergo post-inspections.

[52] APT (Applied Proactive Technologies) is a contractor recruited by LIPA to conduct post-inspection for Commercial program projects that are implemented by TRC.

Post-inspections are recorded as an activity in Siebel. The activity contains the name of the person who entered it (TRC staff member), the result of the activity, and the time stamp.

Currently, Siebel capabilities limit automation of the post-inspection process. TRC staff has to alert APT staff of the need for post-inspection outside of Siebel, and APT has to email post-inspection reports back to TRC (as opposed to being able to upload them in Siebel and automatically notify TRC staff of the completion of post-inspection). LIPA is currently working on automating this step.

(5) Review of Post-Inspection Reports. Completed post-inspection reports are sent back to TRC, at which point TRC program staff conducts yet another quality check of the data collected in the report to ensure that the invoices, costs, and project scope previously developed correspond with the results of the post-inspection. TRC staff is also responsible for uploading the post-inspection documentation into Siebel. This QA/QC step is performed for every project. There is no documentation to guide the program staff through this QA/QC step. Aside from updating post-inspection as “approved,” this QA/QC step is not consistently recorded in Siebel.

(6) Program Manager Review (TRC). TRC’s program manager further ensures data quality through a periodic review of Prescriptive and Existing Retrofit projects. Not all projects are checked for quality, and there are no written guidelines as to what information is checked by program managers and what projects (as well as the quantity of the projects) should undergo this QA/QC step. Based on the interviews with the program staff, usually more complex, bigger projects undergo this quality assurance step. This QA/QC step is not recorded in Siebel.

(7) Program Manager Review (National Grid). Periodically, the TRC dedicated program manager at National Grid also conducts quality assurance of projects that are in “Payment Processing” stage through a review of Siebel-generated reports. Based on our interviews with program staff, this quality assurance step involves checking that the project status and anticipated project close date are up to date, that core data inputs do not contain anomalies (e.g., zero kW savings), and that the projects are correctly assigned to the program implementer based on rate codes. Not all projects are checked for quality, and there are no written guidelines as to what information program managers check and what projects (as well as the quantity of the projects) should undergo this QA/QC step. This step is not recorded in Siebel.

(8) Rebate Processing Review and Approval. Once the final project documentation is received and uploaded in Siebel and post-inspections are performed and checked for quality, for every project, the rebate processing team at National Grid reviews the application documentation for presence and completeness, substantiates Siebel entries for installed equipment, and updates project status in Seibel. This constitutes the next quality assurance step. The rebate processing team uses the *“CEP Checklist”* document to ensure presence of the needed documentation. Aside from this, there are no protocols to provide directions to the rebate processing team. Based on our interviews with the rebate processing staff, these documents are in the process of being developed.

Results of the rebate processing review and approval are recorded as an activity in Siebel. The activity contains the name of the person who entered it, the result of the activity, and the time stamp.

(9) Rebate Processing Program Manager Review and Approval. Depending on the final rebate amount, there might be additional QA/QC steps involved. If the project incentive amount does not exceed $10,000, the rebate processing clerk issues an Accounts Payable memo, at which point the project is considered paid and closed. If the rebate amount is $10,000 or more, the project incentive needs to undergo an approval by the rebate processing manager. Results of this quality check step and approval are recorded as an activity in Siebel. The activity contains the name of the person who entered it, the result of the activity and the time stamp. It is our understanding that the protocols for what information to check are currently not documented.

(10) ELI Manager Review and Approval. Projects with rebates of $100,000 or more, in addition to being reviewed and approved by the rebate processing manager, need to undergo the approval of the National Grid Energy Efficiency Program Manager for payment. Results of this quality check step and approval are recorded as an activity in Siebel. The activity contains the name of the person who entered it, the result of the activity, and the time stamp. It is our understanding that the protocols for what information to check are currently not documented.

(11) AP Reconciliation Report. The final QA/QC step consists of running an accounts payable reconciliation report, which compares project information on the rebates paid to the rebates issued by the accounts payable department. This step is performed on a monthly basis by the rebate processing program manager. All discrepancies are directed to the accounts payable department for correction.

Throughout the participation process, whenever a customer drops out from the participation process, the records are updated in Siebel. Program staff is required to indicate the reason why the customer did not continue to participate in the program.

A variety of additional documents not mentioned above that have been finalized (or are in the process of being finalized) guide the TRC and National Grid's project teams. The *"Siebel Opportunity Requirements Regarding Attachments and Required Fields"* document is designed to ensure consistency in naming conventions when uploading attachments into Siebel.

Furthermore, if changes or deviations from the standard program processes are needed, TRC is required to formally file a request and obtain an approval through LIPA and National Grid. There is a list of documented guidelines that govern how deviations from the required protocols need to be processed and filed. Such documents include *"LIPA CEP Waiver Request – Large Businesses," "LIPA CEP Policy Decision Memo Large Business," and "LIPA CEP Policy Decision Process – Managed Accounts."* Examples of deviations from standard program protocols include waiver of pre-approval, uncertainties about equipment eligibility, etc.

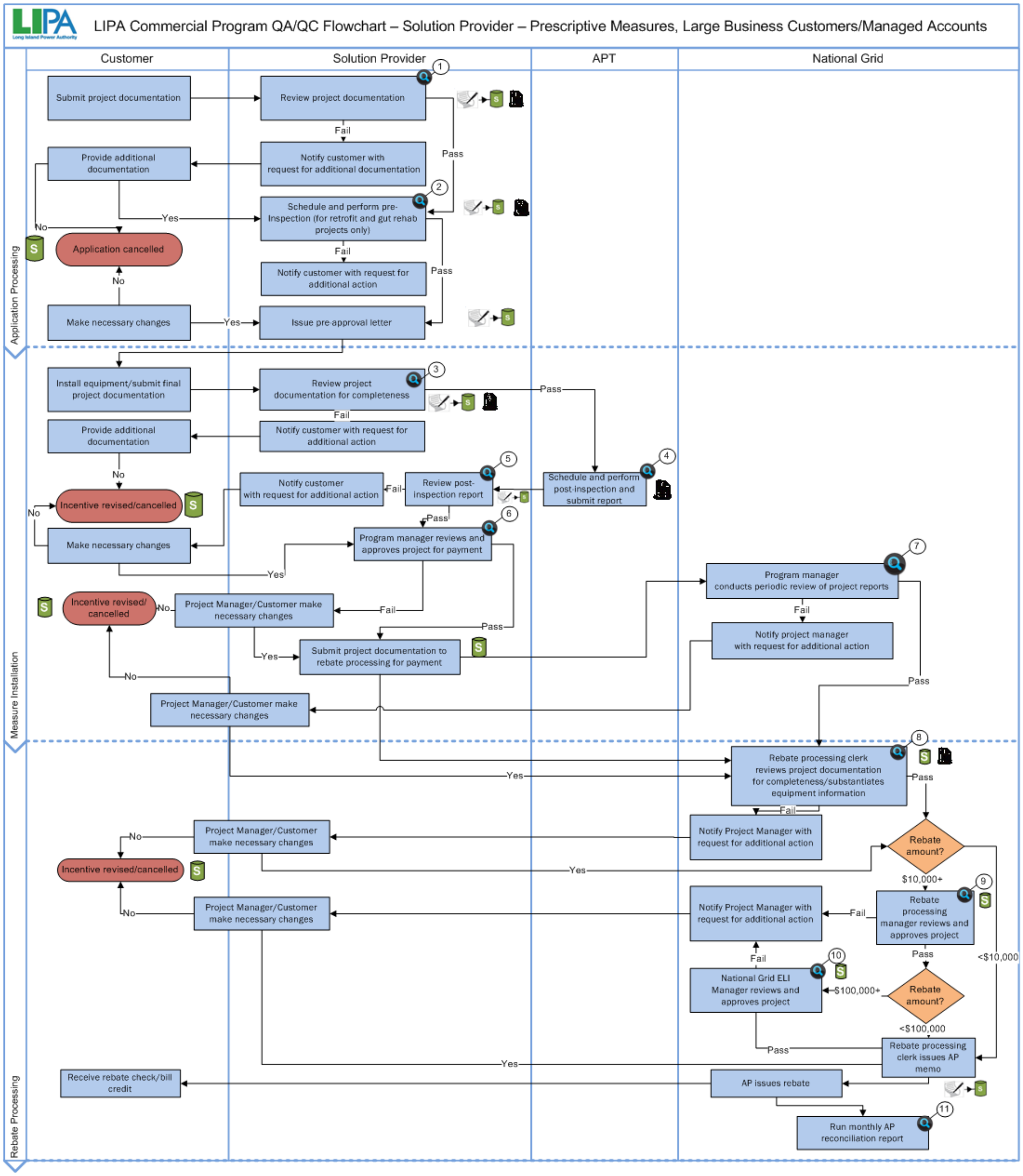
As described above, project data and documentation resides in Siebel from project inception to project completion. There are no data transfers from other program tracking databases. Project staff manually populates critical data fields in Siebel (e.g., savings information, incentive amounts, product/measure specifics, customer and lead partner contact information, etc.). LIPA and the Siebel team are working on automating some of the processes and importing some of the critical data fields into Siebel to eliminate data entry errors and further improve data quality. LIPA and the Siebel team are currently in the process of developing and finalizing a range of "Automation" documents that outline step-by-step project flow and Siebel automation procedures.

Conceptually, program participation process consists of three stages:

- Application Processing
- Measure Installation
- Rebate Processing

As described above, data quality assurance and quality control steps are present at each of the stages. However, timelines associated with each of the stages in the participation process are limited. Based on the interviews with program staff, LIPA and its Commercial program implementation contractors are currently working on developing reasonable timelines around various project steps.

Figure 12-14. LIPA CEP QA/QC Flowchart – SP – Prescriptive Measures, Large Business Customers/Managed Accounts



OPINION DYNAMICS CORPORATION

Prescriptive and Existing Retrofit Component among Small, Medium and Large Unmanaged Accounts

Throughout the implementation process of the Prescriptive and Existing Retrofit component of the Commercial Efficiency program as pertaining to National Grid, quality assurance is performed at ten points.

(1) Application Review. The first quality assurance step occurs when a customer submits initial project documentation. This includes the completed customer information section of the application form and appropriate equipment worksheets. National Grid project managers review project documentation for completeness, start a new opportunity in Siebel, populate proposed products and customer information data fields, and upload available documentation. Every Prescriptive/Existing Retrofit project needs to undergo this step. A checklist that contains required documentation at each step of the project implementation process guides National Grid project managers. In 2012, this checklist also became a part of program application forms.

(2) Pre-Inspection. Pre-inspections follow the review of initial program documentation and constitute the second QA/QC step in the project implementation process. Only existing retrofit projects and major gut rehabilitation projects are subject to pre-inspections – pre-inspections are not required for Prescriptive measures installed as part of new construction projects. The pre-inspection process includes a walk-through of a customer's facility during which existing building conditions are recorded and additional energy saving opportunities are explored. National Grid project managers or senior territory managers usually perform pre-inspections. During 2011, LIPA developed and implemented a new inspection form as well as documents called "*Pre-Inspection Procedure*" and "*Policy – Pre and Post Inspections,*" which describe desired protocols as related to pre-inspections and tighten requirements around what data need to be collected and recorded during pre-inspections. Every existing retrofit or gut rehabilitation project needs to undergo a pre-inspection. Completed pre-inspection forms are uploaded into Siebel as part of the project folder, and project activity status is updated to reflect pre-inspection outcome. Pre-inspection activity update contains the name of the person who entered it, the result, and the time stamp.

Based on the staff interviews, in some cases pre-inspections can be performed before project initiation. One example includes cases when a customer files a complaint about high energy costs. In other cases, an energy audit or consult can count as pre-inspection, if existing building characteristics are collected and recorded to a sufficient degree.

(3) Final Review of Project Documentation. The next quality assurance step takes place once the customer installs equipment and submits final project documentation, such as itemized equipment invoices and schedules. National Grid project managers review project documentation for completeness and update Siebel with additional information (which includes uploading project documentation as attachments in Siebel). This QA/QC step is guided by the "*CEP Checklist*" document, which contains a checklist of required documents for a project to move forward. Every project undergoes this QA/QC step. The results of this step are not consistently recorded in Siebel.[53]

(4) Post-Inspection. Once National Grid project managers check project documentation for completeness, they schedule post-inspection of the facility where the equipment was installed. Post-inspection includes verification of equipment installation and proper operation and is performed by either National Grid project managers or senior territory managers. Every post-inspection should be conducted in accordance with the guidelines outlined in the "*Post Inspection*

[53] Based on the interviews with program staff, project managers are encouraged to records this QA/QC step as an activity in Siebel.

– Third Party" document and *"Policy – Pre and Post Inspections"* document. The *"Inspection Guide"* document should be filled out for each project that undergoes post-inspection. Every project has to undergo post-inspections. Post-inspections are recorded as an activity in Siebel and contain the name of the person who entered it, the result of the activity, and the time stamp. Post-inspection forms should be uploaded into Siebel as attachments.

(5) Review of Post-Inspection Reports. Upon completing post-inspections, project managers review post-inspection reports to verify that the invoices, costs, and project scope previously developed correspond with the results of the post-inspection reports. This represents yet another QA/QC step. Post-inspections are recorded as an activity in Siebel and contain the name of the person who entered it, the outcome of the activity, and the time stamp. Post inspection forms should be uploaded into Siebel as attachments.

(6) Program Manager Review. The program manager at National Grid dedicated to small and medium customers further ensures data quality through a periodic (daily) review of Prescriptive and Existing Retrofit project reports. Based on our interviews with the program staff, this quality assurance step involves checking that the project status and anticipated project close date are up to date, that core data inputs do not contain anomalies (e.g., zero kW savings), and that the projects are correctly assigned to the program implementer based on rate codes. Not all projects are checked for quality, and there are no written guidelines as to what information program managers check and what projects (as well as the quantity of the projects) should undergo this QA/QC step. This step is not reflected in Siebel.

(7) Rebate Processing Review and Approval. Once the presence of required documentation is verified and the project passes post-inspection, the project is sent to the rebate processing team for payment processing. This constitutes the next quality assurance step. For every project, the rebate processing team at National Grid reviews the application documentation for presence and completeness, substantiates Siebel entries for installed equipment, and updates project status in Seibel. The rebate processing team uses the *"CEP Checklist"* document to ensure presence of the needed documentation. Aside from this, there are no other documented protocols to provide directions on what data to check. Based on our interviews with the rebate processing staff, these documents are in the process of being developed.

Results of the rebate processing review and approval are recorded as an activity in Siebel. The activity contains the name of the person who entered it, the result of the activity, and the time stamp.

(8) Rebate Processing Program Manager Review and Approval. Depending on the final rebate amount, there might be additional QA/QC steps involved. If the project incentive amount does not exceed $10,000, the rebate processing clerk issues an Accounts Payable memo, at which point the project is considered paid and closed. If the rebate amount is $10,000 or more, the project incentive needs to undergo an approval by the rebate processing manager. Results of this quality check step and approval are recorded as an activity in Siebel. The activity contains the name of the person who entered it, the result of the activity, and the time stamp. It is our understanding that the protocols for what information to check are currently not documented.

(9) ELI Manager Review and Approval. Projects with rebates of $100,000 or more, in addition to being reviewed and approved by the rebate processing manager, need to undergo the approval of the National Grid Energy Efficiency Program Manager for payment. Results of this quality check step and approval are recorded as an activity in Siebel. The activity contains the name of the person who entered it, the result of the activity, and the time stamp. It is our understanding that the protocols for what information to check are currently not documented.

(10) AP Reconciliation Report. The final QA/QC step consists of running an accounts payable reconciliation report, which compares project information on the rebates paid to the rebates issued by the accounts payable department. This step is performed on a monthly basis by the rebate processing program manager. All discrepancies are directed to the accounts payable department for correction.

Throughout the participation process, whenever a customer drops out from the participation process, project records are updated in Siebel. Program staff is required to indicate the reason why the customer did not continue to participate in the program.

A variety of additional documents not mentioned above that have been finalized (or are in the process of being finalized) guide the National Grid's project team through the implementation process. One of them is "*Siebel Opportunity Requirements Regarding Attachments and Required Fields,"* which is designed to ensure consistency in naming conventions when uploading attachments into Siebel.

Furthermore, if changes or deviations from the standard program processes are needed, National Grid is required to formally file a request and obtain an approval through LIPA. There is a list of documented guidelines that govern how deviations from the required protocols need to be processed and filed. Such documents include *"LIPA CEP Policy Decision Memo – Small Business," "LIPA CEP Waiver Request – Small Business," "LIPA CEP Waiver Request – Small and Medium Business – Process,"* and *"LIPA Policy Decision Process – Small Business."* Examples of deviations from standard program protocols include waiver of pre-approval, uncertainties about equipment eligibility, etc.

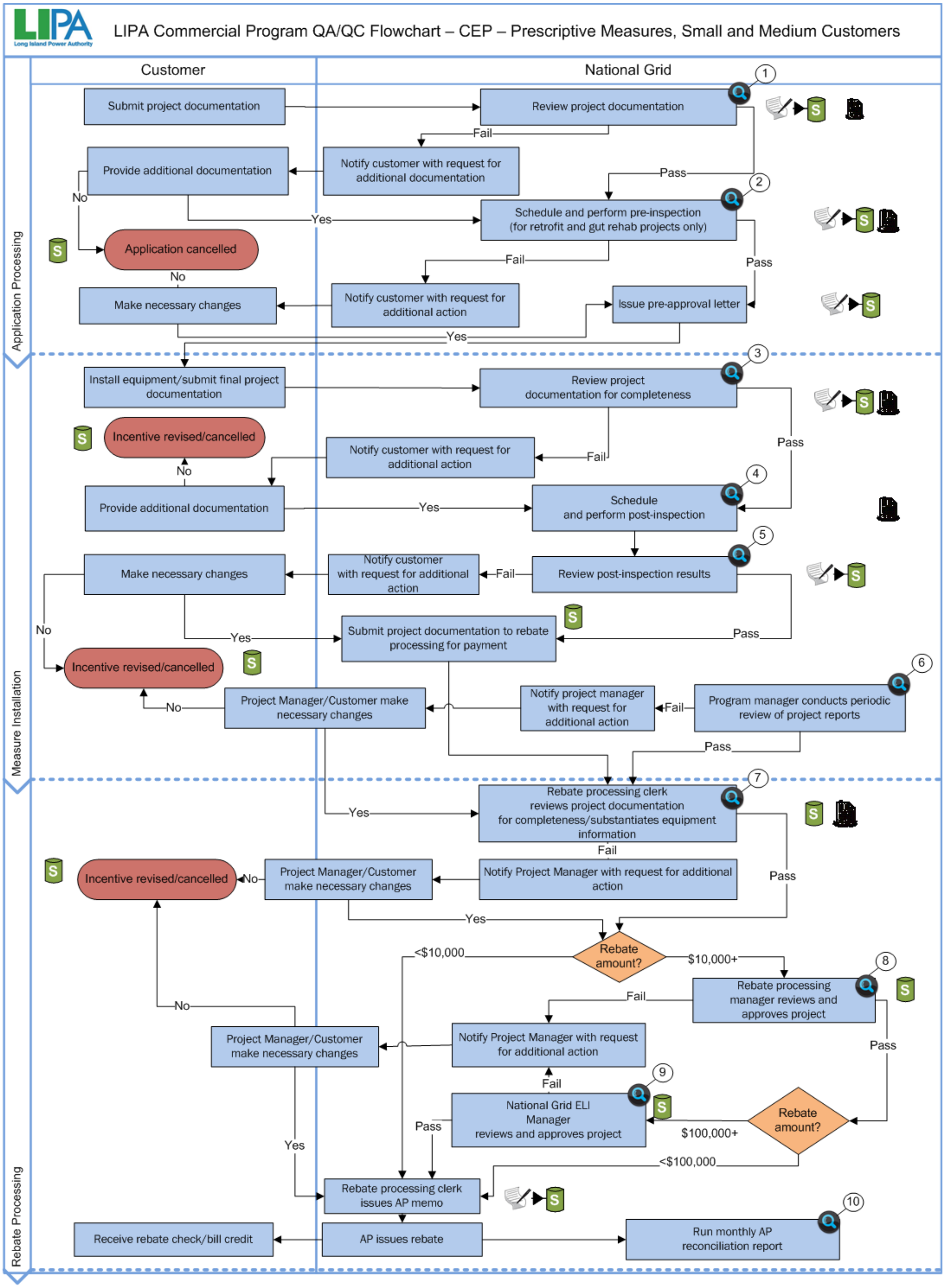
As described above, project data and documentation resides in Siebel from project inception to project completion. There are no data transfers from or to other program tracking databases. Project staff manually populates critical data fields in Siebel (e.g., savings information, incentive amounts, product/measure specifics, customer and lead partner contact information, etc.). LIPA and the Siebel team are working on automating some of the processes and importing some of the critical data fields into Siebel to eliminate data entry errors and further improve data quality.

Conceptually, program participation process consists of three stages:

- Application Processing
- Measure Installation
- Rebate Processing

As discussed earlier, data quality assurance and quality control steps are present at each of the stages. However, timelines associated with each of the stages in the participation process are limited. Based on the interviews with program staff, LIPA and its Commercial program implementation contractors are currently developing reasonable timelines around various project steps.

Figure 12-15. LIPA CEP QA/QC Flowchart – CEP – Prescriptive Measures, Small and Medium Customers



Conclusions and Recommendations

Below, we present the core findings resulting from the process evaluation research. Following the findings, we provide recommendations for further program improvement. It should be noted that LIPA is aware of the findings described below and is working toward addressing them.

Summary of Findings

- In 2011, the Commercial Efficiency program made great strides in increasing its marketing and outreach and engaging various customer segments. We believe that marketing and outreach tactics were appropriate for a commercial program and useful in engaging customers. Marketing opportunities available through the SBDI program have not been fully utilized yet and represent a potential for the program in 2012.
- The Commercial Efficiency program made valuable enhancements to the program implementation processes. Those include streamlining program delivery by giving project managers a greater ownership of and responsibility for the projects, streamlining some of the implementation processes, and documenting and effectively sharing implementation guidelines and procedures. Efforts to improve and further streamline program implementation processes continue to this day.
- Customer and trade ally satisfaction with the program and its various components is generally high, although a few bottlenecks were identified through participant and trade ally research (coordination between the implementation entities, disruptions in communication, lengthy participation processes, incentive/bonus processing)
- All of LIPA's Commercial program components generally contain sufficient QA/QC processes to ensure high quality of the program tracking data. Some of the steps, however, might be redundant and cause unnecessary implementation delays or result in additional implementation costs. This is primarily the case with program requirements for pre-inspections, pre-approvals, and post-inspections of all projects.
- Commercial program staff has made great strides in documenting many core program protocols and procedures, but many documents are still being drafted and approved.
- Siebel program tracking database underwent a great deal of change and – in its current form – is largely able to support data entry and management requirements from the implementation perspective. Data tracking and sharing mechanisms were not fully established to support high quality program implementation and rigorous evaluation.

Recommendations

- Considering the important role that trade allies play in the equipment selection process, continuing and potentially increasing marketing the program to trade allies will be beneficial. Consider conducting measure-specific training sessions geared toward selling specific types of equipment. Also, consider utilizing opportunities for cross-promotion to SBDI participating customers.
- It is uncommon for a commercial efficiency program to require pre-inspections, pre-approvals, and post-inspections for all projects, regardless of the size or type of a project. While having these processes in place ensures more rigorous quality assurance of the data (savings and incentives), it might result in customer reluctance to participate in the program. We recommend that the program monitor customer feedback and adjust protocols, if needed.

- ➢ Assess need for additional approval of custom projects completed by TRC and ramp down additional oversight by AEG if high quality of engineering estimates persists in 2012.
- ➢ Monitor and assess the need for additional post-inspections for the Small Business Direct Install program component, revise protocols if high-quality installations persist, and document new protocols.
- ➢ Continue work on streamlining Siebel. Specific recommendations pertaining to improving Siebel as it pertains to evaluation include the following:
  - Record contact information (first name, last name, and phone number at the very minimum) for all contacts whose information might have been made available during the project implementation process. Flagging primary project contact and providing further detail on the type of contact (e.g., contractor, facility contact, company contact, etc.) would help facilitate evaluation research.
  - Institute a requirement to enter facility address and company name, as opposed to importing it from the CAS system. This will ensure that project-specific, rather than generic, information is recorded.
  - If not already being done:
    - Work on developing a set of written guidelines as to what data fields need to be populated at various stages of the implementation process and make those fields compulsory and impossible to bypass to move a project to the next stage in Siebel.
    - Institute additional QA/QC procedures to check validity of participant contact information data fields, and document those procedures.
    - Supplement existing documentation, or develop new documentation that would provide program staff with detailed instructions on how to review post-inspection reports.
  - Consider doing the following for the evaluation team to more quickly extract information from Siebel and perform detailed analysis of savings:
    - Work on developing a comprehensive data dictionary that will provide names and descriptions of all data fields in Siebel. This will eliminate any confusion as to what data fields are present and can be extracted, as well as eliminate any ambiguity regarding what data those fields contain.
    - Work on developing queries that would enable the evaluation team to obtain data extracts with data fields that are critical for evaluation purposes (including customer contact information, program partner contact information, critical measure attributes, etc.). Having such queries set up and tested for quality would ensure that data extracts used by the evaluation team for measurement and verification purposes properly reflect what is in Siebel.
- ➢ Continue enhancing the ability to access Siebel by implementation contractors. This will help expedite approvals as well as data transfers.

12.2 Energy Efficient Products Program

Downstream Products

The processing of refrigerators, dehumidifiers, and pool pumps applications are subject to nine QA/QC points. The first three stages are unique to these downstream products; however, the final six steps are identical to upstream products.

(1A) Review for Completeness of Materials (EFI). Upon receipt of applications, EFI staff members check that all materials (applications and receipts) have been received. If these materials are incomplete, the team contacts the customer and requests the missing materials. (*"EFI Incentive Processing Quality Assurance Procedures"* documents this step.) Customers are expected to provide any missing materials within 30 days of receiving the request from EFI (this expectation is undocumented).

(1B) Verification of Participant Eligibility (EFI). Before entering applications into EFI's program tracking database, the EFI team ensures that the applicants have valid LIPA account numbers (either with LIPA's data files to which they have access or with the provided customer utility bill). If the account number information is missing or invalid, the team, using the customer database, contacts National Grid to provide or validate the information. If the customer is not a LIPA customer, the application is rejected. (*"EFI Incentive Processing Quality Assurance Procedures"* documents this step.) In the case of pool pumps, the team must also ensure that the installer is a certified program installer. This is done manually with EFI cross checking a qualified contractor list provided by Applied Proactive Technologies, Inc. (APT) including those contractors that have completed certification. EFI informally seeks to have applications entered into their database within three days of receipt.

(1C) Verification of Product Eligibility (EFI). EFI's database has built-in logic to ensure that applications that are entered do not exceed the number of allowed units per customer, are qualifying models, were installed in the LIPA service territory, and were purchased during eligible dates. (*"EFI Incentive Processing Quality Assurance Procedures"* documents this step.) If any applications include appliances purchased outside of the eligible dates, EFI contacts LIPA to determine if the exception can be allowed; if the exception is not permitted, the application will be denied.

The following steps are identical to those performed for EEP upstream products.

(2) Rebate Report Review (EFI). When EFI "closes-out" the program either monthly or more frequently, it generates a report of all approved applications. An EFI manager reviews the electronic file to verify the application's eligibility. (This step is not documented.)

(3) Incentive Check Review (EFI). Once incentive checks are printed, the EFI Chief Operating Officer reviews these for accuracy while signing them. (This step is not documented.)

(4) Participation Report Review (EFI). After checks have been sent (usually within six weeks of receipt), EFI generates an invoice that a manager reviews before it is mailed to National Grid. With approval, the processed-rebate dataset[54] is also loaded onto the FTP site. (This step is not documented.)

(5) Program Manager Review (National Grid). The National Grid Program Manager (PM) downloads the data from the FTP site upon receiving the invoice. The PM transfers the dataset from EFI's text

[54] Ultimately, this is the text file that is used by the Siebel team.

file format into an Excel worksheet. The PM then compares the invoice quantities to those in the dataset. Any discrepancies are resolved via email with EFI. Product totals are then entered into the EEP Goals Tracker and the Rebate Dollar and Participant Count spreadsheets (LIPA's "*Processing Invoices—Energy Efficient Products*" documents this step.) No specific timing expectations are documented for this step.

(6) Invoice Approval (National Grid). Once the PM approves the invoice, it is entered into an Oracle database for payment processing. After the National Grid Manager of Residential Programs reviews and approves the invoice, the reimbursement check is sent to EFI and the invoice is catalogued and filed. (LIPA's "*Processing Invoices—Energy Efficient Products*" documents these steps.) No specific timing expectations are documented for this step.

(7) Program Director Review (LIPA). After National Grid has issued the reimbursement to EFI, it sends the invoice, the Goals Tracker, and the dataset in Excel format to LIPA for review. If the LIPA Program Director finds any discrepancies when comparing the invoice quantities to those in the dataset, they discuss these with National Grid who then circles back to EFI to make any necessary changes. Once the invoice is approved, LIPA issues National Grid a reimbursement. No formal timing expectations are included in this step. (This step is not documented.)

In summary, nine different QA/QC checks occur during the processing of downstream participant data. The participant data is transferred at three different points before they are entered into Siebel:

- From paper applications/POS data to EFI's database
- From EFI's database to a report loaded onto the FTP site
- From the FTP site file to an Excel file

Figure 12-16. LIPA EEP QA/QC Flowchart – Refrigerators and Dehumidifiers

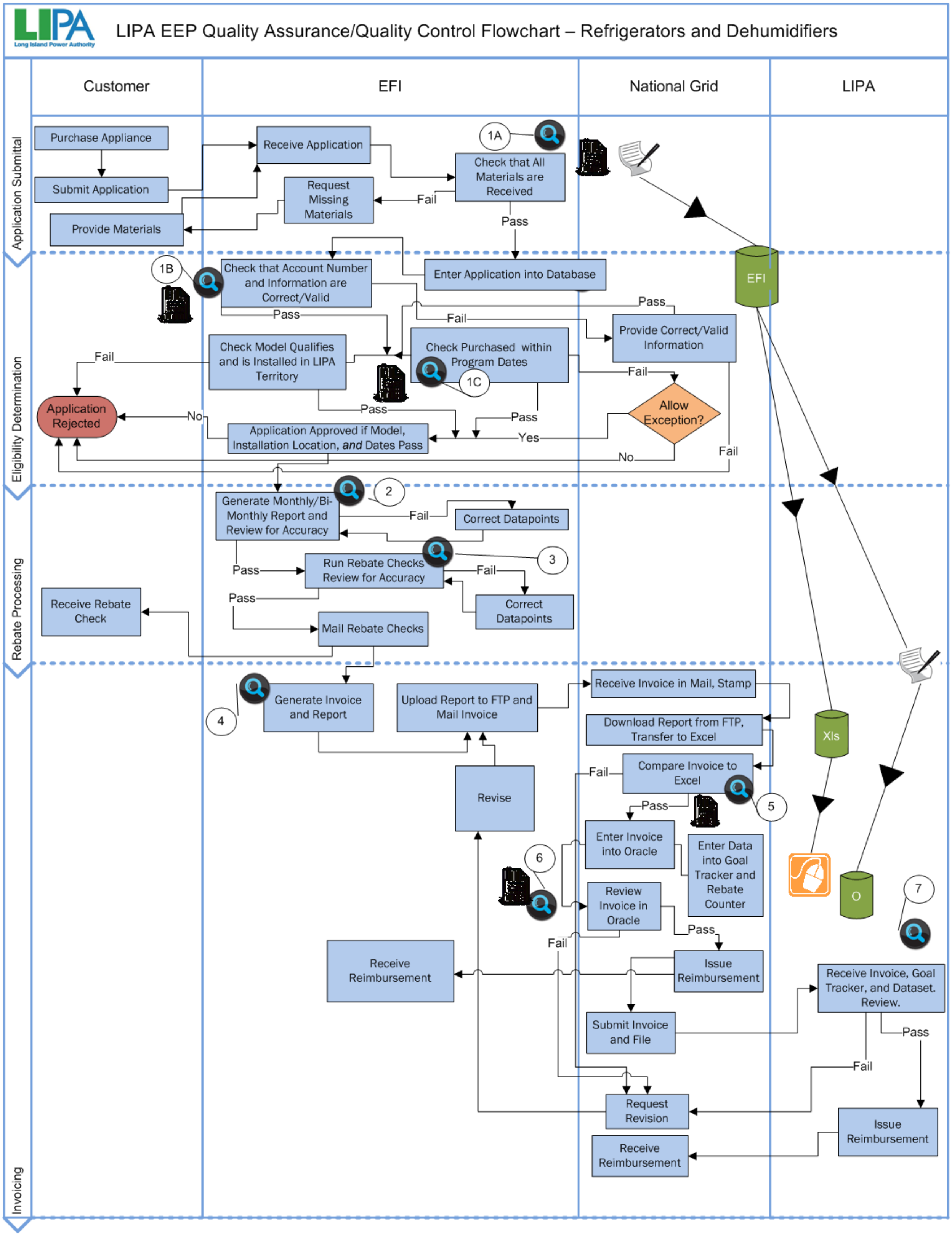
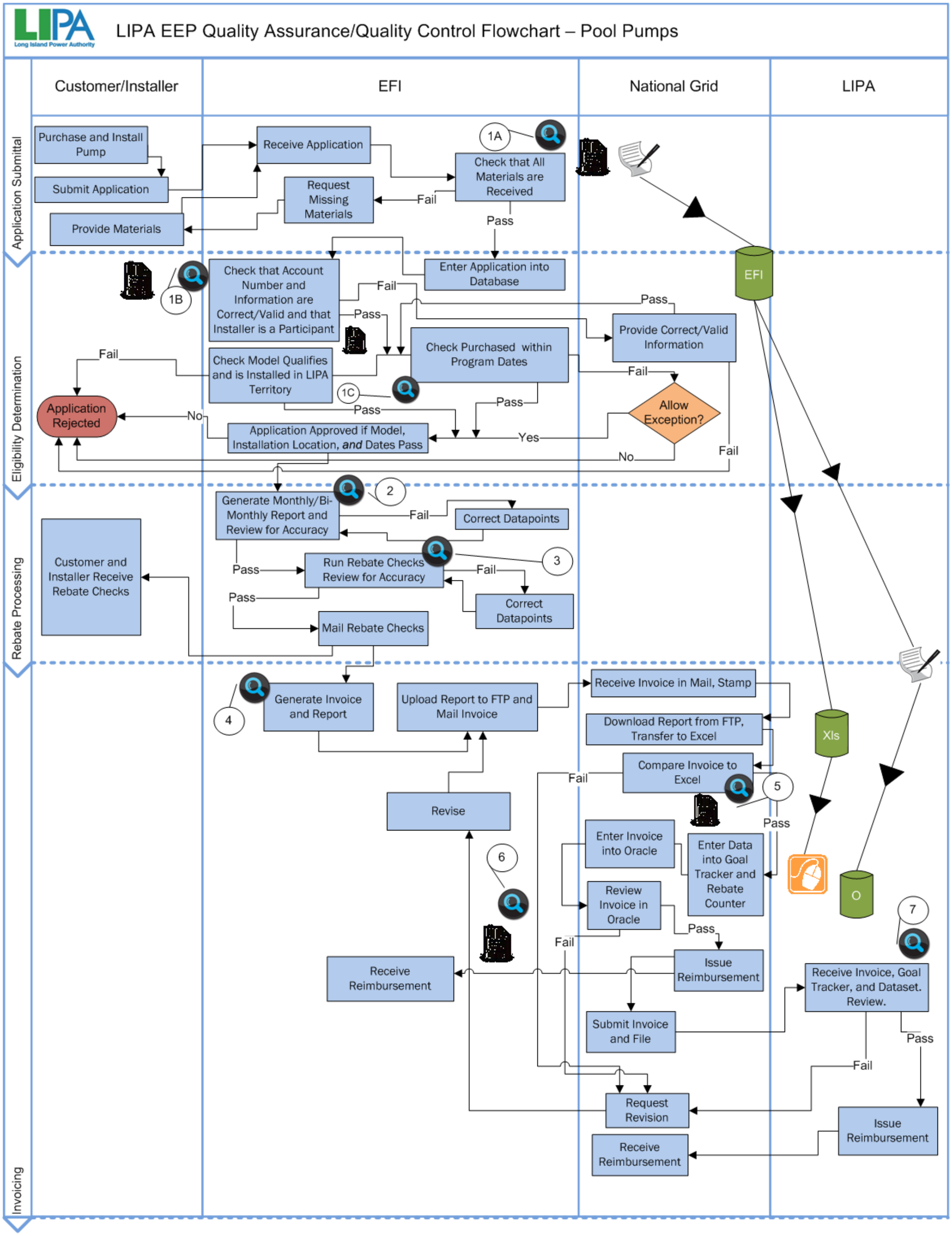


Figure 12-17. LIPA EEP QA/QC Flowchart - Pool Pumps



Upstream Products

The processing of lighting, room air conditioner, and television buydowns are subject to eight QA/QC points. The first three stages are unique to these upstream products; however, the final six steps are identical to downstream products.

(1A) Agreement with MOU Review (EFI). Upon receipt of invoices and/or point of sales (POS) data submitted by retailers or manufacturers (participants) in native format, EFI staff members ensure that the quantities, models, and incentives match those specified in the participants' memoranda of understanding (MOUs) with LIPA. (*"EFI Incentive Processing Quality Assurance Procedures"* documents this step.) If incentive levels do not match the MOUs, EFI contacts the participating retailer or manufacturer to confirm that the products were discounted by the correct incentive levels.

(1B) Duplicative Data Review (EFI). EFI also checks that invoices do not include sales for which they have already issued incentives. (*"EFI Incentive Processing Quality Assurance Procedures"* documents this step.) If EFI finds any duplicate data, EFI returns the invoice to the retailer or manufacturer and requires a revised invoice, or depending on the time of month, will compensate for the difference by underpaying the upcoming reimbursement. (*"EFI Incentive Processing Quality Assurance Procedures"* documents this step.) EFI manually or electronically enter retailer and manufacturer POS data into their database in less than 21 days (this timing expectation is not documented).

The following steps are identical to those performed across EEP program components.

(2) Rebate Report Review (EFI). When EFI "closes-out" the program either monthly or more frequently, it generates a report of all approved applications. An EFI manager reviews the electronic file to verify the application's eligibility. (This step is not documented.)

(3) Incentive Check Review (EFI). Once incentive checks are printed, the EFI Chief Operating Officer reviews these for accuracy while signing them. (This step is not documented.)

(4) Participation Report Review (EFI). After checks have been sent, EFI generates an invoice that a manager reviews before it is mailed to National Grid. With approval, the processed-rebate dataset[55] is also loaded onto the FTP site. (This step is not documented.)

(5) Program Manager Review (National Grid). The National Grid Program Manager (PM) downloads the data from the FTP site upon receiving the invoice. The PM transfers the dataset from EFI's text file format into an Excel worksheet. The PM then compares the invoice quantities to those in the dataset. Any discrepancies are resolved via email with EFI. Product totals are then entered into the EEP Goals Tracker and the Rebate Dollar and Participant Count spreadsheets (LIPA's *"Processing Invoices—Energy Efficient Products"* documents this step.) No specific timing expectations are documented for this step.

(6) Invoice Approval (National Grid). Once the PM approves the invoice, it is entered into an Oracle database for payment processing. After the National Grid Manager of Residential Programs reviews and approves the invoice, the reimbursement check is sent to EFI and the invoice is catalogued and filed. (LIPA's *"Processing Invoices—Energy Efficient Products"* documents these steps.) No specific timing expectations are documented for this step.

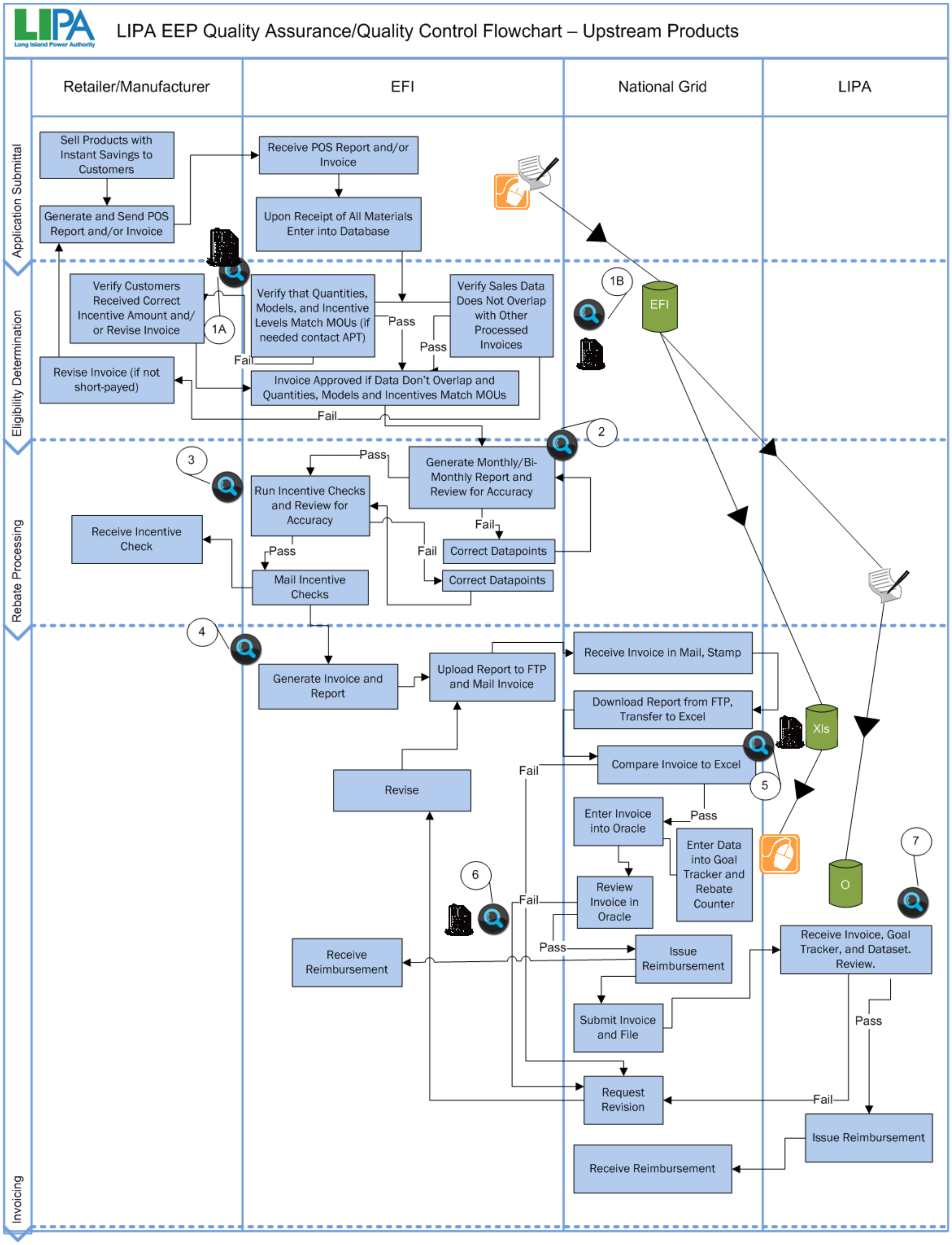
55 Ultimately, this is the text file that is used by the Siebel team.

(7) Program Director Review (LIPA). After National Grid has issued the reimbursement to EFI, it sends the invoice, the Goals Tracker, and the dataset in Excel format to LIPA for review. If the LIPA Program Director finds any discrepancies when comparing the invoice quantities to those in the dataset, they discuss these with National Grid who then circles back to EFI to make any necessary changes. Once the invoice is approved, LIPA issues National Grid a reimbursement. No formal timing expectations are included in this step. (This step is not documented.)

In summary, between eight different QA/QC checks occur during the processing of upstream participant data. The participant data is transferred at three different points before they are entered into Siebel:

- From paper applications/POS data to EFI's database
- From EFI's database to a report loaded onto the FTP site
- From the FTP site file to an Excel file

Figure 12-18. LIPA EEP QA/QC Flowchart - Upstream Products



Appliance Recycling

The processing of appliance recycling incentives is subject to 11 QA/QC points. To date, we have not received ARCA's QA/QC documentation due to confidentiality concerns on the part of ARCA; however, ARCA representatives have indicated that all QA/QC steps are documented. The description of this process follows:

(1) Verification of Participant Eligibility (ARCA). To enroll in the Appliance Recycling Program, customers must verify their LIPA account number either online or verbally on the telephone. If the customer cannot provide the account number or it is invalid, ARCA contacts National Grid to provide or validate the information. If the customer is not confirmed as a LIPA customer within two days, the application is rejected. (It is unclear where this step is documented.)

(2) Preliminary Verification of Appliance Eligibility (ARCA). ARCA's internal database logic flags ineligible units that do not meet the age, size, usage,[56] and quantity qualifications. However, to ensure that their call center representatives are correctly entering the information, ARCA managers occasionally monitor calls. (It is unclear where this step is documented.)

(3) On-site Appliance Eligibility Verification (SLS). The collection team, Sears Logistics Services (SLS) then verifies on-site that the units meet age and size qualifications and that the appliance is being used as a secondary unit. Any inaccuracies in size or age are recorded by hand. Those units that do not pass eligibility are picked up as a courtesy (with ARCA absorbing the cost of pickup) though the customer does not receive an incentive and the program does not claim the units – this information is also recorded by hand. (It is unclear where this step is documented.)

(4) Reconciliation of Appliance Characteristics (ARCA). Upon arrival at the de-manufacturing facility, an ARCA representative photographs the units to document their receipt of the unit and to ensure that its characteristics match those recorded. The team also documents any additional information unique to the unit. (It is unclear where this step is documented.)

(5) Data Review (ARCA). It is unclear what type of verification is performed regarding the process of SLS transferring its on-site handwritten data to its electronic database. After ARCA has received SLS's weekly data file, it uploads this information into its own database, and reviews the data and materials. (It is unclear where this step is documented.)

(6) Incentive Check Report Review (ARCA). After this stage, ARCA generates an incentive check file. ARCA reviews both the report and incentive check file before the check file is sent to the subcontractor, Helgeson Enterprises, for printing and mailing on a weekly basis. The implementers seek to provide participants payment within four weeks of appliance pickup. (It is unclear where this step is documented.)

(7) Incentive Deposit Reconciliation (ARCA). ARCA makes two efforts to ensure that participants have deposited their incentive checks. If a check has not been deposited, ARCA contacts the customer. After failing at a second attempt to contact the customer, ARCA will transfer funds to the state as unclaimed property. (It is unclear where this step is documented or if there are any timing expectations around it although their compliance with this ensures they are adhering to state law around unclaimed property.) (It is unclear where this step is documented.)

(8) Participation Data Review (ARCA). Before sending the participant data and invoice to National Grid on a monthly basis, ARCA reviews the materials. (It is unclear where this step is documented.)

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[56] In some cases, administrators of appliance recycling programs require that a unit must be a secondary unit for a certain number of months; however, LIPA does not have requirements around this.

(9) Program Manager Review (National Grid). After checks have been sent, National Grid receives the participant data and invoice from ARCA on the FTP site, and additionally a compact disc of the photographs taken of the units at the facility through the mail. The participant data arrive in Excel format and National Grid does not perform any manipulations to the data.[57] The PM then compares the invoice quantities to those in the dataset. Any discrepancies are managed via email with ARCA. Product totals are then entered into the EEP Goals Tracker and the Rebate Dollar and Participant Count spreadsheets (This step is not documented.)

The remaining steps are nearly identical to those performed in upstream and downstream programs.

(10) Invoice Approval (National Grid). Once the PM approves the invoice, it is entered into an Oracle database for payment processing. After the Manager of Residential Programs reviews and approves the invoice, National Grid sends ARCA the reimbursement check and the invoice is catalogued and filed. ("*Processing Invoices – Energy Efficient Products"* documents this step.)

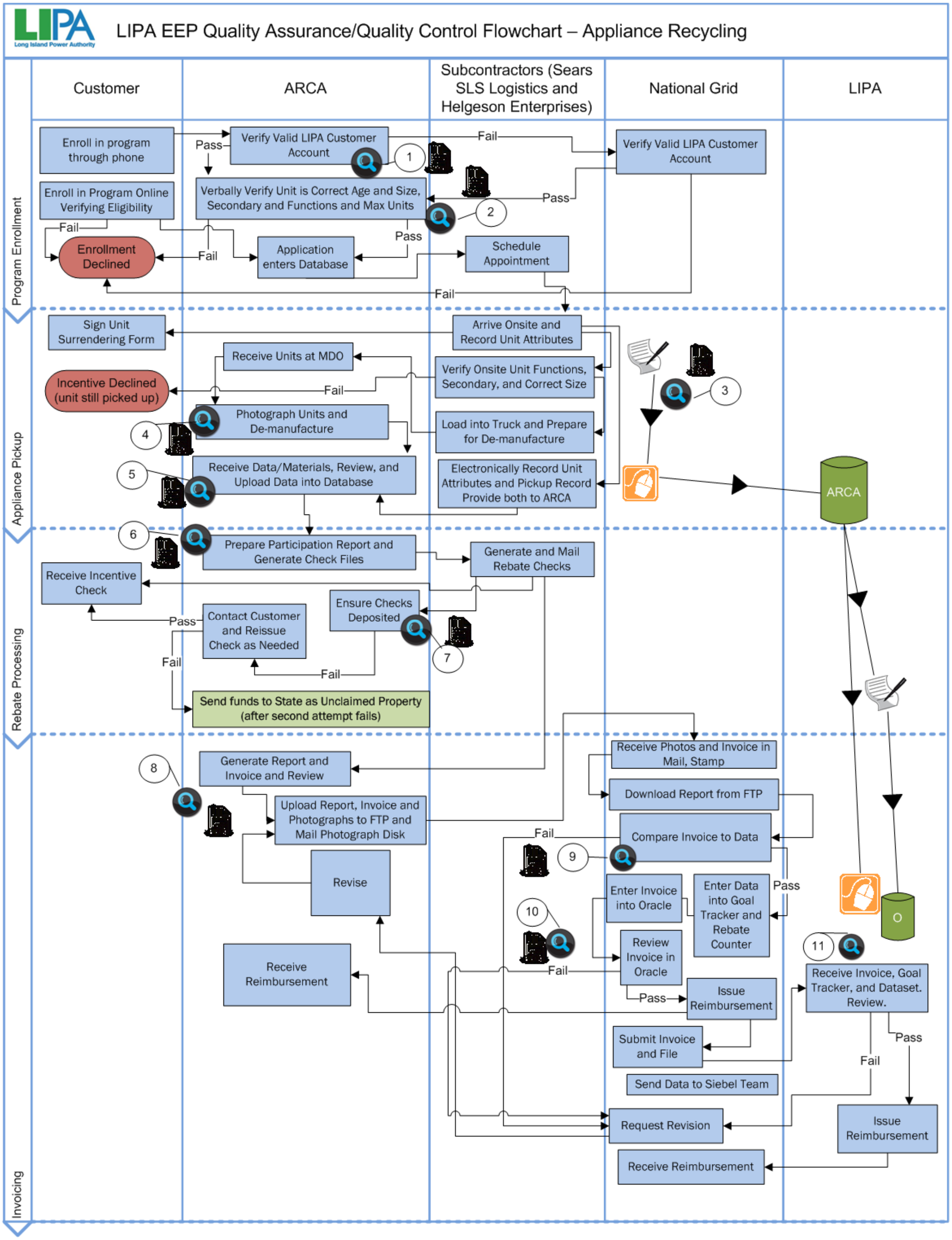
(11) Program Director Review (LIPA). After National Grid has issued the reimbursement to ARCA, it sends LIPA the invoice, the Goals Tracker, and the dataset to review. If the LIPA Program Director finds any discrepancies when comparing the invoice quantities to those in the dataset, they discuss these with National Grid who then circles back to ARCA to make any necessary changes. Once the invoice is approved, LIPA issues National Grid a reimbursement. (This step is not documented.)

In summary, during the processing of participant data, there are 11 different QA/QC checks. The participant data is transferred at three different points before they are entered into Siebel:

- From SLS's handwritten forms to its database
- From SLS's database to ARCA's database
- From ARCA's database to National Grid

[57] Ultimately, this is the file that is used by the Siebel team.

Figure 12-19. LIPA EEP QA/QC Flowchart – Appliance Recycling



12.3 Cool Homes Program

LIPA's Cool Homes program has the following six quality assurance procedures at each step of program implementation.

(1) Initial Application Review. Upon receipt of an application, LIPA Rebate Processing staff reviews the application for completeness and accuracy. LIPA Cool Homes program staff verifies both customer and equipment eligibility based on the Cool Homes Program requirements. This QA/QC step is performed automatically through data entry into the CSG database. If an application is missing the LIPA account number, or the account number is incorrect, Rebate Processing staff cannot continue past the first screen. In addition, the application must contain a valid Air Conditioning, Heating, and Refrigeration Institute (AHRI) number, which links the equipment model and efficiency. Likewise, if the equipment does not meet standards of the Cool Homes program, the application process is halted and either a request for more information or a denial letter is sent to the contractor. The *"LIPA Cool Homes Rebate Data Entry Process"* document highlights these steps, which are performed on all applications. Every project undergoes this QA/QC step.

(2) Pre-inspection of Early Retirement. If a contractor is seeking an additional rebate for an early retirement (ER), CSG staff must assign an early retirement number for use on the application. This serves as an important quality assurance step, as CSG, in issuing early retirement numbers, conducts pre-inspections on a sample of projects to verify that existing equipment is eligible for early retirement. CSG uses Air Conditioning Contractors of America (ACCA) sampling procedures in selecting projects for pre-inspection. Typically, the first five ER applications for a given contractor are automatically subject to a pre-inspection. After that, the program aims to pre-inspect 10% of all ER applications. CSG reports that they perform pre-inspections for more applications than recommended given that early retirement incentives are a new program offering. CSG tracks and documents pre-inspection information in a separate spreadsheet, which is sent back to the Rebate Processing center. LIPA Cool Homes staff enters the results into the CSG database. This step is highlighted in the "equipment tab" of the CSG database under the variable "ER INSPECT DATE."

(3) Post-installation Inspection. Cool Homes program staff uses ACCA protocols to determine the sample of applications subject to post-inspection. While the protocols call for random sampling, currently, the process for flagging applications for post-inspection is not automatic, and Rebate Processing staff must manually flag individual applications in the CSG database. CSG, responsible for the post-inspections, examines the installed equipment, confirms that the equipment specifications listed in the application are correct, and determines the operational status of the equipment. This is done by both a visual and operational inspection in which CSG staff collects nameplate information and performs Manual J calculations verifying a proper quality install. CSG staff documents the post-inspection results on paper and sends it back to the Rebate Processing center where LIPA staff enters the data in the CSG database. This step is highlighted in the "projects tab" of the CSG database under the variable "NOTES."

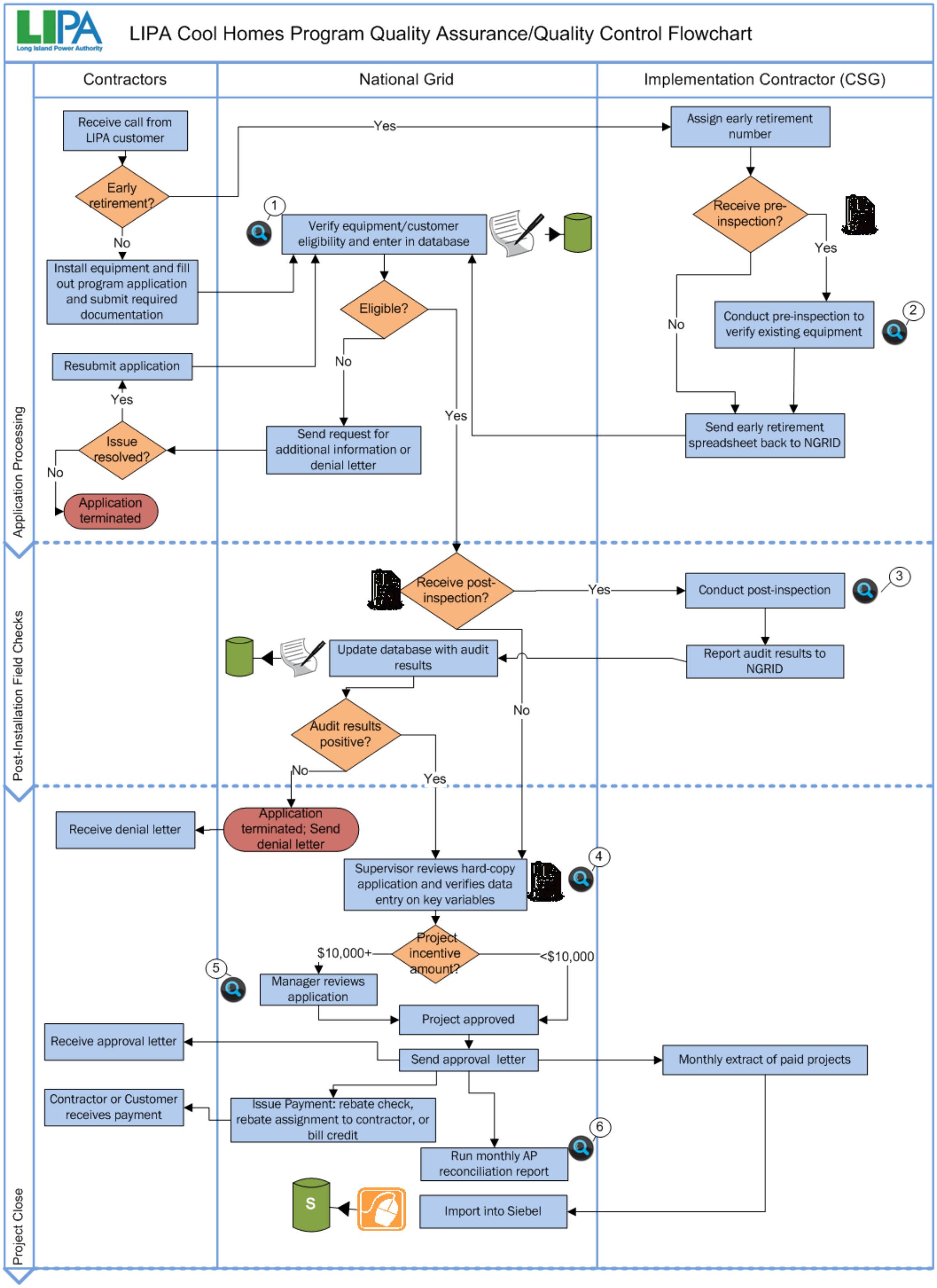
(4) Supervisor Application Review. For an application to be approved and forwarded to Accounts Payable, the supervisor must verify that the data was entered into the database properly. This serves as an important QA step for all applications. The supervisor compares hard-copy applications and verifies data entry on key variables such as the ARI#, Model#, Serial#, LIPA Account #, and the type of incentive offering preferred by the customer (i.e., customer check, contractor check, or bill credit). These procedures are clearly outlined in the *"LIPA Cool Homes Rebate Approval Process"* document.

(5) Manager Application Review. There is an additional QA/QC procedure for projects receiving $10,000 or more in incentives. For these rare large projects in the Cool Homes program, the

Rebate Processing manager must check program information and be the authorizing signature before the application is approved and forwarded to Accounts Payable. This management review step is common to LIPA's entire ELI portfolio. Results of this quality check step and approval are recorded as an activity in Siebel. The activity contains the name of the person who entered it, the result of the activity, and the time stamp.

(6) AP Reconciliation Report. The final QA/QC step consists of running an Accounts Payable reconciliation report, which documents the results of a comparison between the project information on the rebates paid and the rebates actually issued by the Accounts Payable department. This step is performed on a monthly basis. All discrepancies are directed to the Accounts Payable department for correction.

Figure 12-20. LIPA Cool Homes QA/QC Flowchart



12.4 Home Performance with ENERGY STAR Program

We did not conduct a full process assessment of the Home Performance program in 2011. However, we gathered limited information on measure installation and lighting awareness through a participant telephone survey to provide program staff with insight into participant knowledge and decision-making around CFLs and LED lighting in particular. We also sought to gather information on participant satisfaction with the program. As noted in the methodology section, the team performed the following activities:

- **Participant telephone survey**: We conducted a telephone survey with 140 participating Home Performance customers: 70 in the HPD program and 70 in the HPwES program.
- **In-depth interviews with program staff**: We conducted interviews with the LIPA program manager and program implementer, CSG to support our review of the programs QA/QC procedures and data tracking process.

HPD Only Measure Installation and Lighting Awareness

Verification of Program Bulb Installation

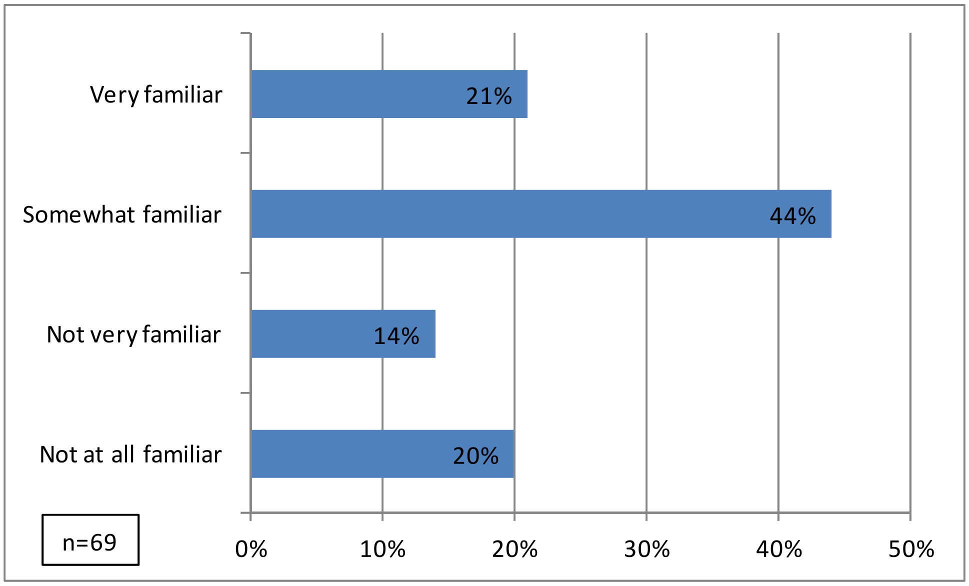
Among the HPD Only participants who received CFLs during the Comprehensive Home Assessment, 17% reported no longer having the bulbs installed. The most common reasons why participants removed the bulbs were the delay in bulbs lighting up when turned on, and that the bulbs were too dim or flickered.

Lighting Purchases and Awareness

Given the large contribution of CFLs to overall HPD savings, the team also asked HPD-Only participants a series of follow-up questions about their use of CFL lighting, as well as their familiarity with LED blubs. In general, we found that it was common for participants to have previously purchased CFLs for their homes – 74% of HPD participants reported purchasing CFLs for home use in the past. We also asked those who had purchased bulbs in the past 3 months (n=13), how many they purchased, as well as how many of those bulbs they installed. On average, these participants purchased nine CFLs and installed an average of five bulbs.

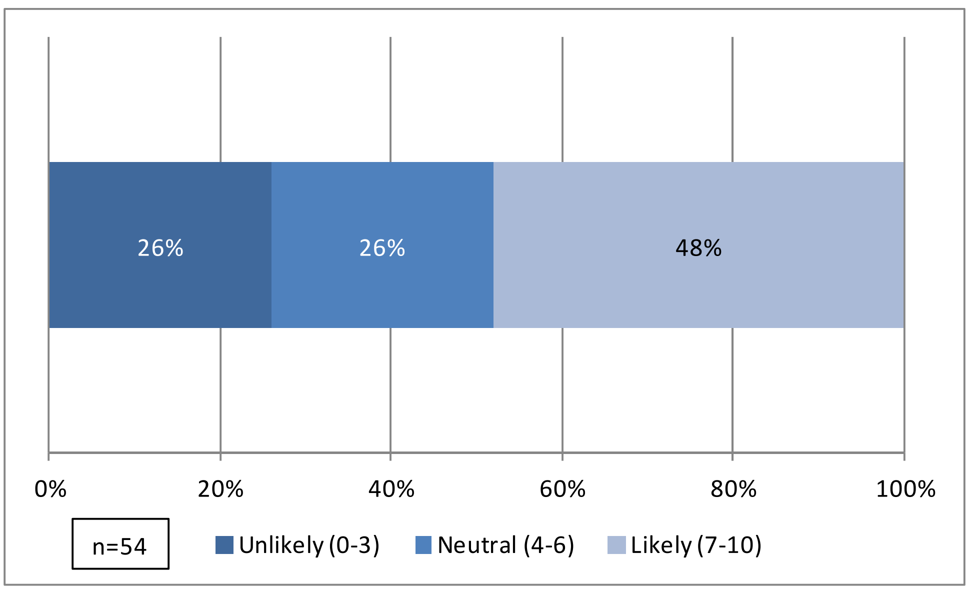
In terms of customer knowledge of new lighting options, more than half of HPD participants have some level of familiarity with LED light bulbs when this lighting option is described to them. As illustrated in Figure 12-21, twenty one percent of participants reported that they are very familiar with LED lighting while 44% consider themselves somewhat familiar.

Figure 12-21. Familiarity with LED Light Bulbs



We also asked those participants familiar with LED light bulbs whether they would consider purchasing a screw-in LED bulb under certain conditions. In particular, on a scale from 0 to 10 where 0 is "not at all likely" and 10 is "very likely," almost half of participants familiar with LED light bulbs said they are likely to consider to purchasing one (a score of 7-10) if it cost $15, but would last for 20 years.

Figure 12-22. Likelihood of Considering an LED Lighting Purchase



HPwES Participant Motivation to Complete Follow-On Work

We asked HPwES Follow-On participants to rate the influence of different program components on their decision to continue to HPwES after participating in the HPD program. As seen in Table 12-5, the most influential program component is the rebate offered (85%), followed by recommendations from the HPD contractor (61%) and LIPA marketing materials (57%).

Table 12-5. Motivation to Pursue Follow-On Work

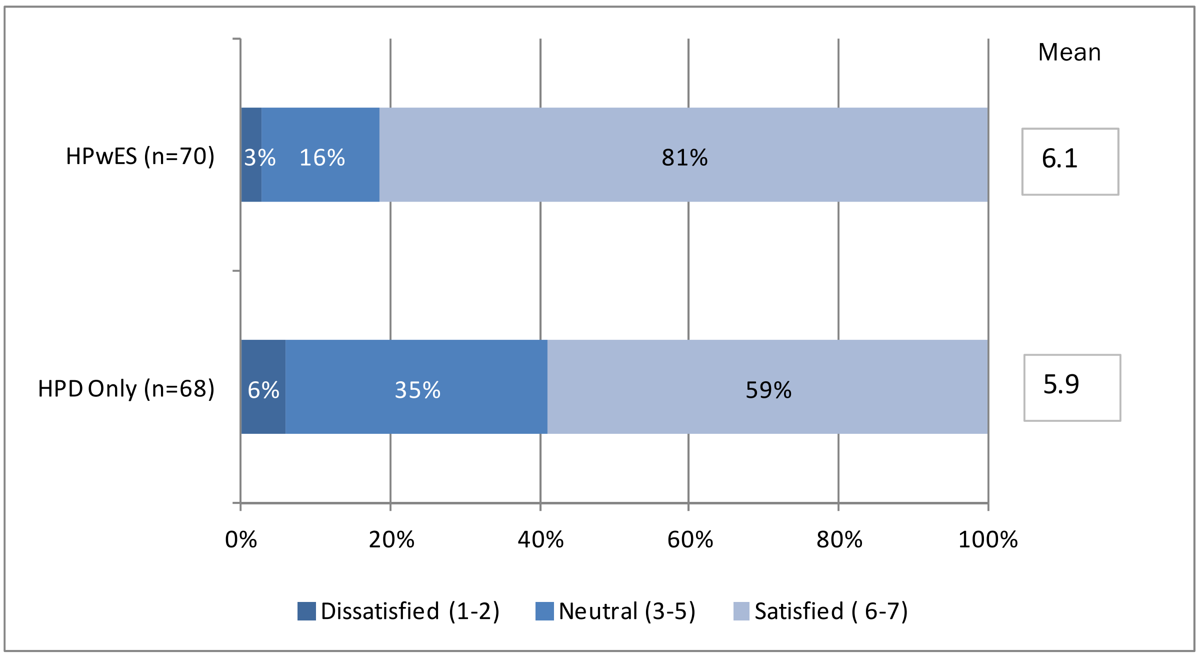
Factor	Percent that Consider Factor Influential (n=46) [a]	Mean Influence Rating
Rebates	85%	6.2
HPD Contractor Recommendation	61%	5.3
HPwES Marketing Materials	57%	5.7

Note: Scale is from 1 to 7, where 1 is “not at all influential” and 7 is “extremely influential.”
[a] A score of 6 or 7 is considered “influential.”

Program Satisfaction

Program participants are generally satisfied with the Home Performance program offerings. Eighty one percent of HPwES participants are satisfied with the program overall-providing a mean rating of 6.1 on a scale from 1 to 7 where 1 is “extremely dissatisfied” and 7 is “extremely satisfied”. In contrast, only 59% of HPD Only participants are satisfied with the program overall.

Figure 12-23. Overall Program Satisfaction



Note: Scale is from 1 to 7, where 1 is “extremely dissatisfied” and 7 is “extremely satisfied.”

In addition to the overall rating of the program, participants in HPwES are highly likely to recommend the program to a friend or family member (90%). Almost three quarters of HPD Only participants are also likely to make a similar recommendation (70%).

Table 12-6: Likelihood to Recommend the Program

Program	Percent Likely to Recommend the Program [a]	Mean Likelihood Rating
HPwES (n=70)	90%	6.4
HPD Only (n=68)	70%	5.9

Note: Scale is from 1 to 7, where 1 is "extremely unlikely" and 7 is "extremely likely."

[a] Respondents providing a score of 6 or 7 are considered "likely" to recommend the program.

Quality Assurance and Quality Control

HPwES Follow-On is the term used to refer to those cases where an HPD participant chooses to conduct follow-on work in their home through the Home Performance with ENERGY STAR Program. There are five quality assurance procedures in place for HPwES Follow-On.

(1) Job Scope Review and Approval. Once the contractor and participating customer sign a contract to complete the follow-on work, the contract and job scope information is submitted to CSG for review. The review, which occurs for all projects, involves verifying the proposed measures and incentive amounts associated with the work, as well as a review of the testing data collected on-site (e.g., blower door test results). CSG staff also confirms that what is proposed also matches the contract in place. The *"Summary of CSG's Quality Assurance and Administrative Review Process & Field Inspection Procedures"* documents this step.

***Change Order Review and Approval.* While not called out in the flow diagram, at any point between the job scope review and installation of measures, the contractor may decide to make a change to the existing contract. In such an event, the contractor obtains customer approval and submits a change order form to CSG typically in paper form. A CSG program administrator then reviews the change orders and provides formal approval or disapproval of the change order to the contractor. Contractors are also required to communicate directly with the customer about any changes in incentives at this time. Every change order goes through this process and the "*Summary of CSG's Quality Assurance Administrative Review Process & Field Inspection Procedures*" documents this step.

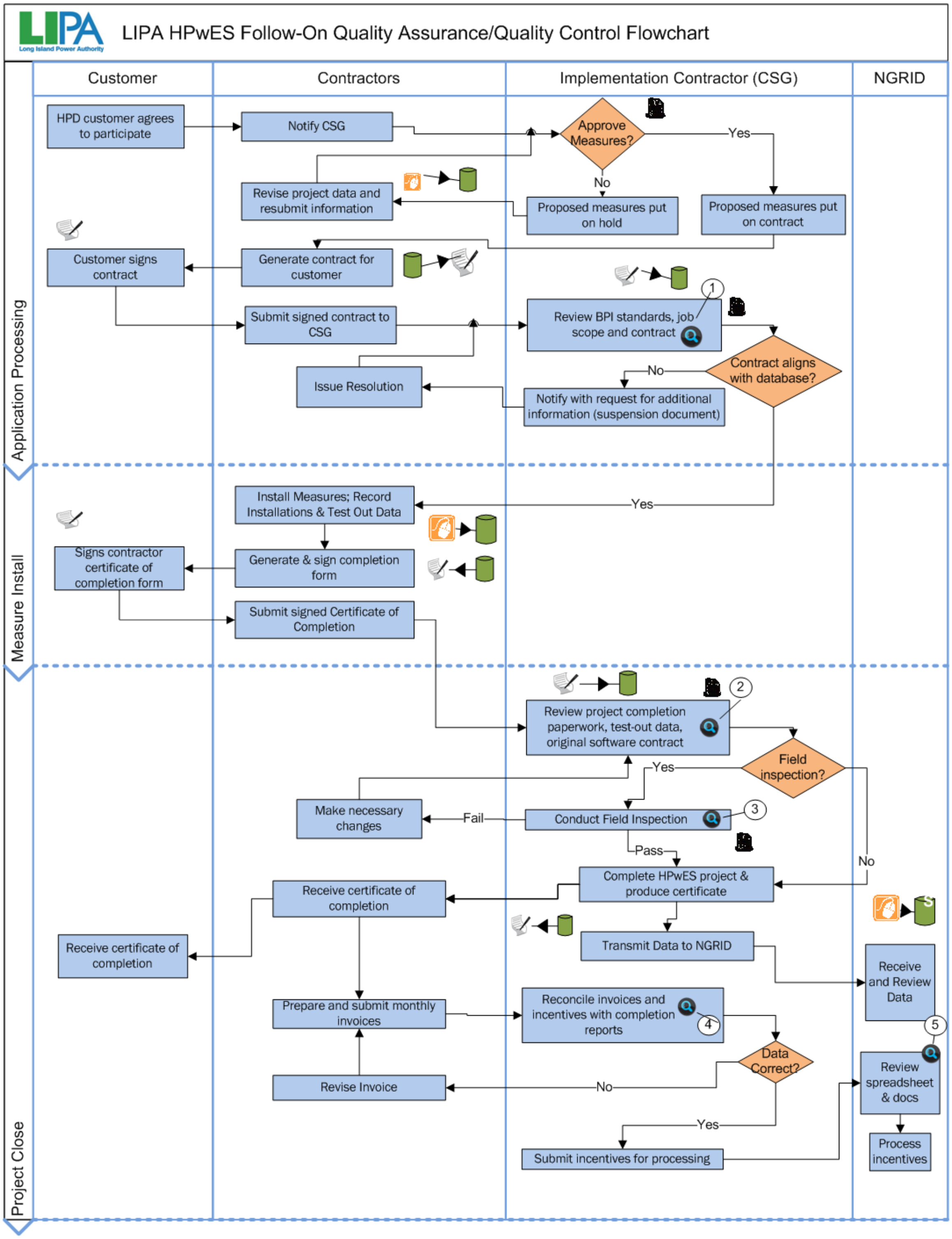
(2) Project Completion Review and Approval. After the installation of measures, the contractor submits a completion form for each project to CSG. The completion form has a customer's signature acknowledging the project information (summary of eligible measures installed) and that the work performed meets the customer's expectations. This document also includes all data collected on-site after the work is completed. At this time, a CSG program administrator also compares the information on the completion form with the data in RHA to make sure all of the details align. As a result of this review, the program administrator approves or disapproves the project completion document. The *"Summary of CSG's Quality Assurance and Administrative Review Process & Field Inspection Procedures"* documents this step.

(3) Field Inspection. At the time that CSG receives the completion form, staff determines whether they will conduct a field inspection of a specific project. Similar to HPD, CSG staff pays special attention to the following criteria in determining which projects will receive an inspection: (1) whether the project was submitted by a new contractor, (2) whether the project was submitted by a contractor that has not met BPI standards in the past, and (3) whether the project was submitted by a contractor who has participated at high levels in the past month. Projects that meet many of these criteria are likely to receive field inspection. The *"Summary of CSG's Quality Assurance and Administrative Review Process & Field Inspection Procedures"* documents this step.

(4) Invoice Review. After an HPwES project is complete, a participating contractor will submit project backup documents to CSG that are reviewed and matched against the RHA database. This quality assurance step ensures that the number of jobs that will receive a rebate in the program were actually completed and documented in the program tracking data. CSG Staff is required to perform this step, but there is no additional documentation of this process. After review, CSG staff creates a spreadsheet summarizing the number of HPwES projects, amount of eligible rebates, and participating contractors for the month. CSG then creates the Accounts Payable, Customer, and Contractor Rebate Notification memos associated with the spreadsheet and submits to the National Grid Program Manager.

(5) National Grid Program Manager Review and Approval. Upon receipt of the monthly spreadsheet and project backup documents from CSG, the National Grid Program Manager conducts an extensive review of the materials, ensuring that the number of homes receiving visits, participating contractors, and the amount of eligible rebates correspond to the backup documentation. Once that is complete, the National Grid Program Manager forwards the spreadsheet along with the Accounts Payable, Customer, and Contractor Rebate Notification memos to the program's Rebate Processing staff. One staff person reviews the rebate amounts in the spreadsheets against the Accounts Payable memos and once reconciled, sends the documentation to Accounts Payable for check processing. A separate staff person prints and mails the contractor and/or customer rebate notification letters. We understand the details of this process from our interviews, but there is no additional documentation of this process.

Figure 12-24. LIPA HPwES Follow-On QA/QC Flowchart



Home Performance with ENERGY STAR Free-Market

The HPwES Free-Market component, where participants have not previously taken part in HPD, has seven quality assurance procedures. The quality assurance procedures for free-market participants are consistent with both the HPD program and HPwES follow-on. As a result, the following steps are the same as those described above, but are presented in the order in which they occur for this particular participant population.

(*1) Comprehensive Home Assessment Review and Approval*. Upon completion of the CHA, the contractor creates a CHA report for every project and submits it to CSG for review electronically. As part of this quality assurance step, two CSG staff members review the report for completeness and ensure that it is technically correct and logical. In addition, CSG staff will review any notes provided by the contractors at this time. If any issues arise, CSG will contact the contractor that performed the CHA and request additional information or revisions to the RHA entry for a particular project. The "*Summary of CSG's Quality Assurance and Administrative Review Process & Field Inspection Procedures"* documents this step.

(2) Field Inspection. At the time that CSG receives the CHA report, staff determines whether it will conduct a field inspection. In selecting CHAs for field inspection, CSG staff pays special attention to the following criteria: (1) whether the project was submitted by a new contractor, (2) whether the project was submitted by a contractor that has not met Building Performance Institute (BPI) standards in the past, and (3) whether the project was submitted by a contractor who has participated at high levels in the past month. Projects that meet many of these criteria are likely to receive field inspection. The "*Summary of CSG's Quality Assurance and Administrative Review Process & Field Inspection Procedures"* documents this step.

(3) Job Scope Review and Approval. Once the contractor and participating customer sign a contract to complete the follow-on work, the contract and job scope information is submitted to CSG for review. The review, which occurs for all projects, involves verifying the proposed measures and incentive amounts associated with the work, as well as a review of the testing data collected on-site (e.g., blower door test results). CSG staff also confirms that what is proposed matches the contract in place. The "*Summary of CSG's Quality Assurance and Administrative Review Process & Field Inspection Procedures*" documents this step.

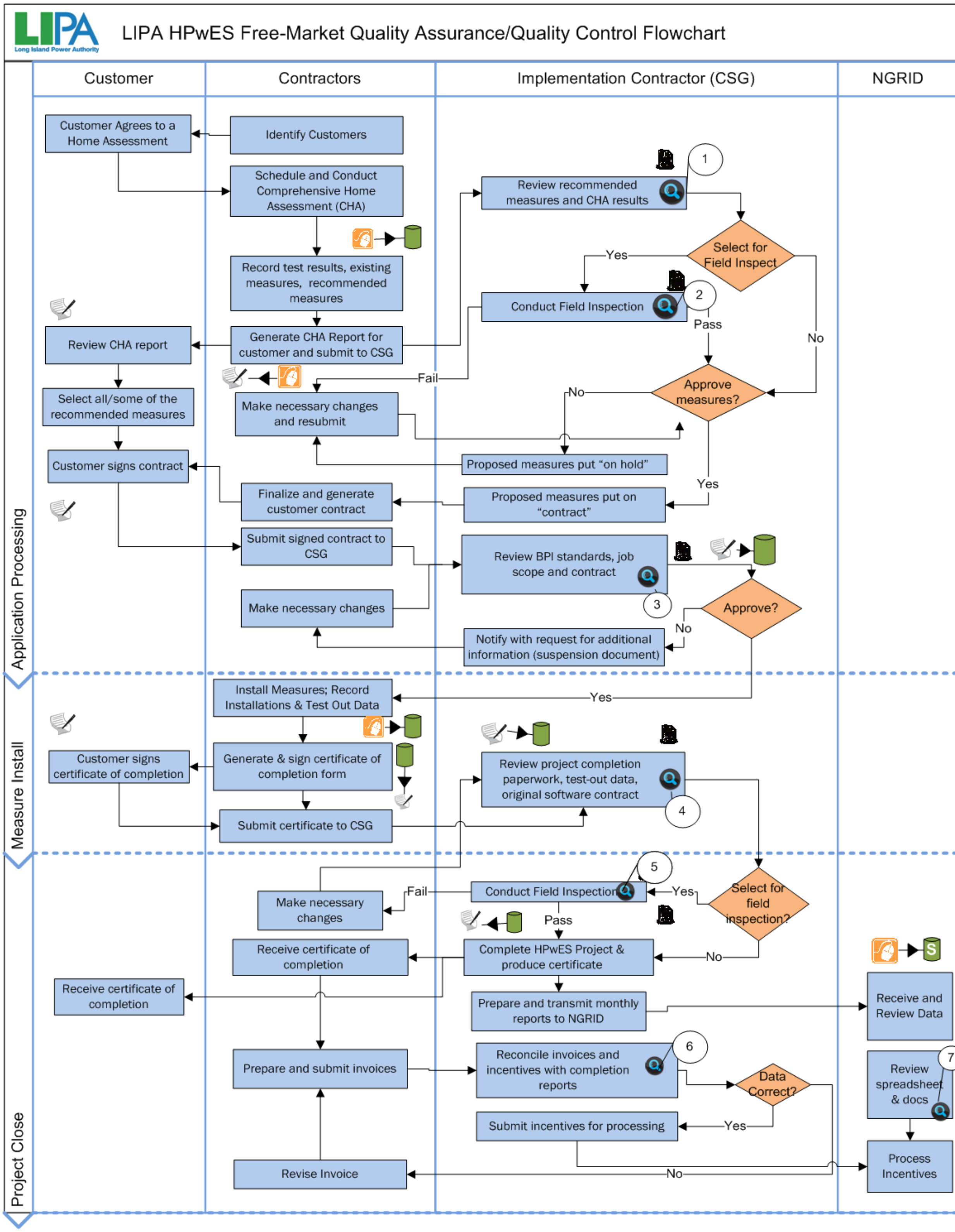
(4) Project Completion Review and Approval. After the installation of measures, the contractor submits a completion form to CSG for each project. The completion form has a customer's signature acknowledging the project information (summary of eligible measures installed) and that the work performed meets the customer's expectations. This document also includes all data collected on-site after the work is completed. At this time, a CSG program administrator also compares the information on the completion form with the data in RHA to make sure all of the details align. As a result of this review, the program administrator approves or disapproves the project completion document. The "*Summary of CSG's Quality Assurance and Administrative Review Process & Field Inspection Procedures"* documents this step.

(5) Field Inspection. At the time that CSG receives the completion form, staff determines whether it will conduct a field inspection of a specific project. Similar to HPD, CSG staff pays special attention to the following criteria in determining which projects will receive an inspection: (1) whether the project was submitted by a new contractor, (2) whether the project was submitted by a contractor that has not met BPI standards in the past, and (3) whether the project was submitted by a contractor who has participated at high levels in the past month. Projects that meet many of these criteria are likely to receive field inspection. The *"Summary of CSG's Quality Assurance and Administrative Review Process & Field Inspection Procedures"* documents this step.

(6) Invoice Review. After completion of any field inspections and a determination that the HPwES project is complete, participating contractors submit invoices to CSG that CSG reviews and matches against RHA Data. This quality assurance step ensures that the number of jobs for which a contractor invoices the program were actually completed and documented in the program tracking data. After review, CSG staff creates a spreadsheet summarizing the number of HPD projects for each participating contractor for the month. CSG then forwards the spreadsheet along with backup project documents to the National Grid Program Manager for review and approval for payment. We understand that CSG staff performs this step, but there is not additional documentation of this process.

(7) National Grid Program Manager Review and Approval. Upon receipt of the monthly invoices and associated documents from CSG, the National Grid Program Manager conducts an extensive review of the materials, ensuring that the number of HPD visits by participating contractors correlate with the backup documentation. Approved invoices are submitted for processing through National Grid's Oracle Payment System.

Figure 12-25. LIPA HPwES Free-Market QA/QC Flowchart



12.5 Home Performance Direct Program

Home Performance Direct program has five quality assurance procedures.

(1) Determination of Customer Eligibility. The first quality assurance step occurs for HPD when LIPA customers contact program staff about the program. At this step, CSG staff determines whether the customer qualifies for the HPD Program. If the customer meets the program's qualifying criteria – they have Central Air Conditioning (CAC) – CSG staff enters their information into Real Home Analyzer (RHA) and creates a new site record for the customer. CSG staff also gathers contact and household information from the customer at this time. Every customer inquiry goes through this process and it occurs in real time. However, we did not receive or review any formal documentation of this process.

(*2) Comprehensive Home Assessment Review and Approval*. Upon completion of the Comprehensive Home Assessment (CHA), the contractor creates a CHA report and submits it to CSG for review electronically. This occurs for all projects. As part of this quality assurance step, two CSG staff members review the report for completeness and ensure that it is technically correct and logical. In addition, CSG staff will review any notes provided by the contractors at this time. If any issues arise, CSG will contact the contractor that performed the CHA and request additional information or revisions to the RHA entry for a particular project. The *"Summary of CSG's Quality Assurance and Administrative Review Process & Field Inspection Procedures"* documents this step. However, there are no formal expectations for how long the review and approval process should take.

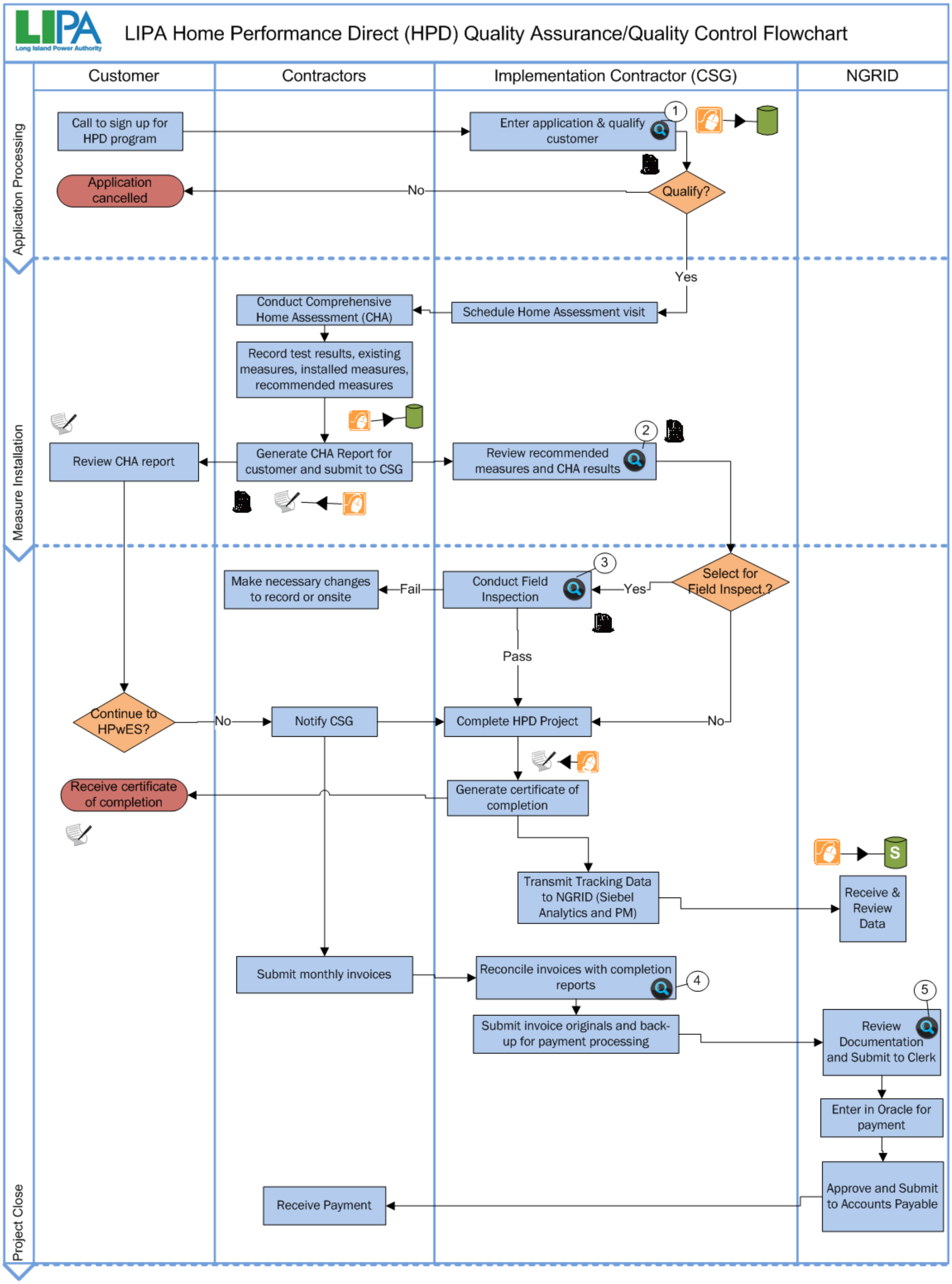
(3) Field Inspection. At the time that CSG receives the CHA report, staff determines whether it will conduct a field inspection of a specific project. In selecting projects for field inspection, CSG staff pays special attention to the following criteria: (1) whether the project was submitted by a new contractor, (2) whether the project was submitted by a contractor that has not met BPI standards in the past, and (3) whether the project was submitted by a contractor who has participated at high levels in the past month. Projects that meet many of these criteria are likely to receive field inspection. "The *Summary of CSG's Quality Assurance and Administrative Review Process & Field Inspection Procedures"* documents this step, but does not specify how quickly the inspection is completed once a decision is made to review a particular project.

(4) Invoice Review. After completion of any field inspections and a determination that the HPD project is complete, participating contractors submit invoices to CSG that are reviewed and matched against project completion reports. This quality assurance step ensures that the number of jobs for which a contractor invoices the program were actually completed and documented in the program tracking data. We understand that CSG staff performs this step, but there is not additional documentation of this process or the expectations for how frequently it will occur.

(5) National Grid Program Manager Review and Approval. Upon receipt of the monthly invoices from CSG, National Grid staff conducts an extensive review of the original invoices and supporting documentation. After the program manager receives the invoice originals and backup materials via mail, she reviews them to ensure that the customer signed off on the job and that the visit actually occurred. Since all HPD contractors have contracts with LIPA, National Grid processes their payment. First, the program manager fills out the necessary information for National Grid to pay the contractor and submits the invoice to a clerk, who uses the Oracle system to arrange for payment. The clerk then emails the HPD program manager with information about the invoice. This information is provided to the manager of residential programs for a second review and approval in Oracle. Once approved, the clerk informs Accounts Payable that they can issue payment and mails an original copy of the invoice to that department. Our knowledge of this process is based on

interviews with program staff and these procedures are not documented. The general timeline for this activity is also unclear at this time.

Figure 12-26. LIPA HPD QA/QC Flowchart



12.6 Residential Energy Affordability Partnership (REAP)

The implementation contractor for the Residential Energy Affordability Program (REAP) changed during the course of 2011 from Honeywell to Conservation Services Group (CSG) and CMC Energy Services. This change in contractors led to minimal changes in the quality assurance and quality control procedures. Our QA/QC diagram and description focus on the QA/QC procedures in place with the new contractor. Therefore, these procedures cover the period from July through December 2011. Overall, REAP has six quality assurance procedures.

(1) Determination of Eligibility. CSG determines eligibility when LIPA customers call the program hotline (1-800-263-6786). CSG staff gathers data from the customer related to home heating fuel type, past participation, and household income. If the customer meets income criteria, CSG staff confirms the customer's LIPA account number via Siebel, as well as their contact information. Every customer inquiry goes through this process and the procedure is documented in detail in the LIPA REAP Scripts. The information collected is entered into the audit tab of the Real Home Analyzer (RHA) database that CSG maintains. This step occurs in real-time. As a result, there are no timing expectations associated with its completion.

(2) Confirmation of Eligibility. Upon arrival at the customer's home, CMC staff confirms customer eligibility through verification of hard copy documentation. In particular, customers must provide one of the following documents: child support or court order, department of public welfare information, employer verification letter, pay stubs from the prior two months, social security disability form, supplemental security income award letter, social security retirement form, social security survivors benefit form, unemployment award letter, veteran's benefits award letter, previous year W-2 or 1040 SSE form, or workman's compensation award letter. Documentation for this procedure exists in the auditor binder: revision one, effective July 1, 2011, page 1.1. Confirmation of eligibility is documented in the RHA database after the visit is completed. Similar to the determination of eligibility, this step occurs in real-time and does not require documented timing expectations.

(3) In-Process Review. CMC identifies a sub-set of homes for "in-process review," which involves an independent staff person following the contractors as they perform the initial site visit. This step occurs at the same time as the initial site visit and should not affect project timing. The staff member performing the review visually inspects the work of contractors to make sure they have identified all of the measure installation opportunities, as well as any threats to the health or safety of the occupant. There is no defined procedure for selecting which homes receive the in-process review, and there is no set number of homes that must be visited each year. However, the implementer reported that these types of reviews occur at approximately 25% of homes visited in the program. They also note that they prioritize homes for in-process review that will likely receive follow-on or air or duct sealing work, or those homes where the assigned auditor requires assistance.[58] The procedures for determining and conducting in-process reviews are not documented, and the RHA database does not track which projects receive this type of review.

(4) CMC Data Entry Review. CMC staff reviews data entered into the RHA database after site visit completion. More specifically, staff reviews the RHA "jump screen," where an icon is displayed next to each section of the application with a colored light indicating where the system has flagged

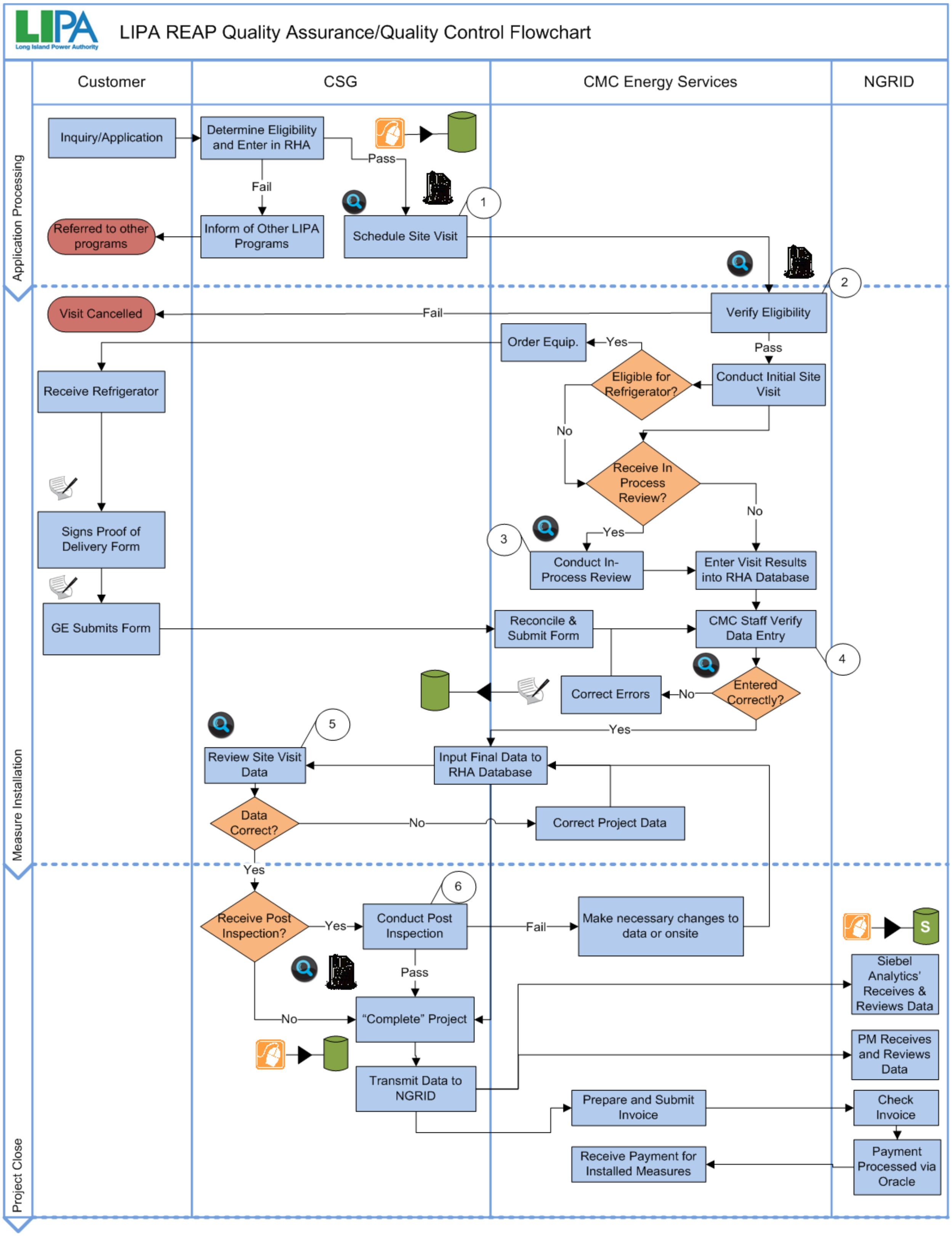
[58] This is determined during the screening process when CSG determines if the customer is a homeowner and has central air.

potential inconsistencies within the data (e.g., a green icon indicates that there are no inconsistencies and data is entered correctly). If there are issues identified on this screen, staff members will review those portions of the application data in greater detail to determine what the issue is. Based on this review, staff reviews database entries and makes appropriate changes as needed. Given that the paper documents completed on-site are not collected and stored for every project, staff does not check every field in the database against the hard copy forms. Overall, there is no defined procedure for reviewing entries, and there is no documentation, including expectations related to the timing of this step's execution, for this QA/QC step.

(5) CSG Data Review. Upon receipt of project data from CMC, CSG staff reviews the project data for all submitted projects. As part of this review, CSG confirms that all measures are eligible under the program guidelines. The CSG program coordinator confirms that the participation agreement form is signed by the customer, the health and safety form is complete for direct install projects, and the proof of delivery form is complete for projects with refrigerator replacement. Any errors are highlighted and CMC is notified to make the appropriate changes. There are no formal timelines documented for this step and interviews with program staff indicate that there are no concerns around the speed with which this review takes place. This procedure is not currently documented for REAP. However, the program manager indicated that the procedures used match those implemented for the Home Performance Direct and Home Performance with ENERGY STAR® programs also administered by CSG. Documentation of procedures for those programs is located in the *"Summary of CSG's Quality Assurance Administrative Review Process & Field Inspection Procedures for LIPA's Home Performance with ENERGY STAR® and Home Performance Direct Programs, 2012."*

(6) Post-Installation Inspection. CSG performs a series of targeted post-installation inspections after the initial site visit. CSG prioritizes projects where there is any question about the validity of the data provided by CMC, or if the subcontractor performing the inspection is new to the program. This procedure is not currently documented for REAP. However, the program manager indicated that the procedures used match those implemented for the Home Performance Direct and Home Performance with ENERGY STAR programs also administered by CSG. Documentation of procedures for those programs is located in the *"Summary of CSG's Quality Assurance Administrative Review Process & Field Inspection Procedures for LIPA's Home Performance with ENERGY STAR® and Home Performance Direct Programs, 2012."* Project data finalized as a result of the inspections are documented in the RHA and Siebel databases. In addition, while the program goal is to conduct these inspections as soon as possible after project completion, there are no documented requirements for how quickly the visits must be scheduled and completed.

Figure 12-27. LIPA REAP QA/QC Flowchart



12.7 Residential New Construction Program

Due to the size of the program and the limited contribution to the overall portfolio savings, process evaluation of the Residential New Construction program was not performed in 2011.

12.8 Solar Photovoltaic (PV) Program

LIPA's Solar PV program (Solar Pioneer and Solar Entrepreneur) has the following five quality assurance procedures at each step of program implementation.

(1) Initial Application Review. Upon receipt of an application, LIPA Rebate Processing staff reviews the application for completeness and accuracy. LIPA Solar PV program staff verifies both customer and equipment eligibility based on the applicable program requirements (Solar Pioneer and Solar Entrepreneur) listed on the application. The clerk inputting the application uses a checklist to make sure that all the proper documents and information are included.

> *Equipment Eligibility* – The program requires that all inverters are on the New York State Public Service Commission (NYS PSC) certified equipment list and that all solar panels are UL approved. When reviewing the application, the Rebate Processing staff calculates the system size by evaluating it in LIPA's Solar Clean Power Estimator, which is available on LIPA's website. When a system meets the requirements listed above, the system's characteristics are sent to National Grid's Power Asset Management (PAM), which performs a technical review to ensure that it can be integrated into LIPA's electrical distribution grid. Finally, the LIPA Rebate Processing staff ensures that all proposed systems meet a minimum efficiency level. The proposed system must have an expected output of at least 80% of the same system optimally oriented south with a 34-degree tilt.

> *Customer Eligibility* – The Rebate Processing staff confirms that the customer has an electric account with LIPA by verifying the customer name and account number supplied on the application. The Rebate Processing staff also verifies that the customer has not met the kW limit (i.e., 10 kW for residential, 50 kW for commercial), and that they are installing only up to 105% of their previous year's annual kWh usage.

If the application review or PAM review is missing information, the Rebate Processing staff notes this in Siebel, which will generate an email that is sent to the appropriate customer contact. In case of a missing email address, a letter is prepared manually and sent to the appropriate customer contact. When the status is changed to "Missing Info," the "Application on Hold" checkbox will be checked and the "Reason on Hold" field will be automatically populated. These steps, performed on all applications, are detailed in the *"Request for Program Tracking Data (Solar Pioneer Program)"* document and the *"Siebel Training Doc – Solar Automation"* document.

(2) Document Verification. After the Rebate Processing clerk and PAM perform their application reviews, the Rebate Processing Manager reviews the application and supporting documentation. Assuming the application and supporting documentation are complete, the Rebate Processing department sends a pre-approval letter to the customer and contractor (if applicable). These steps, performed on all applications, are detailed in the *"Request for Program Tracking Data (Solar Pioneer Program)"* document. Upon receipt of the electrical certificate, rebate Processing notifies M&T to perform the meter inspection and installation.

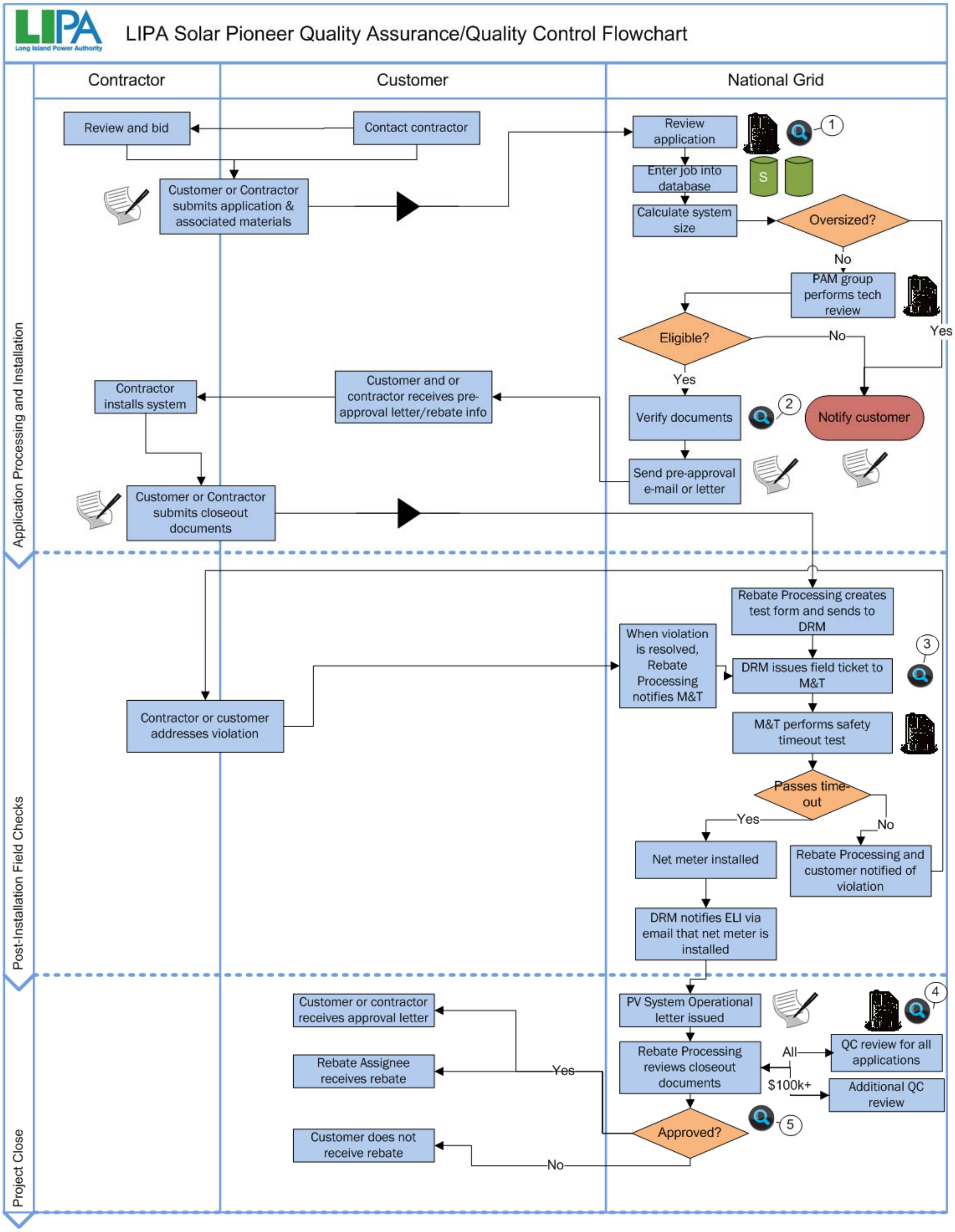
(3) Installation Verification. National Grid's Meter and Test (M&T) department performs an installation verification prior to installing the customer's net meter. M&T verifies the make and model of the inverters installed and the quantity of solar modules. M&T also performs a safety timeout (Loss of Utility) test to ensure functionality of the system. The information collected and

verified is entered on the *"Inspection Form."* If the equipment is verified and the system passes the timeout test, then the net meter is installed; if not, M&T informs Rebate Processing of the violation and sends notification to the appropriate customer/contractor contact. These steps, performed on all applications, are detailed in the *"Request for Program Tracking Data (Solar Pioneer Program)"* document

(4) Review of Closeout Documents. After the net meter is installed, the Rebate Processing department reviews the project's closeout documents to verify that they contain the proper documentation and that the equipment on the application was actually installed. This information is entered into Siebel. The clerk and Rebate Processing Manager review the application and rebate before the payment is sent and the application is closed. Results of the rebate processing review and approval are recorded as an activity in Siebel. The activity contains the name of the person who entered it, the result of the activity, and the time stamp. These steps, performed on all applications, are detailed in the *"Request for Program Tracking Data (Solar Pioneer Program)"* document

(5) Manager Review and Approval. Projects receiving rebates of $100,000 or more receive an additional QA/QC procedure. For these rare large projects in the Solar PV Program, the Director of LIPA Program Strategy must check program information and be the authorizing signature before the application is approved and forwarded to Accounts Payable. This management review step is common to LIPA's entire ELI portfolio. Results of this quality check step and approval are recorded as an activity in Siebel. The activity contains the name of the person who entered it, the result of the activity, and the time stamp.

Figure 12-28. LIPA Solar Pioneer QA/QC Flowchart



Key – PAM: Power Asset Management, DRM: Distributed Resource Management, M&T: Meter & Test, ELI: Efficiency Long Island

12.9 Solar Hot Water Program

LIPA's Solar Hot Water program has the following three quality assurance procedures at each step of program implementation.

(1) Application Review. Upon receipt of an application, LIPA Rebate Processing staff verifies both customer and equipment eligibility based on the applicable program requirements listed on the application and enters the information into Siebel. The clerk inputting the application uses a checklist to make sure that all the proper documents and information are included.

> *Equipment Eligibility* – The program requires that all SHW systems are UL-certified and listed in the Solar Rating and Certification Corporation's (SRCC) OG-100 directory.
>
> *Customer Eligibility* – The Rebate Processing staff confirms that the customer has an electric hot water account with LIPA by verifying the customer name and account number supplied on the application. Eligible customers must be billed under one of the following residential billing codes: Rate 183 (Water Heating[59]), Rates 480 or 481 (Off-Peak Rate), Rates 880 or 882 (Water and Space Heating with Resistant Heat), or Rates 881 or 883 (Water and Space Heating with a Heat Pump).

In addition to the completed application, the customer or contractor must supply the following:

- The SRCC collector rating sheet
- A block system diagram listing the components of the system
- A satellite map view of the installation address
- All required permits (including a copy of the completed plumbing certificate)
- Pre- and post-installation photos of the system as well as photo of electric hot water heater
- An itemized paid invoice for all system components

In addition, the system must be installed with a south, southeast, or southwest orientation

If the application review is missing information, the Rebate Processing staff notes this in Siebel, which will send an automatic email to the appropriate customer/contractor contact. When the status is changed to "Missing Info," the "Application on Hold" checkbox will be checked and the "Reason on Hold" field will be automatically populated. These steps, performed on all applications, are similar to the Solar PV program and are detailed in the *"Request for Program Tracking Data (Solar Pioneer Program)"* document and the *"Siebel Training Doc – Solar Automation"* document. Every project undergoes this step.

(2) Post-Installation Inspection. After the Rebate Processing department performs the application reviews, the project may be chosen for post-inspection. The Solar Hot Water program staff performs these inspections. Because the program only had three applications in 2011, all installations were inspected. The Application Installer Checklist notes that "LIPA will conduct selected post inspections at staff's discretion to verify SHW systems meet siting and installation criteria."

LIPA Solar Hot Water program staff visit projects receiving post-inspection. The staff, along with installer verifies the number of SHW collectors installed and their orientation. The inspection also verifies correct panel installation, the type of controls and temperature monitoring, and the type of plumbing. A post-inspection checklist is completed.

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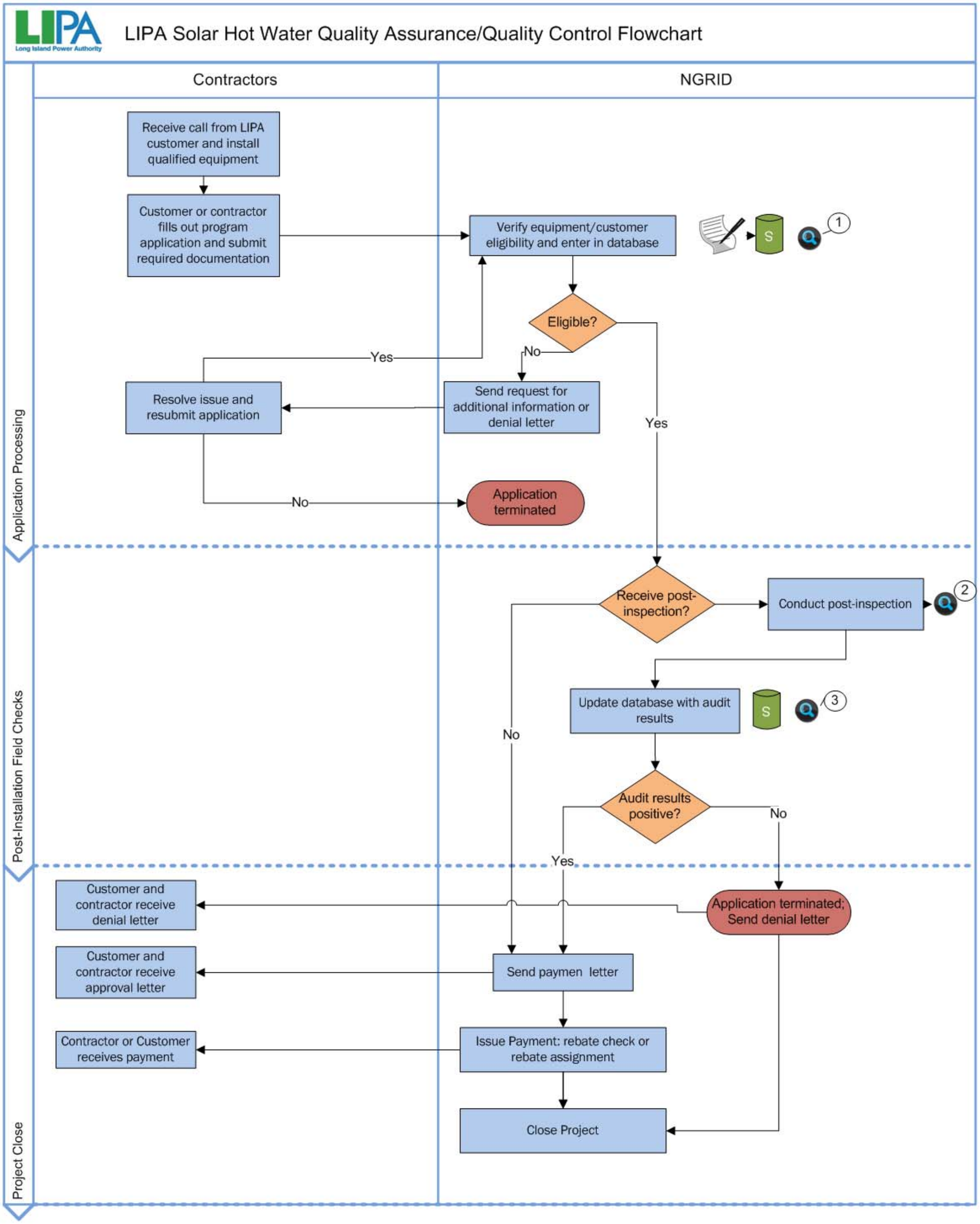
[59] Rate 380 is to be added in 2012.

(3) Rebate Processing Review and Approval. Once the final project documentation is received and uploaded in Siebel and post-inspections, if applicable, are performed, the Rebate Processing team reviews the application documentation for completeness, and updates the project status in Seibel. The Rebate Processing department then sends the customer or contractor a payment letter and issues the rebate payment. Results of the rebate processing review and approval are recorded as an activity in Siebel. The activity contains the name of the person who entered it, the result of the activity, and the time stamp. Every project undergoes this step.

Figure 12-29. LIPA Solar Hot Water QA/QC Flowchart



12.10 Backyard Wind Program

LIPA's Backyard Wind program has the following five quality assurance procedures at each step of program implementation.

(1) Initial Application Review. Upon receipt of an application, LIPA Rebate Processing staff reviews the application for completeness and accuracy. LIPA Backyard Wind program staff verifies both customer and equipment eligibility based on the applicable program requirements listed on the application. The clerk inputting the application uses a checklist to make sure that all the proper documents and information have been submitted. This checklist is also available for the customer's reference on LIPA's website.

> *Customer and Site Eligibility* – The Rebate Processing staff confirms that the customer has an electricity account with LIPA by verifying the customer name and account number supplied on the application. The Rebate Processing staff also verifies that the customer is installing only up to 105% of their previous year's annual kWh usage.
>
> *Equipment Eligibility* – The program requires that all inverters are on the New York State Public Service Commission (NYS PSC) certified equipment list and that all wind systems are UL approved and are part of LIPA eligible equipment list. Applications must include an interconnection agreement form, a "one-line" diagram (listing the components) of the wind system, expected performance-based analysis and production graphs, a site survey, and a signed installer contract. When a system meets the requirements listed above, the Rebate Processing department sends the system's characteristics to National Grid's Power Asset Management (PAM). PAM performs a technical review to ensure that the system can be integrated into LIPA's electrical distribution grid and creates a Parallel Generation Agreement (PGA). Rebate Processing then sends the pre-approval letter to the customer and contractor.

If the application review or PAM review is missing information, the program staff sends a "Missing Info" letter and email to the customer and contractor to collect this information.

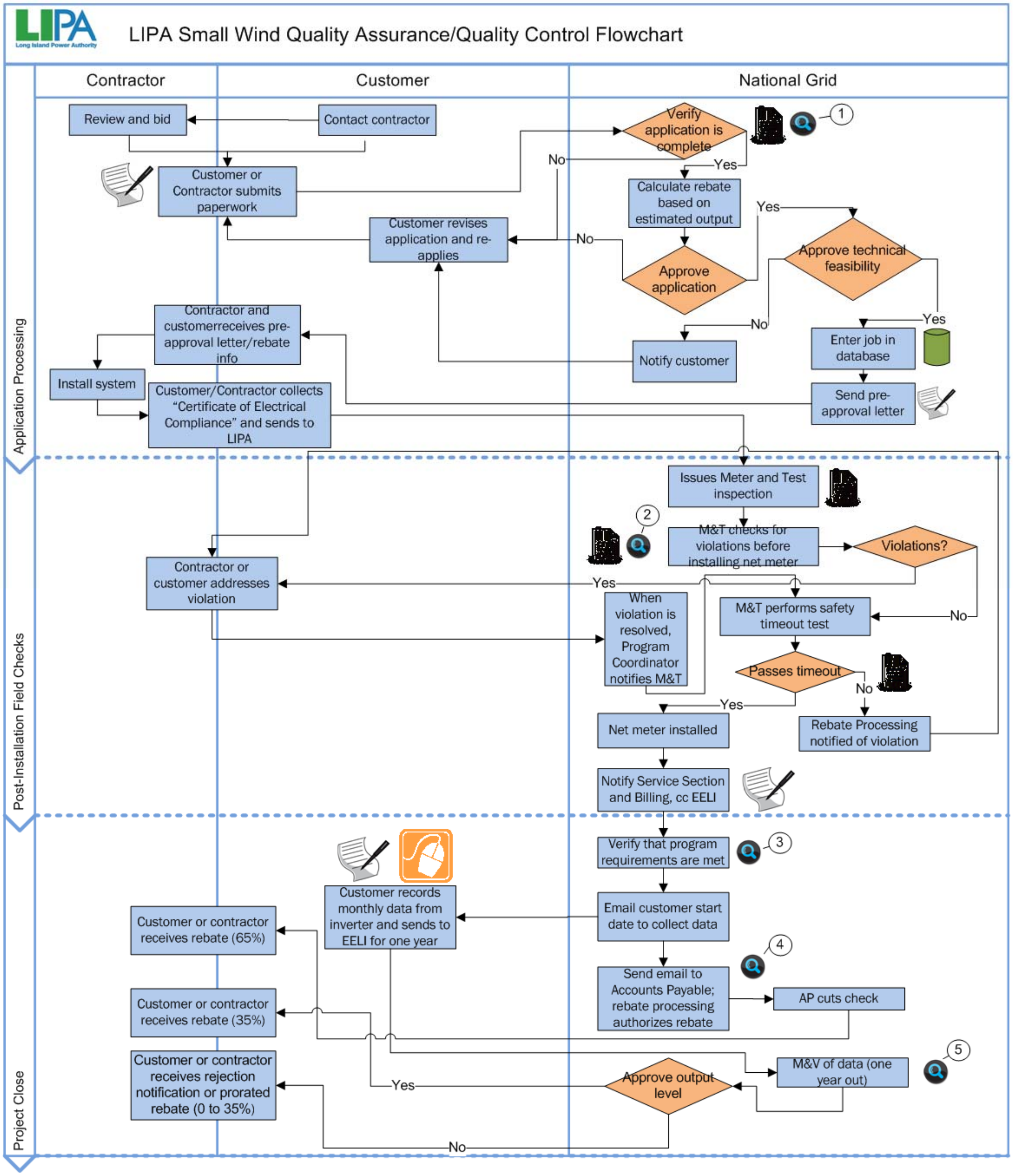
(2) Net Metering Verification. After the contractor installs the system, National Grid's Meter and Test (M&T) department installs the net meter. To install the net meter, the customer/contractor must first collect the "Certificate of Electrical Compliance" from an electrical inspector and send it to the Rebate Processing department. The Rebate Processing department then issues a net M&T form. National Grid's M&T department performs an installation verification prior to installing the customer's net meter. They verify the make and model of the inverter and turbine generator installed. M&T also performs a safety timeout (Loss of Utility) test to ensure functionality of the system. The information collected and verified is entered on the "Inspection Form." If the equipment is verified and the system passes the timeout test, then the net meter is installed; if not, M&T informs Rebate Processing and the customer of the violation.

(3) Review of Closeout Documents. After installing the net meter, the Meter and Test department notifies rebate processing, who then notifies the Service Section and Billing department. The Rebate Processing collects the invoices from the customer or contractor and reviews these closeout documents to verify that they contain the proper documentation and that the equipment on the application was actually installed. These documents include the customer's taxpayer identification number, if applicable; the before and after pictures of the site; relevant permits; and other required documentation identified on the application checklist. The clerk and Rebate Processing Manager then review the application and rebate before the payment is sent.

(4) Manager Review and Approval. Projects receiving rebates of $100,000 or more receive an additional QA/QC procedure. For these rare large projects, the Director of LIPA Program Strategy must check program information and provide the authorizing signature before the application is approved and forwarded to Accounts Payable. This management review step is common to all of LIPA's ELI portfolio.

(5) Measurement and Verification of Output. Upon successful review of the closeout documents, customers receive 65% of the approved rebate and the program claims 100% of demand savings and 65% of energy savings. The customer's monthly kWh data is recorded from the inverter and sent to the LIPA Backyard Wind program for 12 months following installation, usually by the contractor or manufacturer but sometimes by the customer. The program performs random field checks to verify the inverter readings, although this is not formalized. At the end of the 12-month period, if the normalized recorded kWh output level matches that of the calculated output, the customer receives the remaining 35% of the rebate amount. If the normalized actual output is less than the calculated output, the program provides a prorated share of the 35%.

Figure 12-30. LIPA Backyard Wind QA/QC Flowchart



13. DETAILED METHODS

13.1 Data Collection

13.1.1 Overview of Data Collection

This report documents the findings from the 2011 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 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 13-1 lists the primary data collection efforts associated with the evaluation of each program.

Table 13-1. Primary Data Collection Efforts in 2011 Evaluation

Program	Data Collection Type				
	In-Depth Interviews		Telephone Survey	On-site M&V	Delphi Technique – Focus Group
	Program Managers	Retailers / Contractors	Participants		
CEP – Custom	X	X	X	X	
CEP – SBDI	X		X		
CEP – Prescriptive / Existing Retrofit	X	X	X		
EEP - ARP	X		X		
Cool Homes	X	X	X		X
HPD / HPwES	X		X		
REAP	X				
ENERGY STAR New Homes	X				
Solar Pioneer	X	X	X		X
Solar Entrepreneur	X	X	X		
Solar Thermal	X				
Backyard Wind	X				

Quantitative Telephone Surveys

We used quantitative telephone surveys to gather structured data from relevant populations to support the 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 Quality Assurance/Quality Control (QA/QC) protocols possible to all quantitative data sets prior to analysis.

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.

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

On-site Measurement and Verification

To capture the impacts from the custom program that has significantly different measures across the projects, we performed on-site M&V. Our M&V follows the standards set out in the International Protocol for Measurement and Verification Performance (IPMVP). This protocol provides specific guidance on spot metering and short-term metering as well as how the evaluation team should use these types of data.

Focus Group (Delphi Technique)

Data collection from a small group of market experts within a structured setting allows for exploration of themes and concepts not available through in-depth interviews. Participants can hear what their peers are saying and respond in real time. The use of a Delphi technique brings an even more structured approach and attempts to arrive at consensus around difficult issues or to forecast what could happen given current knowledge. In our case, we used the Delphi technique to cast backwards and attempt to determine what may have occurred absent the LIPA program.

Program-Specific Sample Designs

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

For 2011, we conducted surveys with program participants for only some of the programs evaluated. Because of the focus on the data flow, we performed surveys with only those programs where we were again capturing net-to-gross values.

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).[60]

- The **response rate** is the number of completed interviews divided by the total number of potentially eligible respondents in the sample. Response rates can vary substantially and often are different for different populations. The response rates for the surveys we conducted for this evaluation are similar to those of other surveys conducted in the energy evaluation industry.
- 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 agreed to complete an interview out of all of the participants who answered the telephone and heard our request for an interview.

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

Commercial Program

Participant Survey

The Commercial Efficiency program evaluation included two surveys with program participants – one with participants of the Prescriptive, Custom, and Existing Retrofit program components, the other with the participants of the Small Business Direct Install program component. The need to conduct two separate surveys was driven by inherent differences in program design and implementation. Both surveys were designed to support net-to-gross assessment and process evaluation.

We conducted sampling for the participant survey at the level of the project contact, rather than the project. This was necessary because a single contact can be listed for multiple projects across the same or multiple facilities. Research needs called for questions about a specific project, which might represent a significant burden on respondents who appear as contacts for more than one project.

Respondent inclusion in the sample frame was driven by availability of a phone number and presence of contact information for a project decision-maker at a customer company (as opposed to a contractor). LIPA's program tracking database lacked phone numbers for a considerable number of contacts. Furthermore, there were cases where contractor contact information was listed instead of customer contact information. That resulted in considerable data cleaning and manipulation effort. All cases identified as contractors were removed from the sample frame. We supplemented contact information from the program tracking database with contact information from LIPA's CAS system using account number as a unique identifier.[61] As a result of data manipulations, 13 projects were dropped from the sample frame of 1,690 projects because they had no contact information associated with them.

Considering that a survey with SBDI program participants needed to be a separate effort, the evaluation team developed two sample frames, assigning contacts overlapping between the two sample frames to the SBDI sample frame.[62] In cases where a single contact was responsible for more than one project, we used the following rules in assigning a project to ask the respondent about in a survey:

- For the SBDI component, we assigned projects to a respondent on a random basis due to little variation in project kWh savings.
- For the Prescriptive, Existing Retrofit, and Custom program components, we asked respondents who completed multiple projects about the project that resulted in the highest savings. We did this to capture as many savings in the sample as possible to support rigorous net-to-gross assessment.

[61] Note that this also included searching and supplementing contact information for projects where contractor was listed as the contact.

[62] Note that there was only one respondent who overlapped between the two sample frames.

Given the sample frame size of the SBDI program component, the evaluation team conducted a census attempt, completing a total of 29 interviews with the SBDI program participants.

As for the Prescriptive, Existing Retrofit, and Custom program components, to best support estimation of the net-to-gross ratios, the evaluation team used a stratified random sampling approach using the Dalenius-Hodges technique to determine appropriate stratum for each sample frame and the Neyman allocation method to obtain optimal samples by strata. Through this approach, we stratified all projects by savings into four different strata: Stratum 1: small savers (<50,0001 KWh); Stratum 2: medium savers (50,001-150,000 KWh); Stratum 3: large savers (150,001-1,400,000 KWh); and Stratum 4: certainty stratum (1,400,001 kWh+). We attempted census efforts with all strata but Stratum one. We attempted all due diligence efforts to reach every single customer within those strata, including using alternative contact information listed in LIPA's program tracking database or CAS system and requesting LIPA's cooperation in reaching the needed customers.

As a result of the survey efforts, we completed surveys with 92 Prescriptive, Existing Retrofit, and Custom program components and 29 interviews with the Small Business Direct Install program components.

The table below presents an overview of the sample design. As seen in the table, the resulting sample frame for the SBDI program component consisted of 50 unique customers, and the sample frame for the Prescriptive, Existing Retrofit, and Custom program components consisted of 796 unique contacts.

Table 13-2. Commercial Efficiency Program Sample Design

Program Component	Original Number of Applications		Sample Frame (Based on Unique Phone Numbers)		Sample		Completed Interviews	Response Rate	Cooperation Rate
	N	%	n	%	n	%	n		
Prescriptive, Existing Retrofit, and Custom program components	1,636	97%	796	94%	217	45%	92	18%	45%
Small Business Direct Install program component	54	3%	50	6%	159	33%	29	62%	81%
Total	**1,690**	**100%**	**846**	**100%**	**487**	**100%**	**121**		

Given the stratified nature of the sampling approach, survey data needed to be weighted for the process evaluation purposes. The table below shows the shares of the four strata in the population, the sample, and the resulting weighting factors. Note that, despite making all due diligence efforts to reach the certainty stratum contact, we were unable to do so, and therefore excluded the stratum from the weighting scheme.

Table 13-3. Prescriptive, Existing Retrofit, and Custom Survey Process Weights

Stratum	Population (Contacts)	Survey Respondents	Weight
Stratum 1	78%	64%	1.21
Stratum 2	14%	23%	0.60
Stratum 3	8%	12%	0.64
Total	**100%**	**100%**	

The SBDI survey data did not require any weighting, either for process or for net-to-gross estimation due to the census attempt.[63]

Trade Ally Interviews

As part of the 2011 Commercial Efficiency program evaluation, we conducted 10 interviews with participating trade allies using the convenience sampling approach. Program staff provided us with a Siebel extract of participating trade allies as well as a list of preferred trade allies to contact. The goal of the trade ally research was twofold and included assessment of program influence on the trade ally activity, which later served as an input into the NTG algorithm, as well as assessment of program implementation processes. We conducted interviews with a variety of trade ally types, including equipment vendors, installation contractors, distributors, and ESCOs/energy consultants. The size of the interviewed trade allies, their area of expertise (e.g., lighting, HVAC, etc.) as well as commercial sectors they were working with ranged. The level of the trade ally activity with the program in 2011 ranged from 94,000 kWh to 2.2 million kWh in ex post savings.[64]

Program Staff Interviews

As part of the 2011 Commercial Efficiency program evaluation, we conducted in-depth interviews with a total of five program staff members at National Grid, Solution Provider, and Lime Energy. The interviews were designed to support two core components of the process evaluation – understanding programmatic changes made to the program in 2011 as well as understanding quality control and assurance procedures employed by the program to ensure data accuracy. Most of the interviews that we conducted were iterative. That is, we spoke with program staff more than once.

M&V Site Visits and Engineering Desk Reviews

The evaluation team used site visits to determine ex post savings estimates associated with Custom projects and desk reviewed to determine ex post savings for the Small Business Direct Install 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 project size (ex ante impacts) to obtain 90/10 statistical precision. In addition, because a great number of

63 Aside from weighting each individual NTG ratio by project savings for which this ratio was reported.

64 Based on the program tracking data provided to us.

the projects completed in 2011 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 October 2011 as the sample frame for the phase one sample. We used the population of custom projects completed from November through December 2011 as the sample frame for the phase two sample.

We performed engineering desk reviews of the population of 54 Small Business Direct Install projects. This approach was needed, because data was stored in Siebel as attachments and savings were calculated outside of Siebel. For Existing Retrofit projects, due to the way the savings were calculated and due to the volume of projects completed in 2011, desk review of the population of projects was not feasible. We therefore pulled our sample by energy savings to be sure we captured both large and small sites, but applied a straight realization rate back to the population based on the realization rate of total savings across the measures found in our engineering review.

All evaluation that includes sampling has inherent levels of uncertainty in the estimates based solely on the fact that we are only assessing a portion of the population[65]. We can calculate this sampling error using the variability of savings seen from a probability-based sample design. In this type of design, each item in our sample frame has equal probability of being chosen for inclusion in our sample and being further assessed. However, certain sample designs require larger numbers to be included in the sample to reach the level of certainty desired. The Dalenius-Hodges technique is a statistical technique that provides optimal stratification of a population to enable reduction in sample size while maintaining statistical precision.

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. We detail this process below.

Determination of Strata Boundaries

The Dalenius and Hodges method begins with the creation of numerous and narrow strata. Within each strata, the frequency of coupons within each strata, f(y), is calculated. Next, the square root of f(y), $\sqrt{f(y)}$, is calculated and the cumulative of $\sqrt{f(y)}$ is formed. The total of cumulative $\sqrt{f(y)}$ is then divided by the number of desired strata to determine the division points on the cumulative $\sqrt{f(y)}$ scale.

The above rule assumes equal widths *d* for the class intervals, and it must be modified when the class intervals have variable widths d_y. The approach recommended by Kish[66] is to multiply the f(y) by the width the interval, take the square root of this value, and cumulate the values $\sqrt{d_y f(y)}$. Finally, as in the above case, the total of cumulative $\sqrt{d_y f(y)}$ is then divided by the number of desired strata to determine the division points on the cumulative $\sqrt{d_y f(y)}$ scale.

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[65] We note that all evaluation contains levels of uncertainty, some of which can be calculated (e.g., sampling error, measurement error for engineering instruments) and some which cannot (e.g., nonresponse in surveys).

[66] Kish, L. (1995). *Survey Sampling.* Wiley Classics Library Edition.

Optimal Allocation

Once strata boundaries have been determined, an allocation scheme is used which estimates the population mean with the lowest variance for a fixed total sample size n under stratified random sampling. Such a scheme is the Neyman allocation as described in Cochran[67].

$$n_h = n \frac{N_h s_h}{\sum N_h s_h} \quad (1)$$

where N_h = the total number of units in stratum h

n_h = the number of units in the sample of stratum h

n = the total number of units in the sample across all strata

s_h = the variance within stratum h

This formula for optimal allocation may produce an n_h in some stratum that are larger than the corresponding N_h. This problem can arise in the plan for the verification of rebate program savings since the overall sampling fraction is large and some strata are much more variable than others. If the original allocation gives, for example, a n_1 that is greater than N_1 then equation 1 is revised as follows:

$$n_h = (n - N_1) \frac{N_h s_h}{\sum_{2}^{L} N_h s_h} \quad (2)$$

If the original allocation gives, for example, an n_1 that is greater than N_1 and an n_2 that is greater than N_2 , then equation 2 is revised as follows:

$$n_h = (n - N_1 - N_2) \frac{N_h s_h}{\sum_{3}^{L} N_h s_h} \quad (3)$$

Using this approach, the sample design provides statistically valid impact results at the 90% confidence level +/- 8% for the custom projects overall for energy.[68]

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67 Cochran, W. G. (1977). *Sampling Techniques* . Hoboken: John wiley & Sons, Inc.

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

Table 13-4. CEP Custom Projects Sample Design - Energy

Stratum	Boundaries (kWh)	Total Ex Ante Savings (kWh)	Projects in Population[a]	Projects in Sample	Expansion Weights for Realization Rates (Population / Projects in Sample)
Phase 1 – M&V Sites (sample drawn from Jan to Oct 2011 participants)					
1	<140,001	9,967,045	256	5	51.2
2	140,001-1,400,000	12,572,523	41	5	8.2
3	1,400,0001+	2,261,036	2	2	1
Total		24,800,604	299	12	
Phase 2 – M&V Sites (sample drawn from Oct through Dec 2011 participants)					
1	<250,001	3,722,106	42	5	5.25
2	250,001-1,400,000	4,382,473	10	3	3.33
3	1,400,001+	4,483,657	3	3	1
Total		55	55	11	
Existing Retrofit					
1	<40,001	7,171,955	141	13	NA
2	40,0001-350,000	15,460,134	188	20	NA
3	350,001+	1,927,301	3	3	NA
Total		24,559,390	332	36	

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

We cannot sample by both energy and demand within the same sample. After discussion with LIPA at din the early phases of the evaluation process, we chose to sample on energy, to align with the sample design in the previous two evaluations and because there was a possibility of insufficient demand values available to the team when we needed to draw our sample. However, to account for the fact that we drew the sample on energy, not on demand, we created new strata for demand based on the ex ante demand savings from the 23 sampled sites and show these in Table 13-5. The statistically valid impact results for demand were 90% confidence level +/- 19%, a value that is almost twice as wide as we originally planned[69].

[69] This was partly due to analyses that did not have sufficient information around summer peak demand for cooling sites. Our analysis occurred in the winter and extrapolated our available data into the summer through modeling of occupancy patterns provided by the site.

Table 13-5. CEP Custom Projects Sample Design - Demand

Stratum	Boundaries (kW)	Total Ex Ante Savings (kW)	Projects in Population[a]	Projects in Sample	Expansion Weights for Realization Rates (Population / Projects in Sample)
Phase 1 – M&V Sites (sample drawn from Jan to Oct 2011 participants)					
1	<16	917	258	4	64.5
2	16-250	3,238	41	8	5.13
Total		**4,155**	**299**	**12**	
Phase 2 – M&V Sites (sample drawn from Oct through Dec 2011 participants)					
1	<50	721	44	7	6.29
2	50-500	1,918	10	4	2.75
Total		**2,639**	**55**	**11**	

Because this is precision level is higher than expected, after conferring with LIPA, we did not apply the estimated ex post savings for demand on the custom projects based on our M&V, but used a gross realization rate of 1.0. Given the desired precision level for energy, we based our energy savings on the M&V site information. We will pull additional sample and go back into the field in the summer of 2012 to collect additional information on demand for these sites as well as include additional sites to improve our precision. Additionally, because the LIPA database has improved and LIPA is focused on demand, we will pull the custom M&V sites by demand in the future. This may improve the precision of the estimates.

After sample selection, we obtained project application documents to provide background information on the measure(s) installed within each custom project application, as well as their ex ante savings calculations. For site visits, we sent selected customers notification letters and then contacted them by phone to recruit participation in the M&V process. We conducted 23 site visits between December 2011 and March 2012.

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.

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. 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, using case weights from the sample design, and combined the two sample frames to obtain overall program impacts.

We used the ratio adjustment method[70] to extrapolate results for each site back to the overall CEP population. Figure 13-1 shows the algorithm we used to extrapolate to the population.

Figure 13-1. Ratio Adjustment Algorithm

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

Where

I_{EP} = the ex post population impact
I_{EA} = the ex ante population impact
I_{EPS} = the ex post impact from the sample
I_{EAS} = the ex ante impact from the sample
I_{EPS} / I_{EAS} = Realization Rate

There are background algorithms that are used as part of the ratio adjustment algorithm that we describe next. To obtain the phase specific realization rate, we use the following algorithm:

$$Realization\ Rate = \sum_{i=1}^{n} \frac{Ex\ Post\ Savings_i * W_{si}}{Ex\ Ante\ Savings_i * W_{si}}$$

Where:

W_{si}=expansion weight for strata I (shown in tables above)

$Savings_i$ = project values for sampled projects

Once we obtain the realization rate, we calculate the standard error, error bound, and relative precision, as shown next.

$$e_i = Ex\ Post\ Savings_i - (Realization\ Rate * Ex\ Ante\ Savings_i)$$

$$Standard\ Error = \sqrt{\frac{W_{si}(W_{si} - 1) * e_i^2}{\sum_{i=1}^{n} Ex\ Ante\ Savings_i * W_{si}}}$$

$$Error\ Bound = 1.645 * Standard\ Error$$

$$Relative\ Precision = \frac{Error\ Bound}{Realization\ Rate}$$

To pull together the two samples and arrive at a single precision for the population, we use the following algorithm:

$$Relative\ Precision\ Across\ Both\ Samples - \frac{\sqrt{Error\ Bound_1^2 + Error\ Bound_2^2}}{\sum_1^2 Ex\ Post\ Savings_i}$$

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

Residential Programs

Cool Homes

Participant Survey

The Cool Homes 2011 evaluation included a telephone survey with 142 program participants. For this effort, we oversampled early retirement participants compared to their percentage in the population to allow for sufficient data points for statistical analysis. We completed interviews with 71 participants who received a rebate for the early retirement of a central air conditioner or heat pump, and 71 participants who participated through the standard program offering (non-early retirement).

There were 31 applications where one individual received a rebate for more than one piece of equipment (.7% of the population). We removed these cases from the sample frame. The Cool Homes database does not contain customer phone numbers. As a result, we used the 2011 CAS customer dataset to match in phone numbers based on LIPA numbers. We were able to match 99% of participant population to the CAS data. Given the importance of demand savings (kW) for the Cool Homes program, we set quotas by measure type proportionate to their contribution to gross KW savings in their program strata. From the final sample frame, we then drew a random sample by each measure type proportional to their gross demand energy savings.

Table 13-6. Sample Design for Cool Homes Participant Survey

Program	Measure	Ex Ante Gross kW	Population	Sample Frame	Planned Completes	Actual Completes
Early Retirement	Split CAC Early Retirement	90%	1,177		63	64
	Air Source Heat Pump Early Retirement	10%	160		7	7
	Sub-Total		1,143		70	71
Standard Offering (Non-Early Retirement)	Split CAC Non-Early Retirement	69%	2,073		48	49
	Ductless Mini-Split	11%	766		8	8
	Furnace Fan	2%	344		2	2
	Air Source Heat Pump Non-Early Retirement	4%	137		3	2
	Geothermal	14%	115		10	10
	Sub-Total		3,435		70	71
Total			4,578		140	142

Note: There were a few applications that included more than one type of measure; the totals from the database application thus may be more than the total number of unique applications.

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. For the process-related questions, we developed a weighting scheme based on participation levels for each program component.

Table 13-7. Cool Homes Process Weights

Program Component	Population %	Survey Completes %	Weight
Early Retirement	28%	50%	.56
Non-Early Retirement	72%	50%	1.44

The evaluation team decided to focus NTGR research only for split system central air conditioners (CACs). For the analysis of free ridership based on customer information, we used a savings-weighted approach. The weight for each program stratum corresponds to its share of ex ante gross savings in the CAC population. Table 13-8 summarizes ex ante gross energy impacts and KW weights, by program channel.

Table 13-8. CAC Free Ridership Weights for the Participant Survey

Program	Ex Ante Gross kW Impact	kW Weights
Early Retirement CAC	4,001	0.66
Non-Early Retirement CAC	2,052	0.34
Total	6,053	

Non-Participant Survey

For the 2011 evaluation, we completed 70 telephone interviews with nonparticipants. The evaluation team utilized a random sample of 3,006 LIPA customers. We screened out Cool Homes participants to ensure we spoke with LIPA customers who had not participated in the program.

Contractor Survey

The Cool Homes evaluation included a quantitative survey of 32 participating HVAC contractors. We received the original list of 134 contractors from LIPA. Table 13-9 provides the total participating contractor population before dropping records.

Table 13-9. Contractor Survey Sample Frame

Cool Homes Contractors	N	n
Participating Contractors is 2011	134	
No Split CAC System Applications	21	103
No Contact information	10	93
Total Contractors in Sample Frame		93

The survey included only those contractors who submitted applications for split system central air conditioning installations. Ultimately, we attempted a census of our final sample frame, which consisted of 93 contractors.

Cognitive In-Depth Interviews

As part of the evaluation of LIPA's Cool Homes Program, we conducted 10 cognitive in-depth interviews with 2011 participants who received a rebate for purchasing either a split system central air conditioner or a ductless mini split system. We used a purposeful sample to reach customers who live in affluent areas on Long Island. We felt it necessary to reach this target population to understand better a) their drivers and motivations in purchasing energy efficient equipment, and b) to test our program attribution module to determine whether these questions were understood and that our free ridership algorithm appropriately captures these respondents' "story."

Distributor Interviews

As part of the 2011 Cool Homes evaluation, we conducted four interviews with distributors who have knowledge of the Long Island Market. Cool Homes program staff provided us with names and contact information for various distributorships.

Contractor Focus Groups

Opinion Dynamics fielded a quantitative telephone survey with 32 participating Cool Homes contractors in early 2011[71]. As part of this study, we asked respondents if they were interested in participating in a future focus group. Initially, we focused our recruitment on this list of interested contractors, but expanded recruitment to all participating contractors to reach our attendance goals. Ultimately, we held two focus groups – the evening of October 5, 2011 with six contractors and the morning of October 6, 2011 with seven contractors.

Both focus groups consisted of participating contractors, with Cool Homes Program-related activity levels ranging from one contractor who submitted one project in 2011 to a contractor who was responsible for more than 150 projects in 2011.

Home Performance Programs

Participant Survey

The 2011 Home Performance program evaluation included a telephone survey with 140 program participants. The survey included completed interviews with 70 participants in the Home Performance Direct (HPD) program and 70 participants in the Home Performance with ENERGY STAR (HPwES) program. We fielded the participant surveys between March 5 and March 8, 2012. The survey response rate for HPwES was 13% with a cooperation rate of 49%. For HPD, the survey response rate was 9% with a cooperation rate of 47%.

We based the sample of Home Performance participants on the program tracking files that LIPA provided,[72] 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 2,148. The total number of completed interviews for both HPD and HPwES provide results at 90% confidence and 10% precision.

Table 13-10. Home Performance Participant Survey Sample Design

Program	Database Population[a]	Sample Frame	Completed Interviews
HPD	903	1,221	70
HPwES	669	927	70
Total	1,572	2,148	140

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

The evaluation team conducted an unweighted analysis of both the HPD and HPwES survey data.

[71] This survey was part of the annual evaluation of the 2010 program year.

[72] The main data file contained participants through October 31, 2011.

EEP

The EEP program includes upstream incentives for lighting products, room air conditioners, and televisions; downstream rebates for energy efficient appliances and pool pumps; and a refrigerator recycling program component. In addition to in-depth interviews with program managers, the evaluation team conducted two participant surveys focused on net-to-gross, a literature review, interviews with local municipalities and appliance retailers regarding appliance recycling, and QA/QC qualitative and quantitative analyses.

Dehumidifier Net-to-Gross Participant Survey

The 2011 EEP program evaluation included a telephone survey with 71 Dehumidifier program participants. We drew the sample frame from LIPA's full-year participant data. Of the 7,547 unique 2011 participants in the program tracking data[73], we removed 101 contacts because of missing or invalid phone numbers (see Table 13-11). From this sample frame, we drew a simple random sample of 1,000 participants. The sample size of 71 completed interviews provides results at 90% confidence and 10% precision.

Table 13-11. Dehumidifier Program Participant Survey Sample Design

Database Population [a]	Sample Frame	Sample	Completed Interviews
7,547	7,446	1,000	71

[a] Includes only unique participants that received a $20 rebate. One hundred forty-four participants were removed because they received the previous year's rebate amount of $10.

We fielded the dehumidifier participant survey from February 13-15, 2012. The survey response rate was 10% with a cooperation rate of 43%.

Refrigerator Recycling Net-to-Gross Participant Survey

The EEP program 2011 evaluation included a telephone survey with 140 Refrigerator Recycling program participants. We used LIPA's full year of 2011 participation data, containing 10,218 unique participants[74] to construct the sample frame. 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.

Participants are only permitted to recycle two appliances in a given year. For sampling purposes, we removed four participants that had been recorded as recycling three appliances (under the assumption that these are database errors) – resulting in a sample frame of 10,214. From this sample frame, we drew a stratified random sample of 250 participants that recycled one or more refrigerators and 250 participants that recycled one or more freezers (see Table 13-12). To limit the survey burden placed on respondents, interviewers asked respondents about only one appliance. For those participants that recycled both a refrigerator and a freezer, we randomly selected one of the two appliances and asked them to focus on just that appliance when answering the survey questions. 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.

[73] The database we received from LIPA, and used to draw the sample for the dehumidifier participant survey contained 7,547 participants who purchased 7,547 dehumidifiers and received a $20 rebate.

[74] The database we received from LIPA, and used to draw the sample for the refrigerator recycling participant survey, contained 10,218 unique participants who recycled a total of 10,936 appliances.

We completed 140 total interviews with 70 interviews that focused on refrigerators and 70 that focused on freezers resulting in a 90% confidence and 10% precision level for each appliance type. The total sample size of 140 provides results at 90% confidence and 10% precision.

Because we interviewed equal numbers of refrigerator and freezer participants, freezers are overrepresented in the combined results. When presenting overall program results, we apply a survey weight so the results represent the population proportion of refrigerators and freezers.

Table 13-12. Refrigerator Recycling Program Participant Survey Sample Design

	Database Population	Sample Frame (Assigned Survey Appliance)	Sample (Assigned Survey Appliance)	Completed Interviews	Survey Weight
Refrigerator	8,857	8,853 (8,692)	271 (250)	70	1.69
Freezer	1,690	1,688 (1,522)	255 (250)	70	.31
Total [a]	**10,218**	**10,214**	**500**	**140**	

[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 refrigerator recycling participant survey between February 29 and March 5, 2012. The survey response rate was 31% with a cooperation rate of 62%.

13.2 Analytical Methods

The evaluation team used a variety of analytical methods to generate the 2011 findings. Table 13-13 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 13-13. Primary Analytical Methods used in 2011 Evaluation

Program	Qualitative analysis of in-depth interviews/ Delphi group	Quantitative Telephone Surveys	Descriptive statistics (means, frequencies, etc.)	Billing Analysis	Engineering Review of Algorithms	Engineering Desk Review of Custom Projects	On-site M&V of Custom Projects
	Process/ Impact	Process/ Impact	Process/ Impact	Impact	Impact	Impact	Impact
CEP	X	X	X		X	X	X
EEP		X	X		X		
Cool Homes	X		X		X		
HPwES / HPD		X			X		
REAP	X			X	X		
New Homes	X				X		
Solar PV	X				X		
Solar Thermal					X		
Backyard Wind					X		

The remainder of this section describes key analytic approaches used to develop the findings presented throughout the report.

Net-to-Gross Analysis

One objective of evaluation of energy efficiency programs 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, often indicated as an NTGR when regression modeling does not occur, 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.

Spillover contains two parts – participant and nonparticipant spillover. Participant spillover refers to specific energy efficient installations or behaviors taken because of the program, but outside of the program (e.g., the customer did not receive an incentive from a program). Participants could choose to take additional efficient actions because they realized they could save money from such an action or they may have realized that non-monetary benefits can occur (such as a quieter home for double pane windows). The program brought about a change in their thoughts such that they sought out and performed actions that saved additional energy. Nonparticipant spillover refers to specific energy efficient installations or behaviors taken by non-participating customers because of the program, but the customer did not interact directly with the program. For example, the program may perform substantial marketing of high-efficient lighting. This marketing was seen (or heard) by the customer and made an impression such that they chose to change out their lights. This customer may or may not have realized that specific incentives were available, but they made the change without directly participating in the program.

Evaluators have typically estimated net impacts 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 for use within a statistical regression of billing data can be a difficult, if not impossible, process. For example, program participants often have substantial differences from the nonparticipant population (e.g., socioeconomic variables, attitudes, and behaviors), and the nonparticipant population is still often exposed to program marketing and outreach, making it more difficult to find a true, "uncontaminated" baseline. We often use two sets of participants separated in time for our billing analyses, which helps with this issue.

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.[75] 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.

- 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 early 2012, and thus contacted most respondents within 12 months of program participation.
- 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. We screened customers to ensure that they were aware of program participation.
- 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
- 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.
- 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,

[75] 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.

rather than the full algorithm, to limit the burden and potential survey fatigue on the respondent.

- **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.
- **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.
- **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 because 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).
- **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 LIPA program, but the program induced them to install the equipment earlier than they would have otherwise. That is, LIPA accelerated the timing of the equipment installation. Once again, the telephone surveys probed for a timing effect.
- **Scoring Algorithms** As discussed below, the telephone survey used a scoring algorithm to assign each respondent a unique free ridership score.
- **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.
- **Weighting the NTGR.** We utilized NTGR weights, based on the expected energy savings, where appropriate (e.g., we weighted responses regarding the freezer and refrigerator recycling measure based on the respective energy savings of each measure).
- **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.
- **Precision of the Estimated NTGR.** We selected all sample sizes so that the SRA would provide estimates with 90% confidence and 10% precision.
- **Pre-Testing Questionnaire.** We pre-tested all surveys prior to fielding and took this a step further in 2011 with a cognitive interview of Cool Homes customers.
- **The Incorporation of Additional Quantitative and Qualitative Data in Estimating the NTGR.** For dehumidifiers, all HPwES measures, and HPD lighting, we used the SRA. For all other NTG values we calculated as part of the 2011 evaluation (central air conditioners, Solar PV, appliance recycling, and all commercial customers), we included supplemental approaches, including focus groups, trade ally interviews, and secondary research.
- **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, 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. For the trade ally interviews and the cognitive interviews, we used our analytic staff to be sure we captured all nuances of the discussion and could expand on the conversation as needed.

Measure Selection and Algorithms for Net-to- Gross Analysis

The 2011 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.

Commercial Efficiency Program

The Commercial Efficiency program accounted for a large portion of energy and demand savings in LIPA's energy efficiency program portfolio. Estimation of net impacts (through estimation of NTGR), therefore, was an important component of this year's evaluation. We developed two separate NTG algorithms for 1) Prescriptive and Custom program components[76], and 2) the Small Business Direct Install program component.

Prescriptive and Custom Program Components

For the Prescriptive and Custom program components, we conducted research to quantify participant free ridership and establish the presence of participant spillover. We did not complete research or assess nonparticipant spillover. As such, the program component NTGR is calculated as:

NTGR= 1 - Free ridership + Participant Spillover

Free Ridership – Program Participants

Program free riders are program participants who would have implemented the incented energy efficient measure(s) in the absence the program. Free ridership values provide a measure of the degree of program influence on a participant's decision to install energy efficient equipment and range from 0 (full program influence) to 1 (no program influence). These estimates are based on a series of questions that explore the influence of the program in making the energy efficient installations as well as likely actions had the incentive not been available. For the majority of both prescriptive and custom projects included in the survey, we developed a free ridership factor that consists of three concepts: overall influence, influence of program components, and influence of program on timing.[77] The concepts are indexes of customer responses to multiple questions. Each of these concepts received equal weighting in the calculation. Note that we do not present the questions as ordered in the survey, but by concept.

Overall influence. Two survey questions combine to help us determine overall influence. One question asks respondents to rate the importance of the program compared to the importance of other factors in their decision to implement the energy efficient equipment. To do so, we asked respondents to divide 100 points between program and non-program factors. This score is equal to the number of points given to the program.

We asked respondents the following question:

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[76] These components include Prescriptive, Prescriptive Retrofit, Custom, and Custom Retrofit projects.

[77] This algorithm is based on the basic rigor self-report method used in California.

N3p If you were given a TOTAL of 100 points that reflect the importance in your decision to install the <ENDUSE> equipment, and you had to divide those 100 points between: 1) LIPA's Commercial Efficiency program and 2) other factors not related to LIPA's program, such as payback requirements, corporate policy, or standard practice, how many points would you give to the importance of the PROGRAM?

Another question asked if respondents had learned about the program before or after they decided to implement the energy efficient equipment rather than standard efficiency equipment. This is a key question, since if the customer had already decided to install high-efficient equipment and then learned of the program, the influence of the program on their decision is small. We asked respondents the following question:

N1 When did you first learn about LIPA's Commercial Efficiency Program? Was it BEFORE or AFTER you decided to install HIGH efficiency <ENDUSE> equipment as opposed to STANDARD EFFICIENCY equipment?

If respondents learned about the program *after* deciding to install energy efficient equipment, the value from question NP3 is halved. For example, if a respondent gave the program 70 points out of 100, the first component of the overall influence score would be 70. If that same respondent said they learned about the program before they decided to implement the energy efficient equipment, their score would remain 70. However, if they said they learned about the program *after* they decided to implement the energy efficient equipment, their score would be divided in half and equal 35. If the customer learned about the program after deciding to install the same efficient equipment, we do not reduce their score to zero (meaning no influence) as we understand that there can be several influences at play that the customer may be unaware of.

Influence of program components. This index includes scores from a series of seven questions. These questions asked respondents to rate the importance of seven program components, on a scale of 1 to 7 (where 1 is not at all important and 7 is very important):

N3 Next, I'm going to ask you to rate the importance of various factors that might have influenced your decision to install the high efficiency <ENDUSE> equipment. Specifically, I am interested in factors that influenced you to select HIGH EFFICIENCY equipment options as opposed to less efficient options. Please use a scale from 1 to 7, where 1 means "not at all important" and 7 means "extremely important."

- b Availability of the Commercial Efficiency PROGRAM incentive
- c Information and equipment recommendations provided through the technical assistance you received from LIPA or one of its energy efficiency partners – National Grid or TRC
- f Recommendation from LIPA's program staff person, National Grid, or TRC representatives
- h Information from LIPA's marketing and outreach activities. This might include information received from LIPA in seminars and conferences, from LIPA's website, from printed materials, or from other sources
- k Endorsement or recommendation by LIPA's account manager
- q Information and equipment recommendations provided through the initial project scoping meeting that you had with LIPA, National Grid, or TRC

r Information and equipment recommendations provided through LIPA's audit or consult

We include specific choices to reflect the LIPA program. This score is equal to the highest rating given to any one of these components. Greater importance of the program components means lower level of free ridership. In this case, if a respondent rated the program rebate 5 out of 7, the recommendation of program staff 7 out of 7, and the information from program marketing and outreach activities 3 out of 7, the final Influence of Program Components score would be a 7 (the highest of all the scores given).[78]

Influence of program on timing. The score for this concept is based on three questions. We asked respondents about the likelihood that the exact same equipment would have been installed without the program (on a scale of 1 to 7, where 1 means "not at all likely" and 7 means "very likely"):

N5 Using a likelihood scale from 1 to 7, where 1 is "Not at all likely" and 7 is "Extremely likely", if LIPA's Commercial Efficiency program had not been available, what is the likelihood that you would have installed exactly the same equipment?

We followed up with all respondents who gave this question a rating other than 1 to determine when they may have installed the equipment:

N7 You indicated earlier that there was a <N5 RESPONSE> in 7 likelihood that you would have installed the same equipment if the program had not been available. Without the program, when do you think you would have installed this equipment? Would you say at the same time, earlier or later?[79]

If respondents reported that the installation would have been done later, we asked how much later they would have performed the installation:

N7a How much later would you have installed this equipment? Would you say within 6 months, 6 months to a year later, 1 to 2 years later, 2 to 3 years later, 3 to four years later or 4 or more years later?

This score takes the response to the likelihood question and adjusts this value by the responses to the timing questions. A greater likelihood of participating without the program means a higher level of free ridership. Later implementation without the program means a lower level of free ridership.

For example, if the participant says they would have installed the same equipment at the same time, they are considered a full free rider for this part of our net-to-gross index. If they likely would have installed the equipment but would have done it later, they are considered a partial free rider and the influence of the program is higher. Information about how much later helps us to assign a free ridership value. If the customer would not have installed the same equipment until four years later, we do not consider them a free rider for this component of the net-to-gross index (i.e., the program is given full influence on the timing of the installation).

[78] Note that for the final calculation of the free ridership score, we adjusted the ratings given on a 1 to 7 point scale to be representative of 100%.

[79] Note that the response option "never" was also available to respondents, but was not read to them as part of the survey question.

Each score can take on a value of 1 to 7, where a higher score means a lower level of free ridership.[80] Once free ridership is calculated, we take the complement to obtain the NTGR. The overall net-to-gross factor for a project is the average of the three scores. The net-to-gross factor for each project thus ranges from 0 (100% free ridership) to 1 (no free ridership).

Due to survey length issues and need to eliminate survey fatigue, the participant survey focused on the decision-making process within a single project. To capture a higher percentage of savings with the survey effort, we asked survey respondents who completed additional projects through the program in 2011 whether the decision-making process for those projects was the same or whether each project went through its own decision-making process:

> Our records show that <COMPANY> also received an incentive from LIPA for <QUANTITY> other <ENDUSE> project(s).
>
> N26/N27 Was it a single decision to complete all of those <ENDUSE> projects for which you received an incentive from LIPA or did each project go through its own decision process?

Projects that underwent the same decision-making process were included in the NTG and were assigned the same score as the core projects respondents were asked to focus on in the survey.

Due to the stratified random sampling approach, NTG values were derived for each of the three sampling strata, with the final NTG score being a weighted average of the three scores.[81] Individual NTG scores within each stratum were weighted by ex-post kWh savings resulting from the end-use respondents were asked about in the survey.

An NTGR was then applied to the population gross impact to obtain a net impact of the program before any spillover was included.

Participant Spillover

Participant spillover refers to energy efficiency installations that took place without program assistance but that were influenced by participants' prior experience with the program. An example of participant spillover is a customer who installed equipment in one facility and received a rebate from the program and, as a result of the positive experience with the program, installed additional equipment at other facilities without a program incentive.

In addition to assessing free ridership, the evaluation team sought to assess the potential presence of participant spillover attributable to the Prescriptive and Custom program components. For the prescriptive, existing retrofit, and custom components, questions directed at the estimation of net-to-gross ratios and process-related questions were already a significant burden on respondents[82]. Quantifying participant spillover, however, requires capturing additional information, such as quantities, efficiency, usage patterns, etc. Given the incremental time required to capture this additional information, we decided to focus on assessing presence of participant spillover across various end uses with the goal of quantifying it during the next evaluation cycle if we found presence of participant spillover. With this goal in mind, we set

[80] Note that for the final calculation of the free ridership score, we adjusted the ratings given on a 1 to 7 point scale to be representative of 100%.

[81] Weighted by a sum of ex post kWh within for each of the strata.

[82] The call time averaged 17 minutes per interview.

specific response levels that must have been met before asking additional questions. Only if a customer met all the conditions did we ask the full spillover battery.

While this evaluation did not specifically quantify spillover, prior evaluations of similar commercial programs indicate that participant spillover typically ranges from 0 to 2% of total evaluated savings.

We assessed the presence of participant spillover for the following end uses:

- Lighting
- Cooling
- VFDs
- Kitchen Equipment
- Compressed Air Equipment

We asked respondents an additional set of questions aimed at capturing the presence of participant spillover for "other" end-use categories.

We asked respondents if they made any program-qualifying improvements outside of the program:

SP1a Since you completed the <ENDUSE> project, did you install…?

a. any additional ENERGY EFFICIENT equipment at THIS facility that did NOT receive incentives through LIPA's Commercial Efficiency Program?

b. any additional ENERGY EFFICIENT equipment at OTHER facilities in LIPA's service territory that did NOT receive incentives through LIPA's Commercial Efficiency Program?

If respondents gave a positive answer to either one of the above questions, we followed up by asking if they installed any of the specific end uses. For each end use, respondents said they installed, we asked the following questions:

SP2b Why did you purchase this equipment without getting an incentive through LIPA's Commercial Efficiency Program?

Respondents who said that equipment did not qualify or that they did receive an incentive were skipped to the next survey module. If they were not skipped, we determined the influences of the LIPA program on their choice to install the high efficiency equipment.

SP2c How much did your experience with LIPA's Commercial Efficiency Program influence your decision to install the energy efficient equipment that you ended up installing? Please use a scale from 1 to 7 where 1 means no influence and 7 means great influence.

Respondents who gave the influence of the program a rating of less than 5 were skipped to the next survey module. If they were not skipped, we queried them about what they installed.

SP2d What types of energy efficient equipment did you install without getting an incentive through LIPA's Commercial Efficiency Program?

Net-to-Gross Augmentation through Trade Ally Research

According to the program staff, LIPA's Commercial program used a variety of marketing and outreach tactics to engage trade allies with the program in 2011. Those outreach activities included contractor breakfasts, weekly contractor meetings, and, in the second half of 2011, contractor incentives. Through those outreach activities, contractors could have been exposed to and trained on new energy efficient equipment options, ways to sell and promote energy efficient options to customers, etc. As such, there is a concern that assessment of net-to-gross solely through participant research will not credit the program for influences not visible to customers, primarily outreach to trade allies.

To address this concern, we use the following method to ascribe additional attribution due to trade ally activity. Our method was based on the concepts of attribution prior to assigning any scores from our interviews.

Attribution from LIPA's intervention with the trade ally network is based on two components; 1) setting the maximum possible increase using participant data and 2) determining how much of that maximum possible increase can be attributed to the program using trade ally data.

Setting the Maximum Possible NTG Increase

Based on participant research, we have determined the minimum possible free ridership value, assuming that trade ally influence resulted in non-free-rider projects. To achieve the maximum score, free ridership scores for participants who rated the importance of their contractor/vendor on the selection of energy efficient equipment as 6 or 7[83] AND who said that their contractor/vendor either identified equipment for the project or identified an opportunity for the program incentive were set to 0% (i.e., non-free-riders). The difference between the minimum free ridership score and the initial free ridership score was used as a maximum percent adjustment that trade ally influence can result in.

Determining NTG Increase

Based on our interviews with trade allies, we captured information around four core areas that we believe are essential to ascribing trade ally attribution:

Trade ally knowledge of the programs*.* The trade ally must be knowledgeable about LIPA's program to ascribe attribution to the program.

PI2. How knowledgeable do you consider yourself about LIPA's Commercial Efficiency program and its offerings? Would you say very knowledgeable, somewhat knowledgeable, not very knowledgeable, or not at all knowledgeable? [PROBE FOR KNOWLEDGE OF PROGRAM ELIGIBILITY REQUIREMENTS, INCENTED EQUIPMENT OPTIONS, INCENTIVE LEVELS, PARTICIPATION PROCESS, ETC.]

Trade ally interactions with the program. The trade ally must have had interactions with LIPA's program to ascribe attribution to the program.

PI3. In 2011, how frequently did you have interactions with LIPA's staff (that can be LIPA, National Grid, TRC or Lime Energy staff)? What types of interactions did you have with LIPA staff? [PROBE TO QUANTIFY FREQUENCY – ONCE OR TWICE A MONTH, ONCE OR TWICE EVERY COUPLE OF MONTHS, ETC.] [PROBE TO UNDERSTAND IF THEY ARE PROJECT RELATED OR NON-PROJECT RELATED INTERACTIONS]

PI4. Did you attend any training sessions, meetings or events, both formal and informal, facilitated by LIPA's Commercial Efficiency program in 2011 or before? [PROBE FOR BREAKFAST SESSIONS, CONFERENCES WHERE LIPA HAD PRESENCE, ETC.]
[IF YES]

[83] On a scale from 1 to 7, where 1 is not at all important and 7 is very important.

a. What kind of training did you receive? [PROBE SPECIFICALLY ABOUT TRAINING ON PROGRAM DESIGN AND PARTICIPATION PROCESSES, TRAINING ON HOW TO PROMOTE ENERGY EFFICIENCY TO CUSTOMERS, TRAINING ON HOW TO LEVERAGE PROGRAM INCENTIVES TO SELL EQUIPMENT]

b. Did you find trainings informative? Why? Why not? What did you learn during those meetings?

PI5. Do you remember receiving any marketing or promotional materials or any ongoing communications from LIPA in 2011?
[IF YES]
a. What did you receive? [PROBE FOR BROCHURES, CASE STUDIES, TOOL KITS, NEWSLETTERS, ETC.]
b. How often did you receive those materials? [PROBE TO QUANTIFY FREQUENCY – ONCE OR TWICE A MONTH, ONCE OR TWICE EVERY COUPLE OF MONTHS, ETC.]
c. Do you provide any of these materials to your customers?

PI6. Did you receive ANY OTHER information or support from the program that either improved your ability to sell energy efficiency to customers or improved your overall knowledge of energy efficient equipment options? If so, what support did you receive?

Program influence on trade allies. The trade allies must have indicated that the program influenced their ability to sell high-efficient projects or they must have indicated a change in practices since participation in the program.

PI7. What influence, if any, did LIPA's Commercial Efficiency Program had on your ability to sell energy efficient equipment options, as opposed to standard efficiency options to customers?

M1. In what percent of sales situations do you recommend high efficiency products to your customers?
a. [IF NOT 100%] When you don't recommend high efficiency products, what are the reasons?

M2. Has the frequency with which you recommend high efficiency equipment changed since you became active with the program? How? [IF NEEDED CLARIFY: BECOMING ACTIVE WITH THE PROGRAM MEANS STARTING TO INTERACT WITH PROGRAM STAFF AND/OR WORK ON PROJECTS THAT APPLIED FOR LIPA INCENTIVES]
<u>If change noted:</u>
a. How influential was LIPA's Commercial Efficiency program in this change? [PROBE FOR SPECIFIC PROGRAM COMPONENTS: INCENTIVES, TRAINING, PROGRAM WEBSITE, OTHER PROGRAM COMPONENTS.]
b. How influential are other factors not related to the program? What are these other factors? [PROBE FOR TAX CREDITS/GOVERNMENT REBATES, GENERAL EE AWARENESS, CHANGE IN CODES OR STANDARDS.]

M3. What percentage of all of your commercial and industrial projects in LIPA's service territory in 2011 involved energy efficient equipment?

a. Of these energy efficiency projects, approximately what percentage would qualify for incentives from LIPA's Commercial Efficiency program?

M4. You just told me that about ___% of your projects involve high efficiency equipment. How does this percent compare to before you became active in the program? In other words, do more of your sales involve high efficiency equipment now that you are active in the program? [IF NEEDED CLARIFY: BECOMING ACTIVE WITH THE PROGRAM MEANS STARTING TO INTERACT WITH PROGRAM STAFF AND/OR WORK ON PROJECTS THAT APPLIED FOR LIPA INCENTIVES]

<u>If increase:</u>

a. How influential was LIPA's Commercial efficiency program in this change? [PROBE FOR SPECIFIC PROGRAM COMPONENTS: INCENTIVES, TRAINING, PROGRAM WEBSITE, OTHER PROGRAM COMPONENTS.]

b. How influential are other factors not related to the program? What are these other factors? [PROBE FOR TAX CREDITS/GOVERNMENT REBATES, GENERAL EE AWARENESS, CHANGE IN CODES OR STANDARDS.]

M4a. Has the share of projects that you complete in LIPA's service territory increased, decreased or stayed the same since you became active in LIPA's Commercial Efficiency program?

a. How influential was LIPA's Commercial efficiency program in this change? [PROBE FOR SPECIFIC PROGRAM COMPONENTS: INCENTIVES, TRAINING, PROGRAM WEBSITE, OTHER PROGRAM COMPONENTS.]

b. How influential are other factors not related to the program? What are these other factors? [PROBE FOR TAX CREDITS/GOVERNMENT REBATES, GENERAL EE AWARENESS, CHANGE IN CODES OR STANDARDS.]

Trade ally interactions with customers . The trade allies will have some customers that look to them for guidance. Only those customers that can have been influenced by the trade ally are included in this method. If the program influenced the customer directly, the customer battery of questions will pick that up.

M5. Thinking about all of your commercial and industrial customers that participated in LIPA's Commercial Efficiency Program in 2011, which of the following scenarios was most typical for them?

a. The customers installed what you recommend.

b. The customers wanted to work with you to make a decision about what to install.

c. The customer had already selected the equipment and just wanted you to install it.

[PROBE FOR PERCENTAGES.]

Each of these four concepts were given equal weighting in our method and are additive. For each trade ally, we developed an overall influence score ranging from 0% to 100%, with each of the four components described above contributing equally to the score. The final trade ally influence score was a weighted average of individual trade ally scores by known ex post savings that each trade ally contributed to the program in 2011[84] and computed in a way that falls within the range of the maximum percent adjustment.

As stated earlier, the final program NTG ratio will represent the NTG ratio derived through participant research augmented with the trade ally influence ratio.

Small Business Direct Install Component

For the Small Business Direct Install program component, NTG research included quantifying participant free ridership and establishing presence of participant spillover. We did not conduct research into nonparticipant spillover.

Free ridership – Program Participants

The Evaluation Team used participant self-reported data to calculate free ridership associated with the SBDI program component. Because this is a direct install program, we developed a free ridership score comprising two separate concepts rather than the three concepts in the prescriptive and custom program: 1) influence of program components and 2) influence of program on timing and quantity. 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. The average of the scores from these two concepts produces the final free ridership rating for each respondent. The overall SBDI free ridership score is the ex post savings-weighted average of each respondent's rating.

Influence of Program Components. The program can influence installation decisions through several mechanisms. We adapted our set of potential influences to match this program and asked respondents about the influence of five program components:

N2 How important were the following factors in your decision to install the lighting upgrades identified through the Energy Survey? 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 dollar incentive
b. The option to pay in installments
c. That it was easy to participate
d. The information and equipment recommendations provided through Lime Energy's Energy Survey
e. Information from program marketing materials

Identical to our other algorithms, the program component score is based on the maximum rating for any one program component. Greater importance of the program components means a lower level of free ridership.

Influence of program on timing and quantity. The score for this concept is based on three questions. We asked respondents about the likelihood that lighting equipment would have been installed without the program (on a scale of 1 to 7, where 1 means "not at all likely" and 7 means "very likely"):

[84] Note that the program tracking data provided to us does not accurately reflect all savings associated with a specific trade ally.

N3 If you had not participated in LIPA's Small Business Direct Install Program, what is the likelihood that you would have installed any new lighting equipment on your own within the next four years? (Scale of 1 to 7)

We followed up with all respondents who give this question a rating other than 1 to determine program influence on efficiency, quantity, and timing of the lighting equipment they may have installed.

N4 What is the likelihood that the lighting would have been as EFFICIENT, if you had installed it on your own? (Scale of 1 to 7)

N5 What is the likelihood that you would have installed the same QUANTITY of lighting equipment, if you had installed it on your own? (Scale of 1 to 7)

N6 Without the Small Business Direct Install Program, when would you have installed this equipment? Would you say at the same time, within 6 months, 6 months to 1 year later, 1 to 2 years later, 2 to 3 years later, 3 to 4 years later, more than 4 years later?

Based on these three questions, we developed an adjustment factor. The program was given credit if, without the program, the respondent would have: 1) installed less efficient lighting equipment, 2) installed a smaller quantity of equipment, or 3) installed equipment later. The adjustment varies depending on the responses to these three questions. The adjustment factor is set to 0, i.e., no free ridership, if the respondent would have been not at all likely to install equipment of the same efficiency level (N4=1) or would have installed it more than four years later.

Participant Spillover

To assess participant spillover, we asked respondents whether they had taken any energy saving actions without an incentive since participating in the SBDI Program.

SP1 Since you completed the lighting project, did you install any additional ENERGY EFFICIENT equipment that did NOT receive an incentive through LIPA's Small Business Direct Install Program? This could have been at this facility or another facility within LIPA's service territory.

We asked those that reported taking additional actions why they did not receive an incentive from LIPA and how important their participation in the SBDI Program had been in taking the additional energy saving actions.

SP2b/SP3c Why did you purchase this […] equipment without getting an incentive through LIPA?

SP2c/SP3d How much did your experience with LIPA's Small Business Direct Install Program influence your decision to install this energy efficient equipment? (Scale of 1 to 7)

We determined that there is evidence of participant spillover in cases where 1) the participant did **not** indicate that the reason they did not receive an incentive was because the installed equipment did not qualify; and 2) they gave a rating greater than 4 (on a scale of 1 to 7) for the influence their experience with the SBDI Program had on their decision to install additional efficient equipment.

EEP Program - Dehumidifiers

For dehumidifiers, LIPA uses the deemed ex ante NTG value for planning and evaluation. In the 2010 evaluation, we estimated program NTG because dehumidifiers represent one of the EEP program's top contributors to demand savings.[85] In 2011, the rebate amount for dehumidifiers increased from $10 (in 2010) to $20 per unit. By asking participants the same questions as we did for the 2010 evaluation, we were able to determine whether the increased rebate amount changed program free ridership.

Free Ridership

As in the 2010 evaluation, for each survey respondent, we developed an overall free ridership score that consists of three scores: overall program influence, influence of program components, and program influence on timing. 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 the scores from three concepts 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 twenty 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 twenty dollars 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 twenty 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."

Influence of program on timing

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 twenty 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?

[85] After lighting, refrigerator recycling, and room ac, dehumidifiers were the fourth largest contributor to the EEP program's total claimed demand savings in 2011. Dehumidifiers were associated with 705 kW of claimed savings.

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 twenty 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?

Free ridership scores are adjusted downward for purchases made earlier due to the program. The adjustment varies depending on how much earlier the purchase was made. As with many other residential programs, we consider any action that the customer says will occur more than a year out, to essentially not occur and set the free rider value to 0.

Influence of Program Components

The program can influence purchase decisions through several mechanisms: the rebate, retailer training, and marketing materials. There were three main areas of this program where influence may have occurred. If applicable, 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 twenty dollar LIPA rebate
> b. Recommendation from the retailer
> c. Information in any marketing materials

The highest responses to N10 were included in the NTGR scoring.

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

We included Refrigerator Recycling in our NTG assessment, because it represents one of the program's top contributors to demand savings.

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 with their appliance:

- Kept the appliance but stored it unused.
- Kept the appliance and used it.
- Gotten rid of the appliance in a manner leading to its eventual destruction.
- Gotten rid of the appliance in a manner that allows someone else to use the appliance.

Of these scenarios, two of them – appliances kept but stored unused and those discarded in a manner leading to destruction – are initially considered free riders since the refrigerator or freezer would not have continued to consume energy in the 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 how often they would have used it or stored it:

> A5N. Since you would have kept the <SURVEYAPP> had LIPA's Refrigerator Recycling program not been available, how often would the <SURVEYAPP> been plugged in and running? Would it have been running…[Read all]
>
> 1. All the time
> 2. For special occasions only
> 3. During certain months of the year only, or
> 4. Never plugged in or running

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 in some way.

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

06. Placed it on the curb for pickup by the municipal or other local garbage service,
00. Some other way I haven't mentioned [SPECIFY]

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, placed it on the curb to be picked up, or had it removed by the store where they got their new appliance. Based on the interviews we conducted with retailers and municipalities, we determined that given the old age of most appliances, the resale market for such appliances was small and retailers and towns 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 as those appliances would have remained on the grid.

After an initial determination of free ridership, we then adjusted respondent free rider status using several other questions in the survey instrument. We designed these questions to understand:

- if learning about the program spurred interest in recycling an appliance,
- if the program removed an appliance more than a year earlier than it would have been otherwise removed from the grid, and
- if respondents considered other methods too much of a hassle in recycling an appliance so that they likely would not have followed through on their own.

We also considered if the respondent indicated that the recycled appliance was a spare refrigerator or freezer that was replaced, or if the respondent indicated that the reason they chose to utilize LIPA was because the incentive was more than they could get from the retailer where they bought a new or replacement appliance.

We asked all program respondents if they were thinking about recycling an appliance before or after hearing about the program:

A1. When you first heard about LIPA's Refrigerator Recycling Program, were you already considering getting rid of this <SURVEYAPP>? [IF NEEDED: This could have been by selling it, giving it away, having someone pick it up, or taking it to the dump or a recycling center.]

If the respondent answered no to this question, they were not a free rider at this point in our analysis.

Among respondents who said they would have gotten rid of the appliance, we asked when they would have done so in the absence of the LIPA Refrigerator Recycling program:

A6. If LIPA's Refrigerator Recycling Program had not been available, how soon do you think you would have gotten rid of your old <SURVEYAPP>? Would you have gotten rid of it within a year of when LIPA took it, or more than a year later?
1. Within a year of when LIPA took it
2. More than a year later

If the respondent said they would have gotten rid of the appliance more than a year later, they were not a free rider at this point in our analysis.

Also among respondents who said they would have gotten rid of the appliance, those who said they would have gotten rid of it in a manner that would have taken it off the grid were asked why they did not use a method other than the LIPA program:

A7_34. Why didn't you end up taking your <SURVEYAPP> to a dump or recycling center?
[DO NOT READ; MARK ALL THAT APPLY]
01. (Couldn't find someone who could take it for me/Did not want to pay someone to take it for me)
02. (Would have to pay to dispose of it there and did not want to pay)
03. (Was too much hassle/Didn't get around to it/No time to do it)
04. (I could get money for the appliance through LIPA)
00. (Something else) (Specify___________)

A7_6. Why didn't you end up putting your <SURVEYAPP> on the curb for your municipal or local garbage service to pick up?
[DO NOT READ; MARK ALL THAT APPLY]
01. (Did not have help to get the appliance to the curb)
02. (Would have to pay my town to pick it up and did not want to pay)
03. (Was too much hassle/Didn't get around to it/No time to do it)
04. (I could get money for the appliance through LIPA)
00. (Something else) (Specify___________)

If a respondent answered either of these questions with "Was too much hassle/Didn't get around to it/No time to do it," they were not free riders.

We also determined free ridership based on whether or not the respondent replaced the appliance in question with another appliance. We asked:

R1. Did you replace the <SURVEYAPP> that you recycled through LIPA's Refrigerator Recycling Program with another <SURVEYAPP>?
1. Yes
2. No

We considered respondents who recycled spare refrigerators or freezers but replaced them with another one to be free riders. These are respondents who still wanted a spare refrigerator or extra freezer but wanted a newer one. After their participation, they still had a secondary refrigerator or extra freezer.

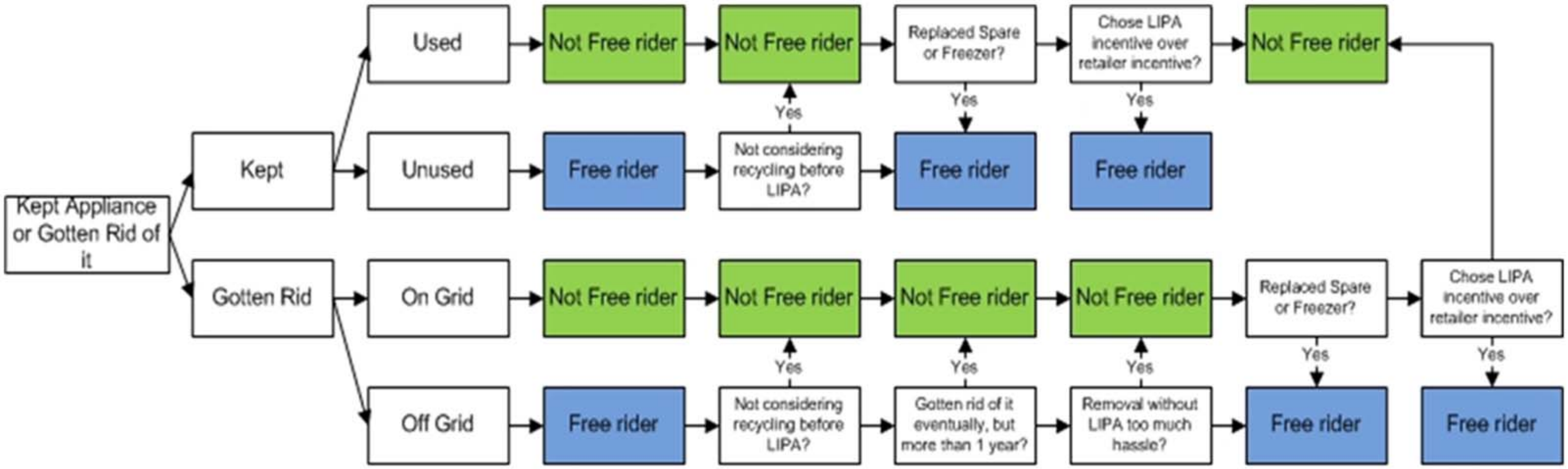
Additionally, we asked respondents who replaced their old appliance with a new one and said they would have had their new appliance dealer remove the appliance without LIPA, why they did not use the dealer:

A7_5. Why didn't you end up having your <SURVEYAPP> removed by the store where you got your new appliance?
[DO NOT READ; MARK ALL THAT APPLY]
01. (Would have had to pay for them to take it and did not want to pay)
02. (I could get money for the appliance through LIPA)
00. (Something else) (Specify___________)

We considered respondents who said they did not have the retailer remove the old appliance because they did not want to pay for removal or LIPA offered them money to be free riders.

Figure 13-2 provides a graphic description of our free ridership algorithm.

Figure 13-2. Free Rider Algorithm



Spillover

To assess spillover, we asked respondents whether they had taken any energy saving actions outside of a LIPA program since participating in the Refrigerator Recycling program. These actions had to be due to their experience with the program. We found no evidence of Refrigerator Recycling program spillover.

EEP Program - Televisions

We did not conduct a formal NTG analysis of the Television program; however, we did complete secondary research that we used to advise LIPA on what an appropriate NTG assumption might be for this program. NTG for this program will come down to a LIPA policy decision, which should be decided with consideration given to the issues that have been raised in other evaluation efforts.

Cool Homes

While our ultimate net-to-gross ratio included several pieces of information, here we describe how we calculated the customer self-report value. The approach is similar to our approach for other programs.

Free Ridership

As in the 2010 evaluation, for each survey respondent, we developed an overall free ridership score that consists of three scores: overall program influence, influence of program components, and program influence on timing. 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 the scores from three concepts produces the final free ridership rating.

Overall Program Influence

The first question asks whether respondents learned about the rebate before or after they decided to purchase the measure included in Cool Homes.

N1. When did you first learn that you could receive a rebate from LIPA for installing a high efficiency <MEASURE>? Was it before or after you had your <MEASURE> installed?

Respondents who learned about the rebate before they purchased the measure were asked the following question to determine overall program influence:

> N3. If the rebate had NOT been available, what is the likelihood that you would have installed the <measure> at all? Please use a likelihood scale from 1 to 7, where 1 is "Not at all likely" and 7 is "Extremely likely."

Influence of program on timing

Respondents who say they would have been likely to purchase the same measure in the absence of the program (i.e., free riders), were asked if the program influenced the timing of their purchase.

> N5a. Did the LIPA rebate cause you to purchase your <MEASURE> earlier than you were planning or did the rebate have no influence on when you purchased it?

Respondents who purchased the measure earlier due to the program were asked when they would have made the purchase if the rebate had not been available:

N5b If you hadn't received the LIPA rebate, when would you have purchased your <MEASURE>? Would you say...(Within 6 months of when you did, 6 months to 1 year later, 1-2 years later, or more than 2 years later)

We adjust free ridership scores downward for purchases made earlier due to the program. The adjustment varies depending on how much earlier the purchase was made. Because a measure purchased within the Cool Homes program is often relatively expensive, we consider any action that the customer says will occur more than two years out, to essentially not occur and set the free rider value to 0. This moves up the scale somewhat from other program actions, when we use a year to differentiate between a non-free rider and a partial free rider.

Influence of Program Components

The program can influence purchase decisions through several mechanisms: the rebate, retailer training, and marketing materials. There were four main areas of this program where influence may have occurred. We asked a question about each:

N6. Now I'm going to ask you to rate the importance of several factors that might have influenced your decision to install a HIGH efficiency <Measure> as opposed to a STANDARD efficiency <measure>. Please use a scale from 1 to 7, where 1 means "not at all important" and 7 means "extremely important." How important was... [Rotate, 1-7; 96=Not Applicable; 98=Don't Know; 99=Refused]

N6a. The availability of the rebate
N6b. Recommendation from your contractor
N6c. Information from the Cool Homes Program or LIPA marketing materials
N6d. Your desire to purchase energy efficient equipment

We included the highest responses to N6a through N65d in the NTGR scoring.

While not part of the algorithm, we also followed up with two open-ended questions so if the respondent provided conflicting information, we could use these pieces of information to determine the best course of action.

N7. Just to make sure I understand, please explain the importance of the rebate on your decision to install your energy efficient <Measure>.

N8. In your own words, can you please explain what motivated you to install an energy efficient <MEAS>? (If respondent says because old unit was broken and needed a new unit – probe for why they chose a HIGH efficiency unit)

Spillover

To assess spillover, we asked respondents whether they had taken any energy saving actions outside of a program since purchasing their Cool Homes measure through the LIPA program. These actions had to be due to their program participation. We found no evidence of program spillover for customers through this survey, although we did provide spillover on QI procedures as described in Section 4.

Home Performance Direct and Home Performance with ENERGY STAR

HPD and HPwES were both important contributors to energy savings within the residential sector and therefore we included them in the NTG assessment.

HPD Free Ridership

For HPD, we focused on CFLs, which are one of the top measures for energy savings in this program. For each survey respondent, we developed a free ridership rating that consists of two scores: overall program influence and program influence on timing and quantity. 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

For CFLs, we first asked respondents a program influence question:

> CN3. If you had not received free CFLs during the home assessment, would you have installed any CFLs on your own?"

Respondents that answered "yes" to this question were considered likely free riders and received an overall free ridership score of 1. Anyone who would not have installed CFLs on their own received an overall free ridership score of 0.

Program Influence on Timing and Quantity

We asked likely free riders as determined by responses to CN3 whether the program influenced the quantity and timing of their 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. Those who would have purchased the same number of CFLs or more, as well as those who would have purchased the bulbs at roughly the same time, were considered full free riders.

HPwES Free Ridership

The HPwES Program has a number of key savings measures, including insulation, lighting, hot water measures, air/duct sealing, and windows/doors. Given that air and duct sealing work accounted for the greatest amount of energy savings, we asked participants who performed air or duct sealing about that measure. If the participant did not perform air or duct sealing, we randomly selected a measure from those they did install. As part of this process, we placed greater emphasis on those measures that contributed more to overall program savings when the participant installed multiple items.

For each survey respondent, we developed a free ridership rating that consists of three scores: overall program influence, program influence on timing, 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

We asked respondents 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 influence of the program:

> 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."

<u>Program Influence on Timing</u>

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?

<u>Influence of Program Components</u>

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 analyzing 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

We assessed spillover for the Home Performance programs 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, we asked respondents if they took any actions, and if so, what these actions were:

> SO2. Since your participation in the LIPA HPD Program, have you made any additional energy saving home improvements for which you did <u>NOT</u> receive a utility incentive or rebates?
>
> SO3. What additional improvements did you make since the assessment to reduce your household energy consumption?

We asked respondents that made improvements to describe, on both an anchored scale and in their own words through an open-ended question, the impact of the program on their decision to make the improvements.

SO4. How much influence did your experience with the LIPA HPD/HPwES 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/HPwES Program influenced your decision to make these additional improvements?

Only respondents that answered a “6” or “7” in terms of program influence, and who did not provide contradictory answers in the open-ended question, were considered candidates for spillover. For each respondent that met these criteria, we quantified the savings from the additional actions, which we then compared to the savings from their program measures. We calculated spillover 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).

REAP Estimation of Savings Using Billing Analysis

In this section, we present the method and results of a billing analysis to estimate program savings for REAP.

Data Preparation and Cleaning

LIPA provided participation and measure data for all customers who participated in REAP from 2010-2011. LIPA also provided a billing history going back 30 months from January 2012 for 2010 and 2011 participants whose account identifier we could verify based on program data. Prior to carrying out the statistical modeling, some matching, cleaning, data QA, and transformations of the data were required. For analysis purposes, we focus primarily on the 2010 participant cohort, but retained 2011 participants as a comparison group, and cleaned 2011 participant and billing records to the same specifications as 2010 participants.

Cleaning Participation Data

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 excluded them from analysis. We drew our analysis sample from Initial Site Visit records available in early February 2012, which included complete 2010 and 2011 participant data.

We cleaned participant and measure data separately for both 2010 and 2011 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 2010 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 the 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 we then rolled up to a unique household level (defined as unique Enrollment ID).

Finally, we merged the measure data set for 2010 participants into the project-level data set. We also merged in measure data for the first six months of 2011 to capture households with initial site visits in late 2010 which may have had measures installed in early 2011. After July 1, 2011, the program implementer changed, so we did not include measure data collected after July 1. We retained for further analysis only those participants whose clean measure data matched cleaned 2010 participant data. After cleaning the measure data, we calculated annual 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 2011 participant 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 for 2011 participants by account number (as data from the new program implementer, CMC, does not contain an enrollment ID) and dropped records with duplicate or incomplete/corrupted account numbers. We used the first installation date as the cut-off for retaining 2011 participant billing records, as this group serves as the comparison group for analysis.

Matching Participant Information with LIPA Account Information

REAP tracks LIPA customer account information with participant records. As a result, we used the customer account numbers provided with participation data to match billing histories to program participants.

Cleaning Billing Data

After merging 2010 and 2011 participants' 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 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 2011 only, we dropped all billing periods occurring after their first installation date, as these 2011 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:** REAP 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 (2000-2009), 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 2010 participants to have a minimum number of billing days in heating and cooling months after program participation. We dropped 2010 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 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

[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 dates 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 there have been 10 heating degree days (65 minus 55 equals 10). Quoted from http://www.srh.noaa.gov/ffc/html/degdays.shtml.

dates). For analysis purposes, we then calculated average daily heating degree days (HDD) and average daily cooling degree days (CDD), based on the number of days within each billing period.

Statistical Method Used

The model we used was a fixed-effects panel model. This type of model allows all household factors that do not vary over time to be absorbed by (and therefore controlled for) the constant term in the equation. This would include such things as square footage, appliance stock, habitual behaviors, household size, and many other factors. Of course, any of these factors can change during the evaluation period and in that case, the effects of those changes would be confounded with the program effects, either artificially increasing or decreasing them. However, these effects are likely to be quite infrequent and would probably be a wash over the sample. The critical things to include in these models are the time-varying factors, including weather.

The evaluation design included a comparison group of customers who participated in the program in the program year of 2011. This model allows us to compare the post-installation billing records of the first group to its own pre-participation records and to the first-year (i.e., 2009) billing records of the second. Those two periods (pre for participants and 2009 for later participants) are contemporaneous.

Selecting a comparison group of later participants means that they are the types of customers who are oriented to participating in an energy efficiency program. This customer orientation (propensity to participate) is often difficult to measure or control for because most variables at our disposal that we might use to control statistically for differences between treatment and comparison groups might not capture the largely unobservable factors that drive people to participate, or to be interested in energy efficiency. Using a comparison group of future participants addresses this problem to a very large degree.

Note that the billing analysis, using a good comparison group, incorporates the effects of both free ridership and spillover. For example, the 2010 energy use for the comparison-group (2011 participants) homes would reflect measures installed that evaluation-period participants would have installed in the absence of the program. In addition, any additional measures evaluation-period participants installed beyond program measures (spillover) would be picked up by an increased coefficient for the participation variables.

The billing analysis we conducted estimated program savings overall and by end use. We fit a number of possible models, primarily considering different interaction terms. One model displayed the best fit, based on the Akaike's Information Criterion (AIC), but it was necessary to remove some interaction terms from that model to reduce multicollinearity, which is always a potential problem in these models. The following equation represents the final model:

$$y_{it}=a_i+B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 +B_5X_5 +B_6X_6 +B_7X_7 +B_8X_8 +B_9X_9 +B_{10}X_{10} + \square$$

where:

y_{it}	=	Average energy consumption per day for home i during month t (ADC)
a_i	=	Constant term for home i
B_1	=	Coefficient for lighting installation
B_2	=	Coefficient for refrigerator installation
B_3	=	Coefficient for HVAC installation
B_4	=	Coefficient for domestic hot water (DHW) installation
B_5	=	Coefficient for cooling degree days
B_6	=	Coefficient for heating degree days (base 65)
B_7	=	Coefficient for CDD x refrigerators
B_8	=	Coefficient for CDD x HVAC

B_9 = Coefficient for HDD x HVAC
B_{10} = Coefficient for HDD x DHW
X_1 = Program installation of lighting measures for home i during month t
X_2 = Program installation of refrigerator for home i during month t
X_3 = Program installation of HVAC measures for home i during month t
X_4 = Program installation of DHW measures for home i during month t
X_5 = Cooling degree days* for home i during month t
X_6 = Heating degree days (base 65) for home i during month t
X_7 = CDD x refrigerator installation
X_8 = CDD x HVAC installation
X_9 = HDD x HVAC installation
X_{10} = HDD x DHW installation
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)

It is important to note that the end-use installation variables used in the billing analysis took on a value of 1 during the period *after* a home received the installation, i.e., excluding the month of the installation. In cases where a participant received multiple installations, the period between the first and last installation was excluded from the analysis by setting them to missing, creating a "dead-band" period. Even if the installations took place within the same billing period, we would not know exactly when the installations took place and, therefore, how many days of the period to consider pre-program and post-program. For situations where installations occurred over more than one billing period, the period between first and last installations would be too short on which to base an estimate of the effect of the first measure separate from the second. The installation variable(s) were set to 0 for all months before installation commenced.

Baseline consumption is a variable that is often important in these models as it represents the household's energy habits. It cannot be incorporated as a main effect in the fixed-effects models because it is constant for each household (it is a mean over the entire pre-program period, so does not change for the models). It is most useful as a part of interaction terms. In other words, the effect of a measure on consumption may be different for different levels of base usage. In this particular analysis, however, the terms involving baseline usage had to be removed due to multicollinearity.

We incorporated the expected savings, based on LIPA's engineering estimates, into the dataset in the appropriate months of participation. Thus, summing these estimates produced the expected savings for each household for each end use and overall.

We "evaluated" the final model with the weather variables set to their means, and the installation variables set at 0 and then 1 to determine the savings estimates for the program overall, weighting each estimate by the number of participants with each measure. We evaluated the model for each end use individually as well, producing savings associated with each end use. This method produces predicted savings under conditions of both participation and nonparticipation, and subtracting the predicted consumption under nonparticipation conditions from the consumption predicted under participation conditions produces estimated savings. It may seem possible to simply observe the coefficients for the program variables and see the savings directly. However, this does not account for the participation variables that are part of interaction terms.

Electric Savings Results

Before doing any modeling, we determined the overall average baseline kWh consumption for the program and comparison groups, and the average daily kWh and CDDs and HDDs for pre- and post-participation time periods for the program group. These figures provide the context for further analyses. Table 13-14 shows the comparison of the pre and post kWh and weather variables for the program group. It shows that the consumption was not significantly different in the post-installation period compared to the pre period. However, the CDD means indicate that the summer was significantly hotter in the post period, which means it is likely that the energy-efficient measures reduced consumption compared to what it would have been without them. However, the HDD means show that the winter was significantly milder in the program period.

Table 13-14. REAP Analysis - Average Values of Key Variables by Time Period for Treatment Group

Variable	Statistic	Period		Significantly Different
		Pre	Post	
Daily kWh	Mean	23.78	23.21	No
	SD	18.93	18.69	
CDD	Mean	2.62	3.79	Yes
	SD	3.69	4.51	
HDD	Mean	15.05	12.81	Yes
	SD	12.42	12.13	

Also of interest is the difference between the program and the comparison group during the baseline period, i.e., the pre-installation period for participants, and the year 2009 for nonparticipants, which is roughly the same period for the two groups. Table 13-15 reveals significantly lower baseline consumption for the comparison group versus the program group.

Table 13-15. REAP Analysis - Baseline kWh by Sample Group

Variable	Statistic	Treatment	Comparison Group	Significantly Different
Baseline kWh	Mean	23.82	22.39	Yes
	SD	15.14	15.06	

Table 13-16 shows the final model. Compared to other models we estimated, this one best fits[88] all the available data. Notably, all except one of the terms are significant at the .05 alpha level and all are significant at the .10 level, indicating that these variables do impact electric energy use (i.e., the absolute value of the t value shown is greater than 1.645).

The main effects coefficients in the model shown in Table 13-16 are all negative, making it clear that each of the end-use installations reduced consumption overall, with HVAC and Domestic Hot Water measures showing the largest per-household decrease. In addition, the significant interaction terms that include both installation and weather variables indicate that the savings are somewhat dependent on the weather conditions.

[88] As noted above, we used the Akaike information criterion (AIC) as a tool to compare different models. The AIC considers the goodness of fit relative to the number of parameters in the model.

Table 13-16. REAP Analysis - Final Model

Predictor	Coefficient	Robust Std. Err.	t	P>|t|	90% Confidence Interval	
					Lower Bound	Upper Bound
Lighting	-0.755	0.213	-3.54	<.001	-1.11	-0.40
Refrigerators	-0.850	0.377	-2.26	0.024	-1.47	-0.23
HVAC	-4.257	1.567	-2.72	0.007	-6.83	-1.68
Domestic Hot Water	-5.853	1.966	-2.98	0.003	-9.09	-2.62
CDD	1.391	0.030	46.63	<.001	1.34	1.44
HDD	0.360	0.015	24.51	<.001	0.34	0.38
CDD X Refrigerators	-0.251	0.072	-3.47	0.001	-0.37	-0.13
CDD X HVAC	1.379	0.298	4.63	<.001	0.89	1.87
HDD X HVAC	-0.106	0.053	-2.01	0.045	-0.19	-0.02
HDD X DHW	0.246	0.133	1.85	0.064	0.03	0.46
Constant	13.932	0.258	54.1	<.001	13.51	14.36

The model shows a reduction in electricity use after program participants installed measures and after controlling for weather and the household characteristics (reflected in the constant term). Evaluating the model, we calculated estimated average daily electricity use and percent electricity savings. As shown in Table 13-17, the average daily electricity use across studied participating homes dropped approximately 1.5 kWh per day after measures were installed, representing a 6.0% decrease in electricity usage overall. In addition, as illustrated below, the savings as a percentage of baseline or non-program consumption varied substantially by end use. The savings from each end use were 2.9% from lighting, 2.7% from refrigerators, 0.1% from HVAC measures, and 0.3% from DHW measures. The small savings from HVAC and DHW do not reflect lack of effectiveness, but a small number of participants in these categories, at 39 and 40, respectively.

At the bottom of Table 13-17, we show the savings estimates under historical weather conditions. The savings are somewhat lower than when assuming normal weather conditions since the summer of the program year was unusually warm, thus increasing the savings from certain measures. It looks like an anomaly that the percent savings under normal weather conditions is very slightly higher than under actual weather. This is a function of the non-program (baseline) savings being smaller as well when using normal conditions. The small difference may be attributable to rounding error over many model terms.

Table 13-17. REAP Analysis - Average Program Effects on Electricity Use Savings from Billing Analysis

End Use	Weighted Average Household Daily Savings	% Savings	Average Household Annual Savings	Program-Level Annual Savings	Std Err	90% Confidence Interval	
						Lower Bound	Upper Bound
Using Actual Weather							
Overall	1.455	6.0%	531	803,605	0.133	1.237	1.673
Lighting Only	0.705	2.9%	257	389,570	0.176	0.415	0.996
Refrigerators Only	0.662	2.7%	242	365,470	0.143	0.427	0.897
HVAC Only	0.013	0.1%	5	7,146	0.083	-0.124	0.149
DHW Only	0.075	0.3%	27	41,418	0.086	-0.066	0.216
Using Historical Weather							
Overall	1.4265	6.1%	521	787,777	0.132	1.210	1.643
Lighting Only	0.705	3.0%	257	389,570	0.167	0.431	0.980
Refrigerators Only	0.612	2.6%	223	337,874	0.129	0.400	0.823
HVAC Only	0.029	0.1%	11	16,435	0.055	0.061	0.121
DHW Only	0.079	0.3%	29	43,898	0.059	0.017	0.176

Table 13-18 shows the expected savings for these participants based on LIPA's program planning estimates, and the corresponding savings estimated by the billing analysis, as well as the associated realization rates. The realization rates also vary substantially from a low of 0.30 for lighting, 0.56 for refrigerators, 0.57 for HVAC, to 4.41 for DHW. The weighted average realization rate for the program is 0.41. Because of the small number of sites with HVAC and DHW, we applied the average realization rate for the program to assess the 2011 savings.

Table 13-18. Savings from Billing Analysis Compared to Savings Expected from Program Planning Estimates

End Use	N	Program Planning Savings			Observed Savings			
		Weighted Average Household Daily Savings	Annual Average savings	Total Annual Savings	Weighted Average Household Daily Savings	Annual Average savings	Total Annual Savings	RR
Lighting	1420	2.335	852	1,289,684	0.705	257	389,570	0.30
Refrigerators	581	1.172	428	647,169	0.662	242	365,470	0.56
HVAC	39	0.023	8	12,568	0.013	5	7,146	0.57
DHW	40	0.017	6	9,402	0.075	27	41,418	4.41
Overall Program	2080	3.547	1295	1,958,823	1.455	531	803,605	0.41
Total Participants =1513								

13.2.1 Cost-Effectiveness Method

The evaluation team developed a cost-screening tool to assess cost-effectiveness at the program and portfolio level using information derived from LIPA's 2011 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 costs and any rebate and incentive costs. The PA cost test excludes any net costs incurred by the participant, such as the actual measure cost. The PA cost analysis test reviews the benefits accrued over the life of the measure, including energy, capacity, gas and oil savings.

The PA cost test calculates a Benefit/Cost ratio by taking the net present value (NPV) of benefits and dividing them by the first year program costs as shown in Equation 1. 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]

$$PA\ Cost = \frac{NPV\ of\ Benefits\ [MCE*NRG*EUL+mAD*DR]}{2011\ Costs\ [PA]} \qquad \text{(Eq. 1)}$$

[89] All cost-effectiveness analyses used a nominal discount rate of 5.643% to be consistent with supply side alternatives.

A Benefit/Cost ratio greater than 1 indicates a cost-effective investment of funds from a program administrator perspective.

Table 13-19 presents the sources for inputs used to calculate cost-effectiveness using the PA test.

Table 13-19. 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 Ex Post 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
PA	Program Administrator Cost	$ or % of incentives	LIPA (December 2011 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 the cost of investing in energy efficiency programs is justified from a societal perspective. Societal benefit cost analysis tests review the benefits accrued over the life of the measure from a societal perspective, including energy, capacity, gas and oil savings. The TRC test considers the same program costs as the PA cost test with the addition of incremental cost to the participant of purchasing the program measure. Further, the TRC test does not consider the costs of incentives and rebates as these are viewed as transfers at the societal level. A Benefit/Cost ratio greater than 1 indicates a cost-effective investment of funds from a societal perspective.

[90] For the Energy Efficient Products (EEP), Home Performance with ENERGY STAR, and Home Performance Direct programs, 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 are being 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 81.97% of first year annual value for CFLs installed in 2011.

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 13-19.

$$Levelized\ Costs\ = \frac{2011\ Total\ Utility\ Expenditures}{NPV\ (Lifecycle\ kW\ or\ kWh\ Savings\ from\ 2011\ Installs)} \quad \text{(Eq. 2)}$$

13.2.2 Economic Analysis Method

As part of the 2011 ELI & Renewables Portfolio Evaluation, the evaluation team conducted an impact analysis to quantify the benefits of LIPA's 2011 program spending on economic output and employment on Long Island. The economic impact analysis quantifies the ten-year impact of LIPA's 2011 ELI portfolio and 2011 Renewables program portfolio on the economy of Nassau and Suffolk counties. In particular, it quantifies each portfolio's economic impact in terms of the following impact metrics:

- Overall economic output (valued added portion of sales)
- Employment or jobs created
- Labor income/wages from these jobs

These impacts can be broken into three dimensions – direct, indirect, and induced impact, summarized as:

- Direct Impacts: These impacts are equal to the localized portion of direct spending of the LIPA programs. For example, direct impacts would include money (and associated increases in employment) supplied to contractors to install energy efficiency measures in homes and businesses, such as the HVAC contractor installing energy efficient central A/C systems on a project incented by LIPA's Cool Homes program.
- Indirect Impacts: These impacts are determined by the amount of the direct impacts spent within Long Island on supplies, services, labor and taxes. For example, indirect impacts would include money (and associated employment) transferred to local businesses by contractors for supplies needed to install energy efficiency measures, such as if a local wholesaler of HVAC equipment had increased sales and added additional workers to help meet the growing demand for the company's products.
- Induced Impacts: These impacts are associated with the effects of the direct and indirect impacts on household and business proprietors' income. For example, money expended on Long Island by households or business proprietors benefitting from energy efficiency savings and direct and indirect program spending, such as if the employee of an HVAC contractor used their income (increased by work through LIPA's Cool Homes program) to purchase a car, which stimulates business at the local car dealership.

Along each dimension, we quantify economic impact in terms of economic output and employment outcomes.

Next, we describe the methodology and key assumptions used in this economic impact analysis.

Evaluated Program Effects

Program effects are the mechanisms through which LIPA programs may benefit participants and the regional economy – essentially, via changes in cash flow. Based on a review of publicly-available economic impact analyses of efficiency and renewable programs, and discussions with LIPA, we identified two main program effects (and associated costs) to quantify in the 2011 analysis. These high-priority program effects are participant bill savings and program and measure spending (on administration and management, and equipment and installation), shown in the Societal Benefits column in Table 13-20. To determine the overall impact of net participant bill savings and program spending on the regional economy, we also quantify the monetary costs associated with these efforts – namely incremental participant costs and the efficiency and renewable charge (that funds programs). These costs are shown in the Societal Costs column of Table 13-20.

Table 13-20. Evaluated Program Effects

Category	Societal Benefits *(Realized Benefit or Avoided Cost)*	Societal Costs *(Realized Cost or Opportunity Cost)*
Participant Savings	➢ Program participant bill savings: Increased household and business savings over 10 years, with potential increase in regional spending	➢ Incremental Participant Spending[91] Participant co-payments that are incrementally higher than what they may have been in the absence of LIPA programs, due to purchase of higher-efficiency equipment
Program & Measure Spending	➢ Program Spending Increased sales of goods & services and increased employment, due to LIPA's spending on equipment, contractors, customer services, administration and management ➢ Incremental Participant Spending[91] Increased spending on goods & services due to purchase of higher-efficiency equipment and contractor services	➢ Efficiency and Renewables Charge Decreased disposable income for ratepayers in 2011 due to small efficiency and renewables charge(s) and riders leveraged to fund LIPA programs

Our analysis of high-priority program impacts will estimate economic gains associated with portfolio-level spending and net participant savings. The impacts we estimate will be "net" in the sense that they account for the complete flow of funds associated with the benefits we are estimating: Program spending enters the model as inflows and outflows, as does incremental

[91] Incremental participant spending is measured as both a benefit and a cost, to reflect the flow of funds in the local economy – while program participants experience this spending as a negative cash flow, contractors, retailers, manufacturers and other service providers experience an equivalent positive cash flow.

participant spending. Because only avoided costs are used to estimate bill savings, the total monetary value of bill savings in each year is equal to the net societal benefit of installation of high-efficiency measures in 2011. Though participant savings will be "net" and the flow of funds will be "net" in the sense that we account for both societal benefits and costs, the economic impact will be gross, as it will not "net out" what economic output, employment, and wages would have been *without* any program spending.

Model-Based Approach

The economic impact analysis is based on an Input-Output model. We used IMPLAN (Impact Analysis for Planning) software to analyze the economic impact of LIPA's programs. With information on program spending and costs, and the IMPLAN software, the evaluation team built a static model for the effects of program spending based on a matrix of underlying relationships among various sectors, including households, industries, and government. Assumptions about these relationships are an underlying component of the IMPLAN software, based on localized economic and employment data from sources such as the Bureau of Economic Analysis' Regional Economic Accounts and the Bureau of Labor Statistics' Census of Employment and Wages. These assumptions are also specific to the local economy (i.e., Nassau and Suffolk Counties, containing information on how spending is "multiplied" to multiple local sectors, as well as what portion of spending may extend beyond the local economy.[92]

To prepare the model, the evaluation team aggregated spending and cost data at a sector level for each year, and entered this information into the software. There are 440 IMPLAN sectors, which generally correspond to NAICS codes, plus a household sector to represent residential customers. For example, the stream of residential *household* benefits accounts for *participant* bill savings, *participant* incremental measure cost, and the efficiency and renewable charge (proportional to energy sales), where participant bill savings persist for as long as the expected measure life of installed measures. For commercial sectors that participate in the administration, management or implementation of LIPA's programs (e.g., receive program spending), each sector would receive a positive value in 2011 (from program spending) that would be slightly offset by that sector's proportional payment of the efficiency and renewables charge for 2011. In this way, the model accounts for spending going to a specific sector (e.g., contractors), as well as expenditure from a specific sector (e.g., household spending on incremental measure costs).

Data Inputs and Assumptions

In this section, we briefly describe the data that we used as inputs in our model.[93] The data inputs are broken into the four different spending and savings components outlined in Table 13-20.

We performed all steps for the Efficiency Portfolio and Renewables Portfolio separately, though the steps were identical. Therefore, we provide a single methodology that reflects analysis steps taken for both portfolios.

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[92] It is worth noting that IMPLAN makes a number of simplifying assumptions, such as fixed prices, no substitution effects, no supply constraints, no changes in competitiveness or other demographic factors. However, such assumptions are not worrisome in assessing short-term impacts, in which the focus is on attaining a snapshot of a regional economy. In fact, this methodology is deemed to be an effective tool for the evaluation of impacts that do not shift economic equilibrium conditions, and has been used successfully in economic impact evaluation of a number of different energy efficiency and renewable energy programs.

[93] Detailed data description can be found in the data request memorandum presented to LIPA.

Program Participant Bill Savings

To calculate the monetary value of participant bill savings over a ten year period due to measure installation in 2011, we incorporated the following data inputs:

- **Evaluated net ex post annual kW and kWh savings for each program:** At a measure, measure-category, or program level, depending on the level used in the cost effectiveness screening tool.
- **Measure life for each program:** To estimate savings by sector for each of the next ten years, we applied program-level measure life value to net savings for each program, utilizing the same assumptions as LIPA's cost effectiveness tests.
- **Load shapes:** We used measure-level load shapes to distribute net ex post kWh savings to load periods (e.g., summer on-peak) so that we could apply avoided energy cost per kWh values appropriately, in each year.
- **Avoided costs:** To calculate the monetary value of bill savings for the next 10 years, we used the same avoided capacity and energy cost forecast that is used for the cost benefit screening tool. Multiplying net ex post savings (kW and kWh) by avoided costs (capacity and energy, respectively) gives the total monetary savings that will be realized among LIPA customers.

Using net ex post savings, load shapes, avoided costs, and measure life assumptions, we calculated the nominal monetary value of bill savings for each program, at the program or measure-category level. We distributed all annual bill savings achieved by residential programs to the residential sector. We distributed bill savings achieved by C&I programs to C&I participant sectors in two steps: first, we assigned participants to IMPLAN sectors based on the SIC codes of C&I participants whose SIC code could be found in CAS data.[94] For Efficiency programs, we then calculated the proportion of gross kWh savings by sector, by program, and applied these proportions to the annual monetary bill savings values. For Renewables programs, we calculated the proportion of gross kW savings by sector, by program, and applied these proportions to the annual monetary bill savings values.

Program Spending

Program spending on measures and installation – LIPA provided program-level actual 2011 expenditures for three spending categories: Rebates, incentives, and customer services. To assign expenditures to an IMPLAN sector, we took a slightly different approach for each category.

- **Rebates:** Spending on rebates is assigned to participating customer sectors – either the household sector or the commercial and industrial sector. For C&I, we linked participant accounts to SIC codes (available in the 2009 CAS data). We then matched SIC codes to IMPLAN sectors.
- **Incentives and Customer Services:** For most programs, incentives are defined as spending that goes directly to the specialty trade contractors, and customer service expenditures are defined as spending on installation services in participant homes or businesses, which may include spending on "direct transfers" to participants (e.g., direct install). Because spending in each of these categories could be distributed to multiple sectors for a given program, we leveraged additional information such as the 2011 budget and

[94] We used 2009 CAS data, which contains 2- and 4-digit SIC codes, which can be mapped to IMPLAN sectors. For participants without an SIC code or whose account number was not present in 2009 data, we assigned IMPLAN sectors in proportion to gross kWh achieved by all participants with known SIC code.

discussions with program staff to determine what comprised incentives and customer services for each program, and how to distribute these expenditures (e.g., by identifying sectors in the budget, and distributing actual expenditures proportional to the budget).

Program administration and management expenditures – LIPA provided actual expenditures on program delivery and administration spending, broken out by the following categories:

Contractors, Marketing, Advertising, Evaluation: These expenditures were available at a program level. We identified appropriate sectors based on detailed information in the budget, and where applicable, applied the budgetary proportions (of sector spending) to each program-level spending category. For a few expenditures, we developed sector assumptions (both sector assignment and proportion) based on discussion with LIPA program staff.

Professional Services, General and Administrative, Salaries: These expenditures were available at the portfolio level. We first developed assumptions about the sectors of each expenditure line item (e.g., IT consulting) based on a breakdown of subcategories provided by LIPA, that we assigned to an IMPLAN sector. We then assigned expenditures to a portfolio (e.g., efficiency or renewables). Though some line items were specific to efficiency or renewables, in most cases we assigned expenditures to either the Efficiency or Renewables portfolio in proportion to each portfolio's expenditures on all other program-level costs.[95]

Incremental Participant Spending

The evaluation team modeled the additional measure spending that occurs due to programs (i.e., total participant spending on measures and installation that is attributable to programs) using three sources of information:

Incremental measure cost assumptions: We use the same per-unit incremental cost assumptions as developed for the 2011 cost benefit screening tool. Incremental costs are available at a measure level (per unit) for the majority of programs.

Ex post measure counts: Final measures counts from 2011 evaluation, that are needed if incremental costs are per unit

Free ridership and spillover rates: After estimating the total incremental measure expenditures associated with each measure (or program, if incremental costs are at the program level), we estimated the incremental spending that occurred due to LIPA's programs by using free ridership and spillover rates (using evaluated net-to-gross ratios).

To model positive cash flows of participant spending to the local economy, we assigned an IMPLAN sector to each measure in the benefit cost Screening Tool.

To model negative cash flows of participant spending to appropriate sectors, we assigned all residential program incremental spending to the household sector. In addition, program induced, non-labor-related cash flows to the household sector were modeled as household income change. Here we assumed that, the distribution of cash flows are proportion to the distribution of households into different income brackets.[96] For Commercial programs, we distributed spending across commercial sectors by first assigning a sector to participants based on their SIC code (using the same assignments as for participant bill savings), and then calculating the percentage of total rebate dollars each sector accounts for (with the assumption that incremental measure costs will

[95] Sum of rebates, incentives, customer services, contractors, marketing, advertising, and evaluation

[96] Source: U.S. Census Bureau's American Community Survey

be roughly proportional to available rebates). Program induced non-sale-related cash flows, specifically, rebates, savings, incremental cost and ELI charge, were modeled as change in proprietor income.

Efficiency and Renewables Charges

To adequately represent local cash flows resulting from offering Efficiency & Renewables programs, the model includes efficiency and renewables charge revenues that were used to fund the 2011 programs. We assume that this revenue is equivalent to total program spending (less any funds from other sources, such as ARRA grants). To distribute revenue across portfolios, we used the sum of program spending by portfolio, described above. To distribute revenue across sectors, LIPA provided a breakdown of 2011 sales (in MWh) for residential and C&I customers. The evaluation team applied these proportions to the total efficiency and renewables charge revenue estimate. The estimated proportion of charges from residential customers was applied to the household sector. We then broke down the C&I portion by IMPLAN sector based on the distribution of annual kWh by IMPLAN sector (again, based on SIC code) reflected in 2009 CAS data.

A. Survey Frequencies

2011 LIPA Program
Guidelines -Appendix A

B. MEASUREMENT AND VERIFICATION RESULTS

Included as separate PDF file due to size.

C. Ex Ante and Ex Post Net-to-Gross Values by Program and Measure

Below are the ex ante and ex post values used in the results shown in this report.

Program	Measure	Ex Post minus Ex Ante	Ex Post Values			Ex Ante - Calculated Program Values (All values calculated from gross and net values provided by the program)			
		NTGR Differences	FR	SO	NTGR	FR	SO	NTGR	Notes
Cool Homes	Central AC	-14.00%	See Report, table 4-5 for data		84%	2%	0%	98.00%	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 as a 2% free ridership and 0% spillover.

Program	Measure	Ex Post minus Ex Ante	Ex Post Values			Ex Ante - Calculated Program Values (All values calculated from gross and net values provided by the program)			
		NTGR Differences	FR	SO	NTGR	FR	SO	NTGR	Notes
Cool Homes	Furnace Fan	0.00%	10%	0%	90%	10%	0%	90.00%	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.
Cool Homes	Geothermal Heat Pump	0.00%	2%	0%	98%	2%	0%	98.00%	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 was a 2% reduction, e.g., 98% net-to-gross. This was simply entered as a 2% free ridership and 0% spillover.

Program	Measure	Ex Post minus Ex Ante	Ex Post Values			Ex Ante - Calculated Program Values (All values calculated from gross and net values provided by the program)			
		NTGR Differences	FR	SO	NTGR	FR	SO	NTGR	Notes
Cool Homes	Unitary Heat Pump	0.00%	2%	0%	98%	2%	0%	98.00%	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 was a 2% reduction, e.g., 98% net-to-gross. This was simply entered as a 2% free ridership and 0% spillover.
Cool Homes	Ductless Mini Split AC	0.00%	2%	0%	98%	2%	0%	98.00%	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 was a 2% reduction, e.g., 98% net-to-gross. This was simply entered a 2%

Program	Measure	Ex Post minus Ex Ante	Ex Post Values			Ex Ante - Calculated Program Values (All values calculated from gross and net values provided by the program)			
		NTGR Differences	FR	SO	NTGR	FR	SO	NTGR	Notes
									free ridership and 0% spillover.
HPD	All Measures Except Lighting	0.00%	0%	0%	100%	0%	0%	100.00%	No evidence of NTGR applied in data received by evaluation team
HPD	Lighting	-51.00%	51%	0%	49%	0%	0%	100.00%	No evidence of NTGR applied in data received by evaluation team
EEP	ENERGY STAR Refrigerator	-55.00%	67%	0%	33%	20%	10%	88.00%	NTGR values not sourced.
EEP	ENERGY STAR Dehumidifier	-47.50%	67%	0%	33%	30%	15%	80.50%	NTGR values not sourced. Program should be 85% when calculated appropriately.
EEP	Room A/C <=6kBtuh	7.50%	30%	25%	95%	30%	25%	87.50%	NTGR values not sourced. Program should be 95% when calculated appropriately.
EEP	Room A/C >6kBtuh	7.50%	30%	25%	95%	30%	25%	87.50%	NTGR values not sourced. Program should be 95% when calculated appropriately.

Program	Measure	Ex Post minus Ex Ante	Ex Post Values			Ex Ante - Calculated Program Values (All values calculated from gross and net values provided by the program)			
		NTGR Differences	FR	SO	NTGR	FR	SO	NTGR	Notes
EEP	ENERGY STAR Common CFLs	1.20%	30%	4%	74%	30%	4%	72.80%	NTGR values not sourced. Program should be 74% when calculated appropriately.
EEP	ENERGY STAR Specialty CFLs	5.00%	25%	20%	95%	25%	20%	90.00%	NTGR values not sourced. Program should be 95% when calculated appropriately.
EEP	SSL	1.20%	5%	25%	120%	5%	25%	118.80%	NTGR values not sourced. Program should be 95% when calculated appropriately.
EEP	ENERGY STAR Fixtures	0.00%	2%	3%	101%	2%	3%	101.40%	NTGR values not sourced. Program should be 101.5% when calculated appropriately.
EEP	Refrigerator recycle	-9.00%	52%	0%	48%	43%	0%	57.00%	NTGR values not sourced.
EEP	Pool pumps-two spd	2.00%	20%	10%	90%	20%	10%	88.00%	NTGR values not sourced. Program should be 90% when calculated appropriately.
EEP	Pool pumps-var spd	2.00%	20%	10%	90%	20%	10%	88.00%	NTGR values not sourced. Program should be 90% when calculated appropriately.
EEP	TVs - 30% above ES	2.00%	20%	10%	90%	20%	10%	88.00%	NTGR values not sourced. Program should be 90% when calculated appropriately.

Program	Measure	Ex Post minus Ex Ante	Ex Post Values			Ex Ante - Calculated Program Values (All values calculated from gross and net values provided by the program)			
		NTGR Differences	FR	SO	NTGR	FR	SO	NTGR	Notes
HPwES	All Measures	-28.00%	28%	0%	72%	0%	0%	100.00%	No evidence of NTGR applied in data received by evaluation team
CEP Prescriptive	Lighting	-22.00%	30%	0%	70%	8%	0%	92.00%	Reference from 2007
CEP Prescriptive	Performance Lighting	-22.00%	30%	0%	70%	15%	7%	92.00%	Reference from 2007
CEP Prescriptive	Motors-Premium Efficiency	29.00%	30%	0%	70%	59%	0%	41.00%	
CEP Prescriptive	Motors-VFD	29.00%	30%	0%	70%	59%	0%	41.00%	
CEP Prescriptive	Compressed Air - VFD, Refrigerated Dryers	-5.00%	30%	0%	70%	25%	0%	75.00%	
CEP Prescriptive	Motors - ECM	-22.65%	30%	0%	70%	15%	9%	92.65%	
CEP Prescriptive	Compressed Air (All Measures)	29.00%	30%	0%	70%	59%	0%	41.00%	
CEP Prescriptive	HVAC - Split/Packaged AC, HP, Chiller	-20.00%	30%	0%	70%	10%	0%	90.00%	

Program	Measure	Ex Post minus Ex Ante	Ex Post Values			Ex Ante - Calculated Program Values (All values calculated from gross and net values provided by the program)			
		NTGR Differences	FR	SO	NTGR	FR	SO	NTGR	Notes
CEP Prescriptive	HVAC Controls-Programmable thermostat	10.00%	30%	0%	70%	40%	0%	60.00%	
CEP Prescriptive	HVAC Controls-Dual Enthalpy Economizer	-25.00%	30%	0%	70%	5%	0%	95.00%	
CEP Prescriptive	Kitchen Equipment - Fryer & Steamer	-12.50%	30%	0%	70%	25%	10%	82.50%	
CEP Prescriptive	Kitchen Equipment - Griddle, Convection Oven, Combi Oven	-30.00%	30%	0%	70%	0%	0%	100.00%	
CEP Prescriptive	Kitchen Equipment - Low Flow Pre-Rinse Spray Nozzle	-1.50%	30%	0%	70%	35%	10%	71.50%	

Program	Measure	Ex Post minus Ex Ante	Ex Post Values			Ex Ante - Calculated Program Values (All values calculated from gross and net values provided by the program)			
		NTGR Differences	FR	SO	NTGR	FR	SO	NTGR	Notes
CEP Prescriptive	Kitchen Equipment - Insulated Holding Cabinet	-1.50%	30%	0%	70%	35%	10%	71.50%	
CEP Prescriptive	Vending Machines and Glass Front Refrigerated Cooler Miser	-29.00%	30%	0%	70%	1%	0%	99.00%	
REAP	All Measures	0.00%	0%	0%	100%	0%	0%	100.00%	Assumed 1.0 as Low Income program
RNC	All	0.00%	0%	0%	100%	0%	0%	100.00%	No evidence of NTGR applied in data received by evaluation team
Solar Pioneer	All	0.00%	0%	0%	100%	0%	0%	100.00%	No evidence of NTGR applied in data received by evaluation team
Solar Entrepreneur	All	0.00%	0%	0%	100%	0%	0%	100.00%	No evidence of NTGR applied in data received by evaluation team
Backyard Wind	All	0.00%	0%	0%	100%	0%	0%	100.00%	No evidence of NTGR applied in data received by evaluation team
Solar Hot Water	All	0.00%	0%	0%	100%	0%	0%	100.00%	No evidence of NTGR applied in data received by evaluation team