



Evaluation, Measurement and Verification of the Los Angeles Department of Water and Power Energy Efficiency Programs

Final Report

Prepared for:

Los Angeles Department of Water and Power



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Reference No.: 161132
January 3, 2017

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EXECUTIVE SUMMARY

The Los Angeles Department of Water and Power (LADWP) engaged Navigant Consulting, Inc. (Navigant) to evaluate its portfolio of energy efficiency programs. This report provides the impact and process findings for the programs and fiscal years¹ (FYs) shown in the Overview of Programs section below.

Navigant also undertook an initial evaluation of the effort by the City of Los Angeles to transform its market for energy and water efficient goods and services. The objectives of this evaluation include the following:

- Develop a theory of market change that details the logical linkages between activities (sponsored by LADWP and other city departments) and observable outcomes characterized by greater adoption of energy efficient goods and services.
- Assess current market conditions and trends per the logic model via transparent and replicable data collection methods.
- Identify opportunities to enhance existing programming to optimize market transformation efforts.
- Create a modeling structure that defines current baseline consumption, forecasts potential savings, and can quantify future savings attributable to market transformation over time (2016-2025).

Finally, Navigant benchmarked acquisition costs and spending in LADWP's energy efficiency portfolio level. Navigant provided these initial findings to LADWP in a PowerPoint presentation. A second phase moved to program-level analysis to identify successful designs and processes at the municipal utilities most similar to LADWP in size, goals, and climate. This study compared four utilities: City of Palo Alto Utilities (CPAU), Sacramento Municipal Utility District (SMUD), Austin Energy (AE), and Seattle City Light (SCL) across these energy efficiency program classes:

- Commercial Lighting – CLEO
- Customer Commercial Incentives – CPP
- Prescriptive Residential Rebates – CRP
- Residential Direct Install – HEIP
- Commercial Direct Install – SBDI, LAUSD²

This final summary report combines findings from four reports previously furnished to LADWP:

- “*Evaluation, Measurement, and Verification of the LADWP Energy Efficiency Programs, Annual Report*,” February 13, 2015 (hereafter referred to as the “2015 evaluation report”)

¹LADWP fiscal year, 7-1 to 6-30.

² LADWP's direct install program for the Los Angeles Unified School District (LAUSD) was benchmarked, but not part of either the 2015 or 2016 evaluation reports.

- “*Evaluation, Measurement, and Verification of the LADWP Energy Efficiency Programs, Annual Report 2016*,” July 13, 2016 (“2016 evaluation report”)
- “*Current Energy Efficiency Market Conditions and the Potential for the Transformation*,” September 7, 2016 (“Market Transformation report”)
- “*In-Depth Benchmarking Report*,” summer 2015 (“Benchmarking report”)

Regulatory Context

Two legislative bills, Senate Bill 1037 (SB 1037) and Assembly Bill 2021 (AB 2021), were signed into law a year apart. SB 1037 requires that California’s publicly owned utilities (POUs) (approximately 40)—similar to the state’s investor-owned utilities (IOUs)—place cost-effective, reliable, and feasible energy efficiency and demand reduction resources at the top of the utility resource loading order, giving priority to the efficiency resource in utility operating plans. Additionally, SB 1037 (signed September 29, 2005) requires an annual report describing utility programs, expenditures, expected energy savings, and actual energy savings.

AB 2021, signed by the governor a year later (September 29, 2006), reiterated the loading order and annual report stated in SB 1037, as well as expanded on the annual report requirements. The expanded report required inclusion of investment funding, cost-effectiveness methodologies, and an independent evaluation that measures and verifies the energy efficiency savings and reductions in energy demand achieved by the energy efficiency and demand reduction programs. AB 2021 additionally required a report every 3 years that highlights cost-effective electric potential savings from energy efficiency and established annual targets for electricity energy efficiency and demand reduction over 10 years. The California Energy Commission (CEC, or the Commission) was given the mandate to oversee POU SB 1037 and AB 1021 energy efficiency program and evaluation, measurement, and verification (EM&V) efforts, with the following requirements for CEC:

- Monitor POUs’ annual efficiency progress
- Review POU independent evaluation studies, reporting results, and, if necessary, recommend improvements
- Ensure that savings verification increases the reliability of savings and contributes to better program design

The CEC also was mandated to provide the POUs with EM&V Guidelines under which plans³ should be submitted.

Overview of Programs

LADWP engaged Navigant to evaluate its portfolio of energy efficiency efforts over a 3-year period (2013-2016) with the goals of: 1) determining the reliability of reported energy savings and 2) identifying possible process improvements to enhance both customer experience and uptake of LADWP’s programs.

³ SB 1037 and AB 1021 did not require energy efficiency reporting to the CEC for smaller POUs with loads equal to or less than 500,000 megawatt-hours (MWh)/year.

This document summarizes Navigant's 2015 and 2016 evaluation reports of the following programs and FYs):

Table ES-1. Program Evaluation Summary

Program	2015 Evaluation Report	2016 Evaluation Report
Small Business Direct Install (SBDI)	FY13-14	
Low-Income Refrigerator Exchange Program (LIREP)	FY13-14	
Refrigerator Turn-In and Recycling Program (RETIRE)	FY13-14	
Home Energy Incentive Program (HEIP)		FY14-15
California Advanced Home Program (CAHP)		FY14-15
Energy Upgrade California (EUCA)	FY13-14	
Consumer Rebate Program (CRP)	FY11-12 and FY12-13	
Custom Performance Program (CPP)	FY11-12 and FY12-13	FY14-15
Commercial Lighting Efficient Offering (CLEO) / Commercial Lighting Incentive Program (CLIP)	FY11-12 and FY12-13	FY14-15
Chiller Efficiency Program (CEP)	FY11-12 and FY12-13	
Savings by Design (SBD)		FY14-15
Retro-Commissioning Express (RCx Express)		FY12-13, FY13-14, and FY14-15
Refrigeration Program	FY11-12 and FY12-13	
Codes, Standards, and Ordinances (CSO)		FY14-15
Facilities Program		FY09-11, FY11-12, FY12-13, FY13-14, and FY14-15

Sources: Evaluation, Measurement, and Verification of the Los Angeles Department of Water and Power

The evaluations of these programs constitute Sections 3 through 17. The market transformation effects are summarized in Section 2.2. The benchmarking report (Section 2.3) compared the CLEO/CLIP, CPP, CRP, HEIP, SBDI, and LAUSD results to the programs of peer utilities.

Overview of Methodology

The overarching goals of Navigant's EM&V activities were to provide LADWP unbiased, objective, and independent program evaluations by giving the following:

- Useful recommendations and feedback to improve LADWP program operation, tracking, and measure offerings
- Assessment of each conservation program's effectiveness in reaching target populations

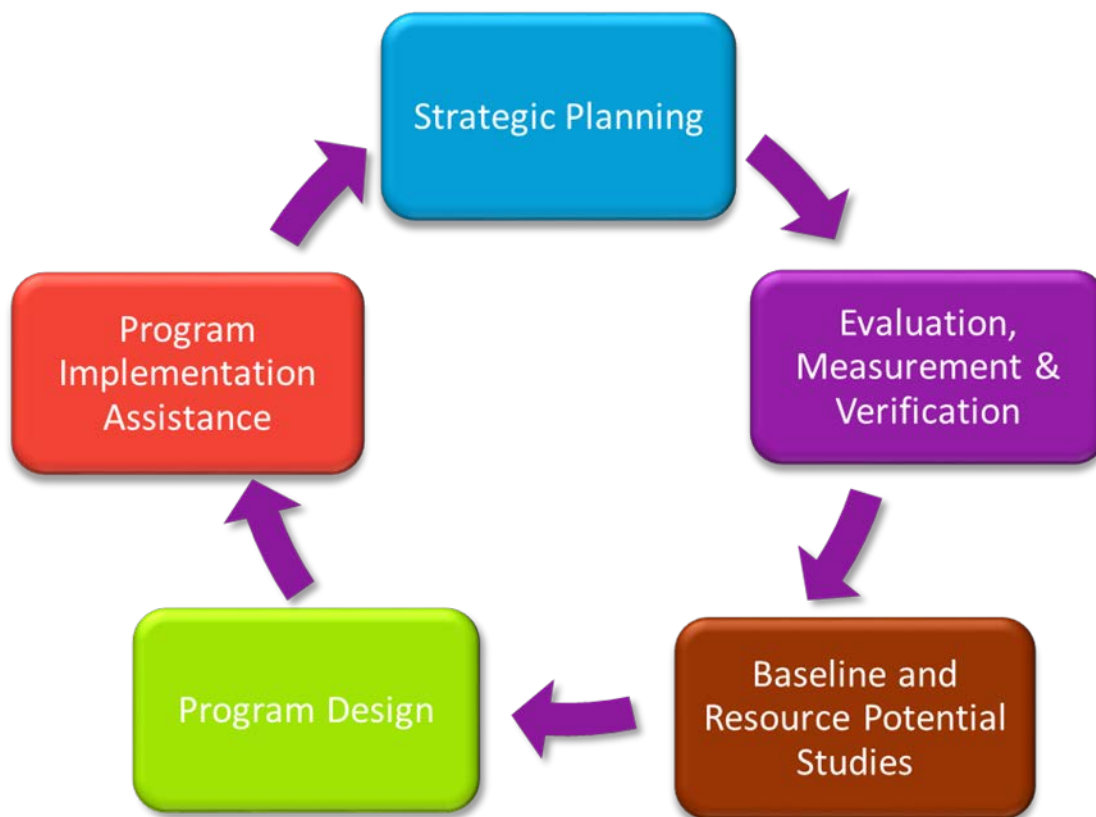
- Assessment of the quality of the program tracking data and supporting project application data for impact evaluation purposes
- Increased level of confidence in conservation program results

To achieve these goals, Navigant undertook both impact and process evaluations of the LADWP programs using the following guidelines for Navigant team activities:

- CEC POU EM&V Guidelines
- California Energy Efficiency Evaluation Protocols
- California Evaluation Framework

This evaluation effort can be viewed as part of a continuous improvement process, as shown in Figure ES-1.

Figure ES-1. Evaluation Is a Part of a Continuous Improvement Process



Over the 3-year period, Navigant used the following references to supplement the evaluation methods, as applicable:

- US Department of Energy (DOE) Uniform Methods Project (both draft and final chapters)
- National Action Plan for Energy Efficiency (NAPEE) Program Impact Evaluation Guide (for net-to-gross [NTG] issues)

To examine the effects of LADWP programming and city ordinances for energy and water conservation on the Los Angeles market, Navigant partnered with Research into Action (collectively “the Navigant Team”) to:

- Develop a theory of market change that details the logical linkages between activities sponsored by the City of Los Angeles (including LADWP) to observable outcomes characterized by greater adoption of energy efficient goods and services (Section 2.2.1).
- Collect data through transparent and replicable methods regarding market conditions in Los Angeles prior to the enforcement of the proposed ordinances (Section 1.5.4).⁴
- Assess the extent to which the indicators of market change are (or are not) present in the Los Angeles market (Section 2.2.2).
- Develop an energy model (the Electric Resource Assessment Model [ELRAM]) that defines current baseline consumption, forecasts potential savings, and can quantify future savings attributable to market transformation (Section 2.2.3).

Navigant’s initial benchmarking compared a group of 10 utilities (seven municipal utilities and three IOUs) across savings (normalized by sales) and spending (per first-year kWh). Building upon these findings, the in-depth benchmarking selected a cohort of municipal utilities most similar to LADWP in size, goals, and climate. Navigant analyzed differences in program design, implementation, and delivery to inform LADWP programming decisions.

Impact Evaluation Findings

The 16 programs achieved realization rates on energy savings that ranged from a low of 0.32 for RETIRE to a high of 2.01 for CRP. For demand, the realization rates range from a low of 0.24 for HEIP to a high of 3.08 for the SBDI. Overall, the realization rates for the combined programs are 1.04 and 0.98 for energy and demand, respectively. Table ES-2 provides details by program. The energy and demand savings below reflect first-year savings evaluated. Navigant evaluated some programs across multiple years and some programs twice. Consequently, the savings cannot be summed to annual savings.

Table ES-2. Summary of Energy and Demand Savings

Program	Reported Gross Energy Savings (kWh)	Energy Realization Rate	Verified Gross Energy Savings (kWh)	Reported Demand Savings (kW)	Demand Realization Rate	Verified Demand Savings (kW)
SBDI	39,022,352	0.72	28,096,093	1,929	3.08	5,941
LIREP	4,954,870	1.08	5,361,435	N/A**	N/A**	643
RETIRE	3,958,164	0.32	1,230,584	597	0.42	248
HEIP	5,907,033	0.35	2,044,244	4,706	0.24	1,129

⁴ For complete results see: Navigant, *Current Energy Efficiency Market Conditions and the Potential for the Transformation*, Final Report, September 7, 2016.

Program	Reported Gross Energy Savings (kWh)	Energy Realization Rate	Verified Gross Energy Savings (kWh)	Reported Demand Savings (kW)	Demand Realization Rate	Verified Demand Savings (kW)
CAHP	3,209,011	1.78	5,712,040	1,153	1.92	2,214
EUCA	Process evaluation only					
CRP	4,562,906	2.01	9,171,533	1,875	2.11	3,957
Mass Market Subtotal	61,614,336	0.84	51,615,929	10,260	1.38	14,132
CPP FY11-12 & FY12-13	111,034,358	0.82	90,982,750	26,819	0.40	10,840
CPP FY14-15	54,673,360	0.85	46,527,517	8,847	0.39	3,419
CLEO	86,118,422	1.10	94,726,274	18,753	0.94	17,679
CLIP	4,273,797	1.09	4,669,671	680	0.95	645
CEP	9,429,798	0.97	9,128,056	N/A*	N/A*	852
SBD	497,693	0.92	457,878	19	0.79	15
RCx Express	1,415,573	0.79	1,116,737	0	N/A*	0
Refrigeration	3,782,527	0.93	3,499,127	423	0.43	182
CII Programs Subtotal	271,225,528	0.93	251,108,010	55,541	0.61	33,632
CSO	121,781,298	1.40	170,031,367	13,630	2.22	30,209
Facilities	3,053,946	1.27	3,874,079	737	0.61	451
Cross-Cutting Programs Subtotal	124,835,244	1.39	173,905,446	14,367	2.13	30,660
Total***	457,675,108	1.04	476,629,385	80,168	0.98	78,424

*Program-level demand savings and realization rates are not reported here because of issues with tracked negative demand savings and discrepancies in ex ante values between sources.

**The E3 model did not include demand saving estimates

***Represents total first-year savings from FYs evaluated (see Table ES-1).

Source: Navigant analysis

The following sections discuss results and recommendations for all evaluated programs.

Small Business Direct Install (SBDI) Program

SBDI achieved 28,096,093 kWh in gross electric energy savings and 5,941 kW of gross coincident peak demand over the evaluation period. Navigant developed these impact results from the 15 SBDI sites included within the sample. The realization rates were 0.72 for energy and 3.08 for coincident peak demand. Navigant determined that the main drivers for these realization rates include the following:

- Quantities were not included in the ex ante demand calculation and reported savings; this significantly affects the coincident demand realization rate. However, when quantities are included in the ex ante demand savings, the coincident demand realization rate is 75 percent.
- Navigant verified an average pre- and post-retrofit coincident factor (CF) of 0.68 and 0.66, respectively. This is lower than the average deemed CF of 0.8.

- Navigant verified an average pre- and post-retrofit annual hours of use of 2,738 and 2,731, respectively. This is lower than the average deemed hours of use of 3,143.

Low-Income Refrigerator Exchange Program (LIREP)

The LIREP program achieved 5,361,435 kWh and 643.372 kW in first-year gross electric energy and demand savings, respectively, for the 2013-2014 fiscal year. The final realization rate for the gross energy savings for the program is 1.08. Because LADWP did not claim demand savings in the E3 report, there is no realization rate for demand savings.

Refrigerator Turn-In and Recycling (RETIRE) Program

The RETIRE program achieved 1,230,584 kWh and 248 kW in gross electric energy and demand savings respectively, for the 2013-2014 program year. The final realization rates for the program are 32 percent for energy and 42 percent for peak demand. The primary driver behind the low realization rates of the RETIRE program are the adjustments made to the unit energy savings estimates for both refrigerators and freezers; namely the subtraction of the replacement unit's energy consumption from that of the existing unit.

Home Energy Incentives Program (HEIP)

Navigant estimates that the sampled sites from the program achieved 2,044,244 kWh and 1,129 kW in gross electric energy and demand savings over the evaluation period. The realization rates for both energy and demand are low. The realization rate is 0.35 for energy and 0.24 for demand relative to the ex ante program savings.

Three measures are included in HEIP. They include shower heads, faucet aerators, and CFLs. The energy realization rate for shower heads is 0.85 and 0.97 for faucet aerators. However, CFLs provide 97 percent of the savings claimed from HEIP, and the energy realization rate for CFLs is only 0.25. There are two primary reasons for the low CFL energy and demand realization rates:

- Only 32 percent of the reported quantity of CFLs could be verified as installed. Most were in storage and some had burnt out.
- The verified annual hours of operation, derived from lighting logger data, is 636 hours. The program tracking data claims 1,460 hours. The ex post hours of operation are 42 percent of the ex ante estimates.

California Advance Homes Program (CAHP)

CAHP is another statewide energy efficiency program implemented by the state IOUs: Pacific Gas & Electric, Southern California Edison, San Diego Gas & Electric, and the Southern California Gas Company (SCG). CAHP drives energy and gas savings by incenting construction of buildings, which outperform Title 24 building code. SCG manages the program for LADWP. Ex ante estimates of program impacts are tracked by utility and year with the realization rates based on evaluation of the statewide program.

The verified savings from the program are 5,712,040 kWh and 2,213 kW in gross electric energy and demand savings over the evaluation period. These savings reflect utilizing the statewide realization rates of 1.78 for energy and 1.92 for demand.

Energy Upgrade California (EUCA) Program

Navigant did not perform an impact evaluation for the EUCA program. The findings from its process evaluation follow in the next section.

Consumer Rebate Program (CRP)

CRP achieved 9,171,533 kWh and 3,957 kW in gross electric energy and demand savings, respectively, between FY11-13. The final realization rates for the program are 2.01 for energy and 2.11 for peak demand. The primary driver behind the high realization rates of CRP was the adjustments made to the baseline assumptions used (i.e., early versus natural replacement). For the program's two highest savings measures, pool pumps and refrigerators, over half of sampled projects were found to be early retirement rather than natural replacement.

The misalignment between program tracking data and E3 calculator values contributed to a lesser degree. This was most evident for windows; in what may be an error in converting units, the deemed E3 savings values was 10 times higher than the tracking data savings.

Custom Performance Program (CPP)

The FY11-12 and FY12-13 CPP achieved 90,982,750 kWh in gross electric energy savings and 10,840 kW of gross demand savings over the evaluation period. These represent realization rates of 0.82 for energy and 0.59 for demand relative to the ex ante program savings. These realization rates varied significantly among the sampled sites; ranging from 0.16 to 1.16, for example, for energy. The measure with the greatest variability, both low and high, was variable speed drives.

LADWP utilized the Standard Performance Contract (SPC) Customized Calculation Tool (CCT) for most of its savings calculations. The wide spread of realization rates found among the sample sites was largely due to the use of the SPC software in the ex ante savings calculations. In Navigant's impact evaluation, direct measurements and facility data logs were used to determine the ex post savings.

The realization rates varied heavily by measure type between the CCT and Navigant's analysis:

- **Chiller savings were largely overestimated by the CCT.** The tool appeared to estimate load based on building square footage, and the average load values produced were substantially larger than the installed chillers were capable of producing at full load in some cases.
- **Savings from variable frequency drives (VFDs) on air handling units (AHUs) were highly dependent on hours of operation.** These hours are manually entered by the CCT user, and very few schedules matched what was reported onsite.
- **Several VFDs were not controlled in a temperature-dependent manner,** which would be typically expected by the CCT; this resulted in wide variations in savings from the ex ante values.
- **Garage fan carbon monoxide (CO) sensors savings were sometimes higher than the ex ante values,** although for parking areas with 24/7 access they tended to be close to the ex ante values, and overall realization rates for these measures were within the expected range. However, Navigant also used baseline motor powers lower than the ex ante values in some cases, so the realization rate of these measures was not increased significantly overall.
- **Light-emitting diode (LED) lighting in refrigerated cases had reported demand three orders of magnitude higher** than would be expected for energy savings reported for these project types. These sites claimed demand savings of around 638 kW, but based on the fixtures replaced at the two sites, the savings are closer to 638W. This is likely an error in data input.

The FY14-15 evaluation of CPP verified a total of 46,527,517 kWh and 3,419 kW in gross electric energy and demand savings over the evaluation period. These savings reflect realization rates of 0.85 for energy and 0.39 for demand.

For CPP, the realization rates varied heavily by measure type between the ex ante values and Navigant's analysis. The largest drivers of the overall CPP low realization rate were that the two of the three largest projects had low realization rates. The ex ante savings for the second largest project were too high due to the lack of weather normalization in the calculations. The third largest project had low savings because the ex ante savings depend upon additional projects which have not yet been completed.

Commercial Lighting Efficiency Offering (CLEO) & Commercial Lighting Incentive Program (CLIP)

For the FY11-12 and FY12-13 commercial lighting program, known then as CLEO, Navigant developed impact results for the 25 CLEO sites included within the sample and extrapolated those findings to report the verified, ex post, impact results program years. The CLEO program achieved gross coincident peak demand and energy savings of 10,075 kW and 55,093,571 kWh for FY11-12 and 7,604 kW and 39,632,703 kWh for FY12-13, respectively. The realization rates were 1.10 for energy and 0.94 for coincident peak demand. The main drivers for these realization rates include the following:

- **Heating, ventilating, and air conditioning (HVAC) interaction factors (IFs) increase energy savings.** The majority (63 percent) of verified fixtures are located within conditioned spaces served by HVAC equipment. The average energy HVAC IF for these fixtures is 1.13. HVAC IFs also increased peak demand savings, but in a magnitude less than CFs reduced savings.
- **CFs decrease peak demand savings.** Using the logged time-of-use lighting data collected, the evaluation team determined that peak demand CFs are generally less than the assumed value of 1.00, and instead average around 0.75.
- **Hours of use increase energy savings.** Navigant verified higher annual hours of use for several projects. For all verified measures, the associated ex ante hours average 4,089 hours while the ex post hours average 4,640 hours.
- **E3 to tracking data ratios increase savings.** Navigant found that E3 generally underreports savings. That is, energy and demand impacts in E3 are less than the impacts shown in tracking data (and subsequently less than Navigant's verified amounts). For both program years combined, E3 reports 94 percent of the demand and 98 percent of the energy reported within the program tracking data.

CLIP is a commercial lighting program launched October 1, 2014 that replaces the CLEO program. The evaluation of FY14-15 verified 4,669,671 kWh and 645 kW in gross electric energy and demand savings over the evaluation period. These savings reflect realization rates of 1.09 for energy and 0.95 for demand.

The main drivers for these realization rates include the following:

- **Verified hours of use increase energy savings.** For fixture-only retrofits, Navigant verified higher annual hours of use for several projects. Specifically, the associated ex ante annual hours averaged 6,532 hours, while the ex post averaged 6,959 hours.
- **Controls curtail post-retrofit energy consumption and increase savings.** For fixture and control combination retrofits, Navigant verified a larger reduction in hours of use between the pre- and post-retrofit cases. For most projects, Navigant verified that controls achieved operating hours well below assumed levels. The average reported control allowance was 0.31, and

Navigant verified an average allowance of 0.41 (see control allowance equation in the 2016 evaluation report).

- **Fixture wattages increase savings.** Navigant found that the 1,291 post-retrofit fixtures reported at 51W per fixture in one large sampled project were actually rated at 31W per fixture. The field team and quality control (QC) analysts investigated this discrepancy and reviewed all available information to confirm this finding. Additionally, amp logger data readouts agreed with this finding and found maximum operations coinciding with 31W.
- **CFs decrease peak demand savings for fixture-only retrofits.** Using the logged time-of-use data collected, the evaluation team determined that peak demand CFs are generally less than the assumed value of 1.00, and instead average around 0.79. For CLEO, that average was 0.75.
- **CFs increase peak demand savings for control retrofits.** Although to a lesser extent, Navigant found that controls were capable of driving down hours of use more so than the program reported. This, in turn, reduced peak time operations and CFs. Again, while CLIP uses a CF of 1.00 for all measurements, control post-retrofit CFs averaged 0.51. Ultimately, these gains were not significant, and Navigant reports a demand realization rate less than 100 percent.
- **Quantities decrease savings.** As stated previously, Navigant verified all fixture counts within the onsite sample. The ratio of verified and reported quantities creates an in-service rate (ISR) of 90 percent. However, the resulting contributions to ex post impacts are less significant than the main drivers previously described that increased the energy realization rate.

Chiller Efficiency Program (CEP)

Navigant estimates that the CEP achieved 9,128,056 kWh in gross electric energy savings over the evaluation period. This represents a realization rate of 0.97 relative to the ex ante program savings. Realization rates varied greatly from site to site, largely due to differences in operating hours compared to the ex ante estimate of hours.

Verification of demand savings was complicated by problems with project records. According to project records, the program achieved negative 366 kW in gross ex ante electric demand savings. The tracking data reported negative demand savings values for several of the projects. These values did not always match the project files, nor did they appear to correspond to the deemed values in the E3 calculator. Because of these issues, Navigant cannot report a program-level realization rate for demand savings. For verified gross savings, Navigant developed a prorated estimate of program-level demand impact of 852 kW of demand based on data collected from the sample.

Savings by Design (SBD) Program

SBD is a statewide program offered by LADWP as well as SMUD and California's four IOUs. It offers technical assistance and financial incentives to builders of new commercial construction or significant renovations. Ex ante estimates of program impacts are tracked by utility and year with the realization rates based on evaluation of the statewide program.

The verified savings from the program, are 457,878 kWh and 15 kW in gross electric energy and demand savings over the evaluation period. These savings reflect utilizing the statewide realization rates of 0.92 for energy and 0.79 for demand.

Retro-Commissioning Express (RCx Express) Program

All nine available sites were included in the sample for RCx Express. Navigant estimated 1,116,737 kWh in gross electric energy savings over the evaluation period. No demand savings were claimed. The realization rate is 0.79 relative to the ex ante program savings.

Navigant discovered during its onsite inspections that not all of the measures or conditions (such as adjustments to setpoints) were implemented. Findings such as these led to the 0.79 realization rate.

Refrigeration Program

The Refrigeration program achieved 3,499,127 kWh and 182 kW in gross electric energy and demand savings, respectively, over the evaluation period. The most significant driver of the realization rates (0.93 for energy and 0.43 for demand) was the misalignment of program data and reported E3 data. A secondary driver of the realization rates was adjustments derived from onsite observations.

Codes, Standards, and Ordinances (CSO) Program

The ex post gross savings verified from the CSO program are 170,031,367 kWh and 30,209 kW in gross electric energy and demand savings over the evaluation period. These savings reflect realization rates of 1.40 for energy and 2.22 for demand.

The characteristics of the CSO program require means for estimating program impacts that is different from most programs. State and federal agencies develop codes and standards (C&S), and utilities such as LADWP help in this development through participation in state C&S working groups and providing feedback to both state and federal C&S as they are being developed. LADWP and the City of Los Angeles also create and enforce ordinances that provide energy savings. Currently, LADWP includes in its CSO savings claim the impacts from its plumbing ordinance.

The California Public Utilities Commission (CPUC) has a methodology for estimating the impacts of C&S in California and has established an attribution mechanism that allows for utilities participating in the C&S development to claim a portion of the savings as part of their energy efficiency targets and goals. LADWP participates in this development process and claims savings based on the CPUC methodology and attribution mechanism. However, there is the potential for LADWP to double count savings within its C&S claims compared to claims from its energy efficiency programs. A framework is needed to assess how the ex ante estimates for the program relate to the current activities provided by LADWP to support improvements and compliance with CSO and the program offerings provided by LADWP to its customers.

The framework selected is an application of Navigant's demand-side management (DSM) potentials model known as the ELRAM. Various forms of ELRAM are used by all the electric and gas utilities in the state of California, both privately and publicly owned. Utilizing ELRAM provides consistency, at least in terms of modeling DSM potential and the effects of CSO on these potential estimates, across all the California utilities.

Facilities Program

The evaluation of the Facilities program verified 3,874,079 kWh and 451 kW in gross electric energy and demand savings over the evaluation period. These savings reflect realization rates of 1.27 for energy and 0.61 for demand.

The drivers for the Facilities program realization rates include the following:

- **Verified retrofit fixture wattage** increased energy and demand savings. For the lighting measures sampled as a part of this program evaluation, the average ex post delta wattage

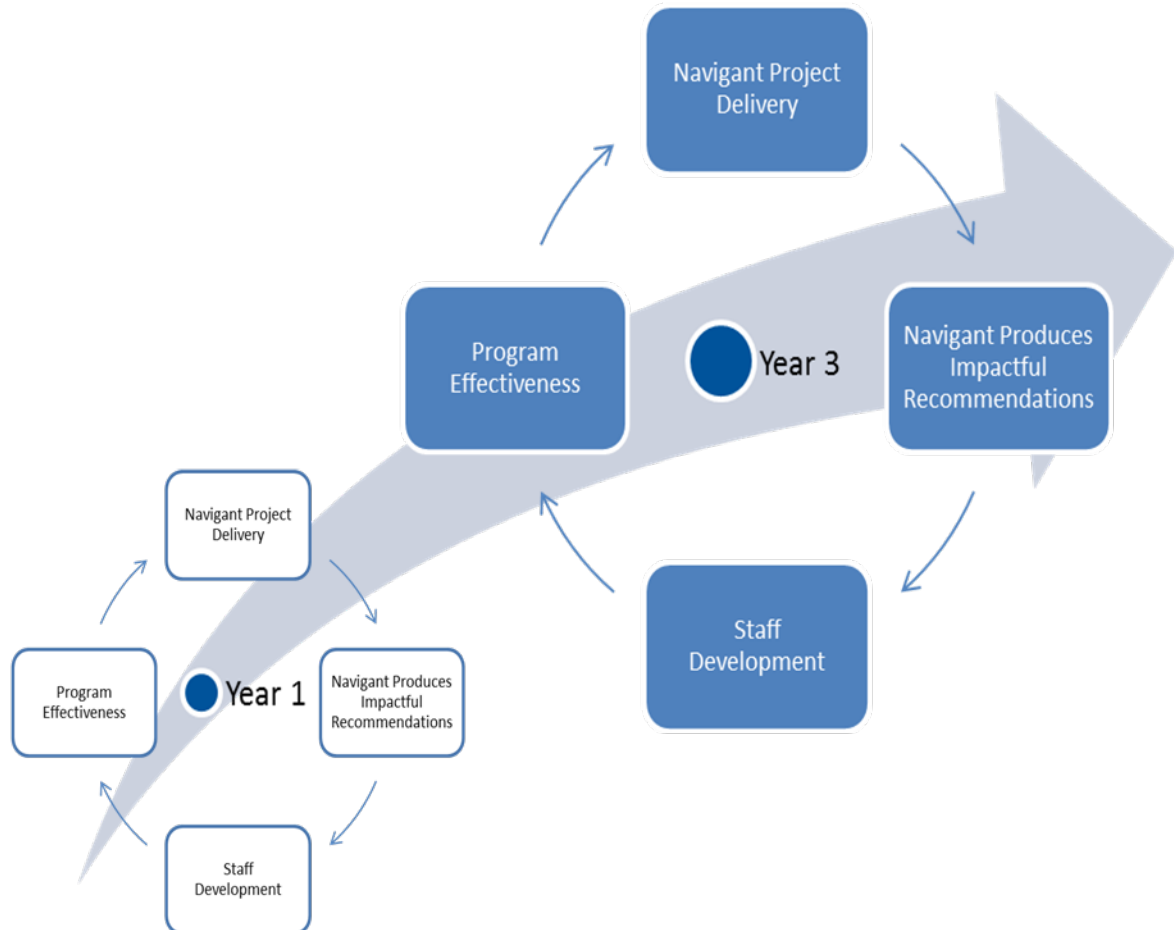
achieved from equipment retrofits was larger than ex ante value, based on verified ex post fixture rated input wattages being less than the ex ante efficient wattages. Specifically, the average claimed retrofit fixture wattage was 82W, whereas the average verified retrofit fixture wattage was 79W.

- **IFs** increase energy and demand savings. While accounting for interactive factors drives energy and demand savings up, the impact is slight because the majority of facilities were unconditioned warehouses.
- **CFs** decrease peak demand savings. Using the time-of-use lighting data collected onsite, the evaluation team determined that CFs are roughly half of the ex ante value of 1.00, with a sample wide average around 0.43.

Process Evaluation Findings

The process evaluations highlights from both the 2015 and 2016 evaluation reports are presented in this section. Navigant integrated the process evaluation results into a feedback loop to ensure improvement of the broader evaluation, as shown in Figure ES-2.

Figure ES-2. Process Evaluations Provide Impactful Recommendations for Improving Program Effectiveness.



Small Business Direct Install (SBDI) Program

The following are the main process finding for the SBDI program.

- The SBDI program is performing well overall; the implementation contractor is effectively implementing the program strategy and customers are satisfied with their overall experience with the program. The program administration is currently providing energy savings to small business customers while also providing additional work for the program subcontractors.
- The SBDI implementation contractor currently maintains an up-to-date, comprehensive database of program projects. The implementation contractor was able to provide requested data in a timely manner and was able to provide all the data necessary for a program process evaluation.
- The market for the program is becoming increasingly saturated and will continue to become more so as the program continues and the high-efficiency lighting market matures. According to the program managers and corroborated by the implementation contractor and subcontractors, the targeted population of A1 customers has been served both by previous iterations of the SBDI program and by the CLEO program. As the current SBDI program and CLEO program continue to install and promote the installation of high-efficiency lighting, the market saturation will continue to

increase. Future evaluation activities may take into effect the market transformation aspect of both this program and the CLEO program.

Low-Income Refrigerator Exchange (LIREP) Program

The following are the main process finding for LIREP.

- **The program did not achieve its annual energy savings goals.** In FY13-14, LADWP reported 4,950,000 kWh in energy savings, compared to a goal of 6,800,00 kWh. There are a number of challenges that kept the program from reaching its goals, the most important being lack of awareness of the program. During FY13-14, the program also had less dedicated staff than in previous years, but plans are in place to fill these positions. In addition, LADWP hired the first supervisor for this program in February 2014. While the supervisor has been helping with day-to-day operations until the planned positions are filled, having a supervisor will help LADWP tackle the challenges listed below moving forward.
- **The current volume of marketing and outreach is insufficient for meeting program goals.** Program and Appliance Recycling Centers of America (ARCA) staff identified awareness as a key barrier from increasing participation and reaching program energy savings goals. Currently, the largest source of awareness by far is word-of-mouth, followed by the LADWP website, neither of which are active outreach activities on behalf of LADWP.

Refrigerator Turn-In and Recycling (RETIRE) Program

The following are the main process findings for the RETIRE program.

- **The program did not achieve its annual energy savings goals.** In FY13-14, LADWP reported 3,900,000 kWh in energy savings, compared to a goal of 6,200,000 kWh. There are a number of challenges that kept the program from reaching its goals, the most important being lack of awareness of the program. During FY13-14, the program also had less dedicated staff than in previous years, but plans are in place to fill these positions. In addition, LADWP hired the first supervisor for this program in February 2014. While the supervisor has been helping with day-to-day operations until the planned positions are filled, having a supervisor will help LADWP tackle the challenges listed below moving forward.
- **Marketing and outreach are the limiting factor for increasing RETIRE energy savings and reaching program goals.** Program and ARCA managers identified awareness as the most significant barrier to increasing participation and energy savings. Currently, the largest sources of awareness are word-of-mouth and the LADWP website, neither of which are active outreach activities on behalf of LADWP. Opportunities exist to leverage appliance retailers and the CRP to market the program toward customers shopping for new appliances.

Home Energy Incentive Program (HEIP)

The following are the main process findings for the HEIP.

- **The HEIP is currently meeting its monthly participant targets.** The program administration is currently providing energy savings to LADWP customers while also targeting lower income customers.
- **The program is currently fully staffed for both administrative and field staff.** It has recently added two additional administrative staff members to assist with rebate processing. Also, because the program uses Integrated Support Services (ISS) team members for field work, it has adequate field staff to complete the targeted number of audits per month.

- **The inability to obtain landlord approval sometimes prevents projects from moving forward.** HEIP is going to be reassessing the way that it works with property owners, especially multi-family property owners, to better serve the rental market and achieve program goals.

California Advanced Home Program (CAHP)

The following are the main process findings for the CAHP.

- A lack of available staffing impedes LADWP's ability to represent its urban and municipal perspective in the CAHP statewide team. Program managers at SCG and LADWP indicate that LADWP's program manager is presently unable to commit the travel time to attend the CAHP statewide team's quarterly meetings in San Francisco. This lack of presence inhibits a more active role by LADWP in the administration of CAHP and denudes the statewide team of their expertise.
- Program data from SCG is not sufficient. Available program data does not explain the administrative costs SCG incurs while implementing the program. Because Navigant did not review the monthly invoices sent from SCG to LADWP and the SCG program manager deferred to permission from Regulatory Affairs for financial questions, Navigant could not identify additional opportunities to streamline the review process.

Energy Upgrade California (EUCAL) Program

Navigant conducted only a process evaluation of the EUCAL program. Some of the key findings were:

- While the EUCAL's administration is nominally a joint effort on the part of the two utilities, SCG's control over all program processes limits LADWP's insights into implementation effectiveness.
- The EUCAL program's current process flow creates a barrier to LADWP reviewing project information prior to completion in the program.
- While being addressed through the EUCAL working group and other program improvements, recent evaluation research found low realization rates and partial free ridership that adversely affected program performance.

Consumer Rebate Program (CRP)

The following are the main process finding for the CRP.

- **The CRP is understaffed, which affects the participation rate and the ability of the program to reach goals.** The program managers have to help process applications, which leaves them little time for steps to help improve or grow the program, such as updating the product mix and incentives, engaging with retailers or contractors, or developing marketing materials.
- **Program participants reported high levels of satisfaction with their experience with the program.** Overall, the program participants were very satisfied with all aspects of the CRP. Customers are most satisfied with the measure they installed and the program rebate and are slightly less satisfied with the electricity and money saved. Despite a few comments that the application and rebate processing time could be improved, two-thirds of participants have already recommended the program, and nearly all say they would consider participating again in the future.
- **Customers are motivated to participate in the program when they need to purchase new equipment, and the barriers to participation among program participants are low.** Current program participants generally found the application process easy, and nearly all say they would

consider participating again in the future. Thus, **the biggest barriers to participation seem to be lack of awareness of the program.** Marketing and outreach for the program are limited, and most participants do not remember receiving information from LADWP about the program.

Custom Performance Program (CPP)

The following are the main process finding for CPP FY11-12 and FY12-13:

- **Overall, respondents were very satisfied with CPP.** Participant survey responses indicated that participants were very satisfied with all aspects of the program and their interactions with LADWP.
- **Based on survey findings, it appears that CPP is not reaching its full potential in terms of influencing its target audience,** which limits participation levels and program savings. CPP's marketing efforts currently focus on regular industry events and informal interactions with individuals in the industry. These events typically include industry functions and Building Owners and Managers Association (BOMA) meetings. While staff engages regularly in these marketing efforts, the staff's interactions focus largely on customers who are already knowledgeable about efficient measures.
- **The program is not sufficiently tracking its contractors or exploring contractors as a communication channel.** Contractors and vendors serve as a key information channel for CPP, both in terms of marketing and throughout the program application process. Although contractors play a large role in customers' CPP experience, CPP staff does not track participating contractors. By keeping relationships with participating contractors informal, CPP is limiting its connection to additional potential participants and creating an informational barrier between itself and some of its current participants.

The following are the main process finding for CPP FY14-15:

- **Participant satisfaction remains high.** Program participants reported satisfaction as high overall, 8.8 on a scale of 0-10. The lack of timeliness for pre- and post-installation site visits concerns participants more than any other issue. LADWP is correct to ameliorate these delays by hiring additional engineering staff, allowing customers with time-sensitive projects to proceed without an incentive offer and consolidating one-off projects into whole building retrofits through the Energy Efficiency Technical Assistance Program (EETAP).
- **Some trade allies have been dissatisfied with EETAP.** Feedback from these trade allies highlights a perception that LADWP wants too much modeling detail for the level provided by current incentives. They recommend EETAP management reduce stringency of audit reports and reduce the number of iterations. Guidelines that simplify the process are already under development by EETAP program managers.
- **The lack of tracking of contractor/vendors and participant firmographics also jeopardizes the ability of CPP to reach new participants.** Participant and contractor surveys indicate the most common participants are real estate firms and large office spaces. These easy-to-reach customers are already well-informed of program incentives and frequently participate year-after-year. Firmographic and contractor/vendor detail in CPP tracking data will enable LADWP and third-party evaluators to establish the sub-markets served by CPP and therefore its ability to identify the harder-to-reach, underserved customers with less awareness of energy efficiency opportunities.

Commercial Lighting Efficiency Offering (CLEO) & Commercial Lighting Incentive Program (CLIP)

The following are the main process findings for CLEO FY11-12 and FY12-13.

- **The CLEO tracking system currently does not include sufficient customer contact information for program evaluation.** The tracking system does not currently include any information about the project contacts, including contact name, site address, business name, and contractor contact information. This limited the ability of the program to track participation and hindered the program evaluation process. Contact information had to be manually extracted from the program files in order to conduct the participant survey.
- **The CLEO program is not currently advertised by LADWP.** LADWP does not currently advertise the CLEO program directly to customers, instead relying on contractors to market the program to potential participants. The program also does not currently have a strategy to market the program to contractors, and instead relies on the contractors to take the initiative and seek out information about rebate programs. Since the evaluation period, the program has developed a trade ally program, a mutually beneficial arrangement that provides additional training to contractors. This should increase the accuracy of program application, leading to fewer pre- and post-inspections and a decrease in processing times, and this may by extension reduce free ridership. Future evaluations will estimate both free ridership and the market transformative effects of this program.
- **While participants are generally satisfied with the program, they are least satisfied with the energy and money they saved after participating in the program.** Because the program does not currently have a comprehensive customer marketing strategy, all the marketing is left to individual contractors, who may oversell the energy savings of the various measures installed under the program. If program participants are regularly disappointed with their energy savings, they may begin to spread negative word-of-mouth about the program, which could have an adverse effect on future participation levels.

The following are the main process findings for CLIP, FY 14-15:

- **By changing the participant focus of CLIP, LADWP will be able to resolve the customer overlap between the SBDI and CLEO programs.** The previous evaluation determined that SBDI and CLEO were competing for smaller projects such as T12 retrofits in small commercial facilities, potentially creating confusion among LADWP non-residential customers. By changing the design of CLIP from CLEO, CLIP should be able to focus on larger, lighting design-based projects, leaving SBDI to service customers with smaller projects. However, due to the small number of completed projects, it was not possible to determine if the average project size had increased under CLIP.
- **CLIP customers reported high levels of satisfaction with the lighting installed through the program.** As shown in the previous program evaluation, almost one in five CLEO customers reported being less than satisfied with the lighting installed through the program and the energy savings resulting from the program lighting. During the CLIP evaluation, all of the participants surveyed with completed projects reported being satisfied with the lighting installed through the program and the money and energy saved after participating in the program. The high standards that LADWP has set for LEDs included in the program may also be contributing to this high level of satisfaction among CLIP participants.
- **The lack of marketing for CLIP continues to be a barrier to increased participation.** LADWP does not currently advertise the CLIP program directly to customers, instead relying on contractors to market the program to potential participants. According to LADWP staff, they are

currently developing a targeted marketing strategy that will be finalized and implemented once the program changes from CLEO to CLIP are complete. In increasing the amount of marketing of CLIP, the program will be better able to achieve its goal of reaching all eligible LADWP customers.

Chiller Efficiency Program (CEP)

The following are the main process findings for the CEP.

- **The technology included in the program has not kept up with changes in the chiller market.** The CEP measure mix was designed around the technologies available several years ago. It is highly possible that many of the technologies in the program have become commonplace in the chiller market, which is demonstrated by the low number of non-free riders. Also, the chiller rebate may in some cases discourage customers from researching and installing newer, high-efficiency HVAC technology, since those measures were not included in the program.
- **The program is not taking full advantage of its participating contractor network.** The program tracking data does not currently contain information about the participating contractors, nor is there any kind of participating contractor database separate from the program database. While it appears that the program manager has made efforts to develop relationships with some of the participating contractors, there appears to be no systematic effort to track or reach out to contractors who have participated in the past.
- **The CEP is currently relying on the program manager to complete all the pre- and post-inspections.** Although the CEP pre- and post-inspections were originally intended to be carried out by the LADWP field staff, due to the length of time of the inspection process, the program manager began completing all the inspections himself. While Navigant recognizes the efforts of the program manager to expedite the application process, the issue of field understaffing remains.

Savings by Design (SBD) Program

The following are the main process finding for the SBD program.

- **SBD has the opportunity to streamline its processes.** Program manager interviews suggest the existing format of tracking data and invoices LADWP receives is not ideal for their review. They have to spend time and effort aligning program costs with program activities. These interviews also suggest general improvements to the format have been requested in the past, but the specifics have not yet been sufficiently articulated by LADWP.

Retro-Commissioning Express (RCx Express) Program

The following are the main process finding for the RCx Express program.

- **Lack of promotion and competition with other LADWP programs has limited RCx Express participation.** Because the program is not vendor-driven, it receives very little promotion from LADWP or from contractors. Customers who could potentially participate in RCx Express are instead participating in EETAP and CPP, mainly because these are contractor-driven programs and contractors are promoting them to their customers.

Refrigeration Program

The following are the main process findings for the Refrigeration program.

- **The Refrigeration program is understaffed, which affects the participation rate and overall program savings.** As revealed in the program manager interview, the Refrigeration program has neither the necessary field nor administrative staffing resources to effectively process program applications. Application processing often can take up to several months, which can lower program participation and savings, as many potential participants have neither the inclination nor the ability to wait for the program inspections and rebates.

Codes, Standards, and Ordinances (CSO) Program

The following are the main process findings for the CSO activities.

- **Track the frequency and contact point at each organization.** This will establish how LADWP reaches audiences like the DOE, ENERGY STAR, Water Sense, and industry groups cited in the business plan with its appliance standards advocacy.
- **Catalog the roles and responsibilities of current personnel and define the activities they undertake.** CSO works with a variety of external organizations and formally defining the process for responding to rules associated with each may be difficult because at least four LADWP departments, Efficiency Solutions, WCP, Environmental Affairs, and Public Affairs may wish to provide input. Clearly defined CSO-specific processes will ensure LADWP departments collaborate effectively and increase organizational resiliency.

Facilities Program

The following are the main process findings for the Facilities program.

- **Program goals are ambiguous.** Effective program management requires clear metrics that are well understood by both staff and participants. LADWP established energy savings goals for the Facilities program after the program was initiated for FY11-12 but did not review these goals on a yearly basis or adjust them as the program evolved. A lack of clear metrics or reviews of progress hampers efforts to expand the program and increase savings.
- **Split incentives and lack of awareness limit recruiting.** Facility managers, the key decision makers for each project, are not accountable for the energy spend of their buildings. Further compounding this challenge, the program has low awareness and declining staff resources. The combination of these factors limits the ability of the program to scale up participation through increased recruitment.
- **Participant satisfaction** is high. For those facility managers who did participate in the program, satisfaction with the program and installed measures was high.

NTG Assessment

As part of the process evaluations, Navigant surveyed a sample of participants regarding the influence of the program upon their decision to purchase qualifying equipment as well as the intentions absent the program. Navigant found a moderate degree of free ridership in all eight programs, with LIREP having the lowest level of free ridership at 0.20 and the CRP the highest with 0.58. While the surveyed participants provided insights into the influence of the program regarding the installation of un-incented equipment, Navigant was able to detect a quantifiable amount of spillover only in two programs: SBDI and CRP. Table ES-3 details the results of this NTG assessment.

Navigant did not conduct a NTG assessment for SBD, RCx Express, Facilities, HEIP, EUCA, CAHP, or CSO in either of its 2015 or 2016 evaluations. However, Navigant's market transformation assessment quantifies the contribution of these programs net energy savings from market effects. NTG does not apply to the Facilities program because LADWP is both the sponsor and the participant of that program.

Table ES-3. Summary Net-to-Gross Findings

Program	Free Ridership	Spillover	Net-to-Gross
SBDI	0.37	0.02	0.65
LIREP	0.20	0.00	0.80
RETIRE	0.30	0.00	0.70
HEIP	N/A	N/A	N/A
CAHP	N/A	N/A	N/A
EUCA	N/A	N/A	N/A
CRP	0.58	0.07	0.49
CPP FY11-12 and 12-13	0.46	0	0.54
CPP FY14-15	0.50	0	0.50
CLEO	0.50	0	0.50
CLIP	0.45	0	0.55
CEP	0.46	0	0.54
SBD	N/A	N/A	N/A
RCx Express	N/A	N/A	N/A
Refrigeration Program	0.34	0.0	0.66
CSO	N/A	N/A	N/A
Facilities Program	N/A	N/A	N/A

Source: 2015 evaluation report; 2016 Evaluation Report, Navigant analysis

Key Issues and Recommendations

For the first round of evaluations conducted in 2015, Navigant highlighted the following portfolio-level issues:

- **Staffing resources are limited.** Key program process steps rely on specific individuals whose time appears oversubscribed, and this limits program success. Provide sufficient staffing to support all program teams in order to deliver each program effectively. Provide sufficient training and authority to personnel so that the absence of individuals cannot affect overall program success.
- **Tracking data is inconsistent and lacks accurate participant contact data.** Many programs keep records in paper form. This practice makes evaluation more difficult and expensive, and reduces accuracy and precision. Further, the lack of participant contact information captured within program tracking data limits LADWP's ability to deliver programming and reduces the sample frame for subsequent evaluations. LADWP should invest in an industry-grade program data tracking tool. The resulting tracking system should provide program managers with accurate

and up-to-date information with which to guide their decisions. The tracking system should be readily accessible by all LADWP project team members and third-party evaluators.

- **Some programs lack clearly defined target customers and targeted marketing efforts.** Some programs were found to target the same customers, which led to confusion among potential program participants and competition between the program. Develop an internal marketing process that allows program staff to co-develop marketing aimed directly at customers. Co-developing marketing materials and approaches will help ensure that customers receive a unified message from LADWP, while limited customer confusion about which programs are relevant to them. Clearly define the targeted customer for each program to minimize unintentional overlap.
- **Some programs lack outreach to installation contractors and other vendors.** While contractors and vendors are key influencers of participant choices and overall program satisfaction, LADWP does not conduct regular outreach to these audiences. Develop and implement a trade ally outreach effort that would provide marketing materials and program details to the contractors and vendors who currently service LADWP customers. Maintain a database of participating contractors or include contractor contact information in the current program tracking databases.
- **Savings values across project files, tracking databases, and the E3 reported values are misaligned.** Many programs have inconsistent, errant, and incomplete program tracking data. This limits program staff's ability to properly identify and report accurate savings, hinders staff's ability to manage the program, and can also lead to savings being overlooked. Develop a data-driven management plan that includes explicit links between measure installations and resulting savings. Review project files to ensure data is compiled and input into the tracking system accurately and completely. Align program tracking data with impacts reported in the E3 calculators. Regularly cross-check and verify all savings values in the tracking data against E3 filings.

In the 2016 evaluation report, Navigant recommended the following for key issues in the portfolio.

- **Program goals and documentation:** For CLIP, CPP, and Facilities, participation appeared to be opportunistic rather than the result of a strategy. Management took goals that were well understood by staff, and management would increase the effectiveness of each of these programs. Along with clear goals, LADWP could enhance program performance with consistent and current documentation. The foundational element of documentation would be a clear delineation of program objectives (energy/demand savings, participation, and costs) followed by the deployment of tracking databases/spreadsheets with systematic QC procedures. An enhanced program tracking database would also improve the program staff's ability to see and QC program impacts, as well as provide for the opportunity for more efficient evaluation of impacts in the future. For programs such as RCx Express, Navigant recommends that simulation model inputs also be tracked to improve the effectiveness of future evaluations.
- **Marketing communications:** If market transformation efforts are successful, demand for all commercial programs could increase dramatically. Program management would be well served to develop marketing communications plans to deliver an accurate understanding of the program's value and ability to serve.

- **Update savings algorithms and deemed parameters:** The evaluation team provides recommendations for updates to both the savings algorithms and deemed parameter for both the HEIP and Facilities program, including updating operating hours and CFs and introducing the use of a verification rate for the residential lighting measures of the HEIP. These recommendations are based on a combination of findings from Navigant’s onsite measurement and verification activities as well as other relevant evaluations.
- **E3 calculator:** The E3 calculator should be updated to provide measure-level savings breakdowns for a fiscal year as well as a transparent process of mapping the tracking database savings to the E3 calculator with the help of a unique identifier at the measure level.

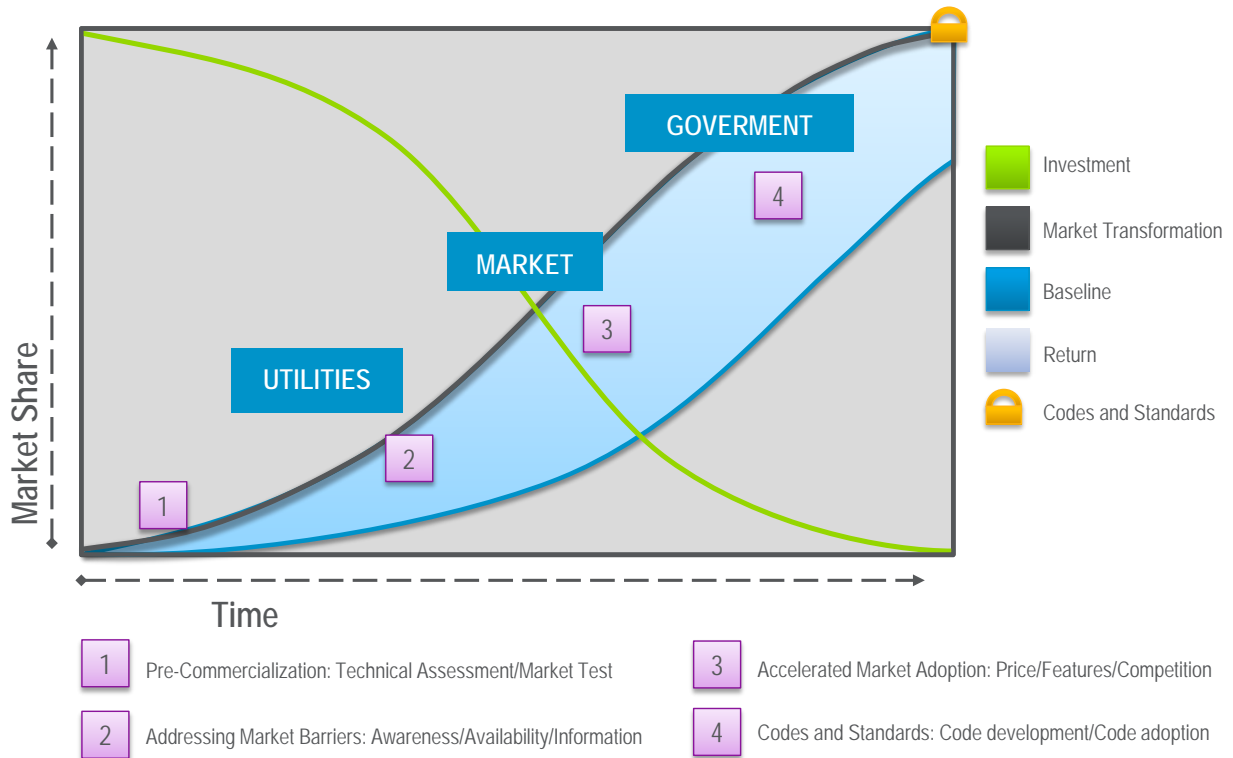
Market Transformation

LADWP retained Navigant to undertake an initial evaluation of the effort by the City of Los Angeles to transform its market for energy and water efficient goods and services. Market transformation is “the strategic process of intervening in a market to create lasting change in market behavior by removing identified barriers or exploiting opportunities to accelerate the adoption of all cost-effective energy efficiency as a matter of standard practice.”⁵ Market transformation aims to reduce market barriers to enable residents, contractors, vendors, manufacturers, and the City of Los Angeles as a whole to adopt and invest in energy and water efficiency opportunities. As a leader on energy and water issues with extensive stakeholder partnerships, LADWP plays an important role in this process.

Traditional market transformation “pulls” market actors towards a final code or standard, as shown in Figure ES-3. The “pull” of incentives and outreach will facilitate compliance. The “push” of an enforced ordinance is necessary to both raise awareness and motivate action. Success requires both the “push” and the “pull”. Without both elements, the program logic breaks down and the market is unlikely to move. The City is pursuing a push/pull strategy, as illustrated Figure ES-4.

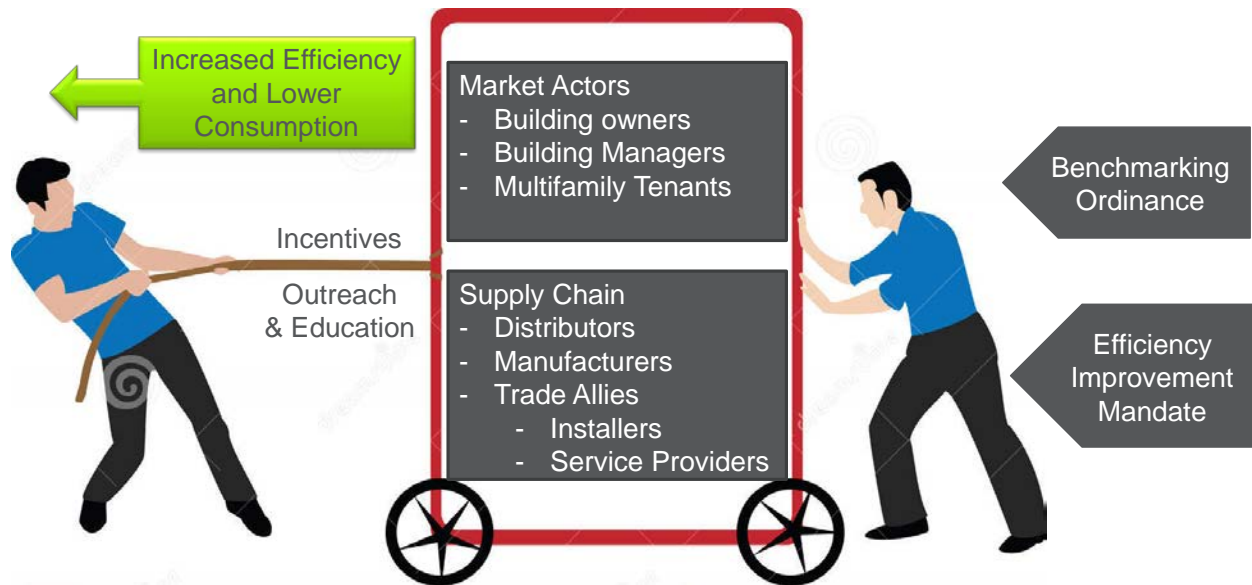
⁵ NEEA’s Definition of Market Transformation. https://neea.org/docs/default-source/marketing-tookits/neea_definition_of_markettransformation.pdf?sfvrsn=2. Downloaded January 1, 2017.

Figure ES-3. Traditional Market Transformation “Pulls” Market Actors Towards a Final Code or Standard



Source: Derived from NEEA's *Definition of Market Transformation*. https://neea.org/docs/default-source/marketing-tookits/neea_definition_of_markettransformation.pdf?sfvrsn=2. Downloaded January 1, 2017.

Figure ES-4. City of LA Push/Pull Strategy.



The objectives of this evaluation include the following:

- Develop a theory of market change that details the logical linkages between activities (sponsored by LADWP and other city departments) and observable outcomes characterized by greater adoption of energy efficient goods and services.
- Assess current market conditions and trends per the logic model via transparent and replicable data collection methods.
- Identify opportunities to enhance existing programming to optimize market transformation efforts.
- Create a modeling structure that defines current baseline consumption, forecasts potential savings, and can quantify future savings attributable to market transformation over time (2016-2025).

This report provides the above deliverables and the following key findings:

Logic Model and Theory of Market Change: A citywide initiative in which LADWP incentives and outreach support building owners' compliance to benchmarking and improvement ordinances appears to be a viable market transformation path for both the commercial and industrial (C&I) sector and the multi-family segment of the residential sector. However, neither LADWP programming nor the ordinances alone are sufficient to achieve this end. The combination of both the "pull" from the incentives and outreach and the "push" by ordinances is essential to fully remove existing barriers to market change. Navigant has created a logic model detailing this "push/pull" path and the relevant linkages.

Current Market Conditions and Trends: While some market actors are already aware of energy and water conservation opportunities and are willing to explore such opportunities, the majority lack both the motivation to address and the means of installing efficient measures. The absence of motivation and means constitutes an appropriate application of a "push/pull" market transformation approach. If successfully applied by city agencies, Navigant expects to be able to quantify the energy savings resulting from the market transformation.

Program Enhancement Opportunities: Market interventions should leverage differences in each building class to achieve optimal results. Class A building owners are able and willing to pursue efficiency to seize a “green premium,” but Class B and C owners face significant challenges to ordinance compliance and efficient measure adoption. Multi-family building owners face the additional hurdle of split incentives. Future program design should include offerings tailored to overcome the market barriers specific to each type of owner and segment.

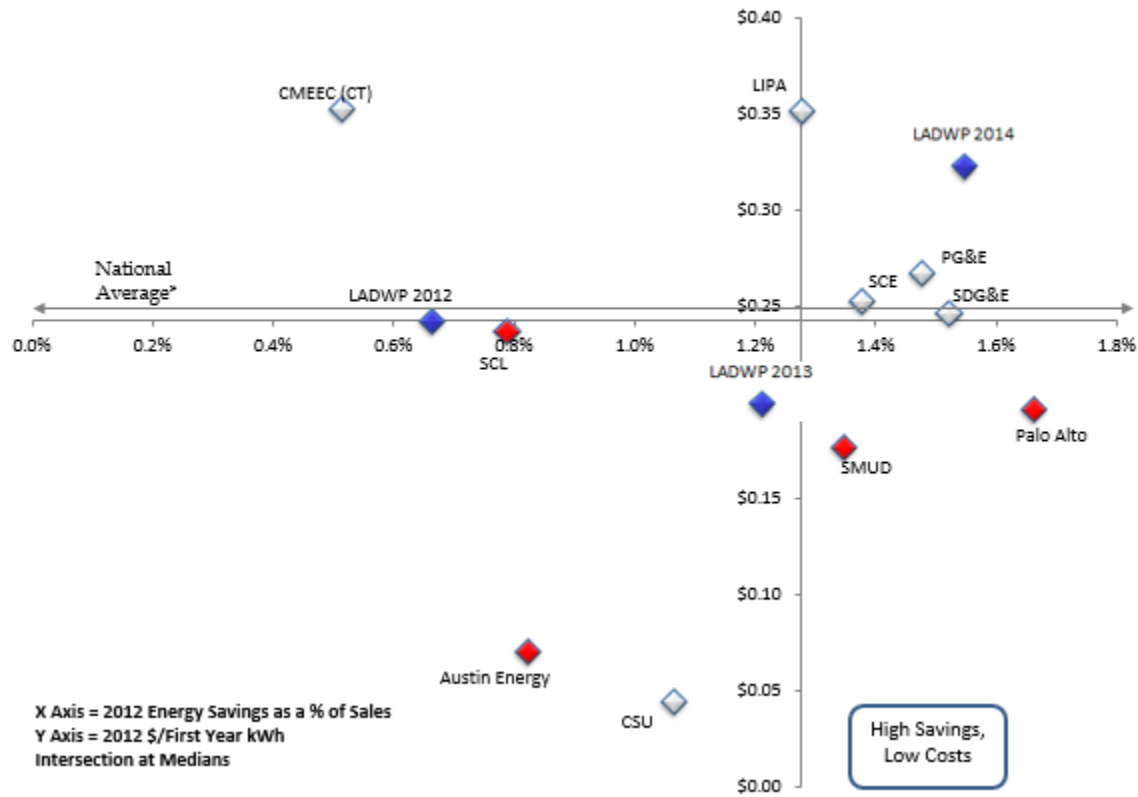
Baseline Energy Savings Model: Navigant used ELRAM to provide a mechanism that quantifies current baseline characteristics and can assess savings from market transformation over time (see Section 2.2.3.3). The ordinance just passed council recently. These are preliminary estimates based on many assumptions that would need to be verified in future years as the MT efforts take effect. The methodology to enumerate these savings, however, is in place for future evaluations.

Benchmarking

While LADWP achieves higher C&I savings than the other municipal utilities, the comparison group members achieved lower acquisition costs (see Figure ES-4). LADWP’s focus on custom and lighting programs is similar to SMUD’s C&I portfolio but lacks elements that the other municipal utilities pursue, such as new construction, retro-commissioning, and non-lighting prescriptive commercial rebates. In particular, the savings achieved by the city building code’s stringent energy efficiency requirements drive AE’s low-cost portfolio savings. The Green Building Program and C&I lighting savings allow AE to offer broader programming to achieve substantial savings from a variety of segments as a result. In the C&I sectors, lighting, custom rebate, and (with growth) new construction programs deliver the majority of C&I savings cost-effectively.

As a result of this study, LADWP has pursued opportunities for non-lighting prescriptive rebates from a subset of applications that would have traditionally been handled as custom projects. Also, through the partnership programs with SoCalGas has been actively incentivizing for new construction projects since 2013 via Savings by Design Program.

Figure ES-5. Commercial & Industrial Energy Savings and Cost Comparison

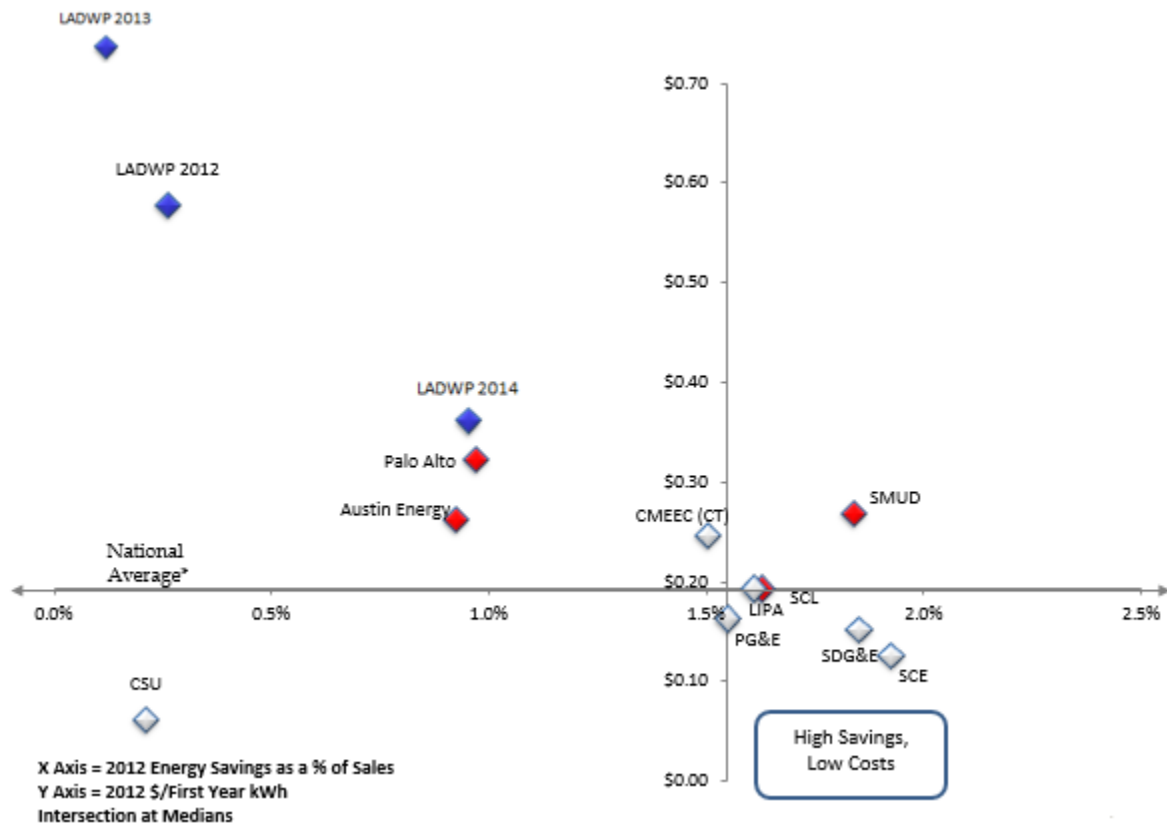


*Commercial, Industrial, and Agricultural Program Administrator Cost of Saved Electricity (2012\$/kWh)

Source: Navigant Analysis

LADWP pays more for residential savings than any member of the comparison group and no other municipal utility is as dependent on low-income programming for residential savings (see Figure ES-5). SMUD, CPAU, and SCL all leverage a few low-cost/high-saving programs with third-party program implementers to generate savings in a variety of segments, namely upstream lighting and behavioral. The absence of residential lighting and behavior programs limits the savings and increases LADWP's costs compared to other municipal utilities.

Figure ES-6. Residential Energy Savings and Cost Comparison



*Residential Program Administrator Cost of Saved Electricity (2012\$/kWh)

Source: Navigant Analysis

In-Depth Benchmarking Results

LADWP delivers lighting to commercial customers in ways similar to programs at comparison utilities. Distinctions can be made over the single-measure focus of CLEO/CLIP, but overall implementation, utilization of contractor networks, and marketing approaches are similar to the comparison group.

Custom commercial programs complement rigid prescriptive programs with broad and non-prescriptive assistance to customers. This broad responsibility belies a very specific focus among our comparison programs for cost-effective resource acquisition. Alternative objectives such as emerging technologies or serving hard-to-reach customers were not present, except where they happen to offer cost-effective resource acquisition. No variations in program design, process, or outreach were noted except related to the presentation of rebate materials and webpages to channel customers to prescriptive rebates first.

The prescriptive residential rebates programs in our comparison group vary in two main ways. The measures mix offered by LADWP, SMUD, and AE were more extensive than CPAU or SCL, whose programs focus only on appliances. Because SMUD and AE offer HVAC, cool roofs, or other contractor-centric measures, they provide a listing on their websites to help customers and incent participation from contractors, which LADWP does not. In the other areas examined—program logic, implementation, administration—the comparison programs shared the same framework as CRP, except with an explicit boundary between small and large multi-family at 3-4 units.

The differences among comparison group utilities in residential direct install programs are minor. Aside from a less restrictive target market that potentially overlaps with the EUCA program, HEIP is implemented in accordance with best practices. Navigant recommended no changes.

The partnership between LAUSD and LADWP was not found in other municipal utilities. Within the comparison group, account representatives channel school districts and like institutional customers through commercial programs of the appropriate customer size. These programs, SCL Energy Smart Services or AE Custom Technology program for instance, are invariably medium to large prescriptive commercial or custom commercial programs. Creating a new program for a large institutional customer is an innovation among comparison utilities. LADWP will prove the advantages or disadvantages of the approach.

The other programs benchmarked here blend from completely free to sharing some costs with the customer. The design of CPAU Right Lights Plus, SMUD Complete Energy Solutions, and AE Small Business Lighting demonstrate that some small to medium commercial customers would still participate in a cost-sharing program. Allowing those customers to share equipment costs with the utility would lower the cost per kilowatt-hour for SBDI.

1. INTRODUCTION

The Los Angeles Department of Water and Power (LADWP) is the largest municipal utility in the United States, serving over 4 million residents. It was founded in 1902 to supply water to residents and businesses in Los Angeles and surrounding communities. In 1916, it started to deliver electricity. Nearly 70 percent of electric usage is by the commercial and industrial (C&I) sectors and just over 30 percent by residential customers. In the energy efficiency realm, the utility offers customers more than 25 efficiency programs, ranging from residential to C&I customer programs.

LADWP engaged Navigant Consulting, Inc. (Navigant) to evaluate these efforts over a 3-year period (2013-2016), with the dual goals of: a) determining the reliability of reported energy savings and b) identifying possible process improvements to enhance both customer experience and uptake of LADWP's energy efficiency programs. This document summarizes Navigant's 2015 and 2016 evaluation reports of the following programs and fiscal years (FYs):

Table 1-1. Program Evaluation Summary

Program	2015 Evaluation Report	2016 Evaluation Report
Small Business Direct Install (SBDI)	FY13-14	
Low-Income Refrigerator Exchange Program (LIREP)	FY13-14	
Refrigerator Turn-In and Recycling Program (RETIRE)	FY13-14	
Home Energy Incentive Program (HEIP)		FY14-15
California Advanced Home Program (CAHP)		FY14-15
Energy Upgrade California (EUCA)	FY13-14	
Consumer Rebate Program (CRP)	FY11-12 and FY12-13	
Custom Performance Program (CPP)	FY11-12 and FY12-13	FY14-15
Commercial Lighting Efficient Offering (CLEO) / Commercial Lighting Incentive Program (CLIP)	FY11-12 and FY12-13	FY14-15
Chiller Efficiency Program (CEP)	FY11-12 and FY12-13	
Savings by Design (SBD)		FY14-15
Retro-Commissioning Express (RCx Express)		FY12-13, FY13-14, and FY14-15
Refrigerator Program	FY11-12 and FY12-13	
Codes, Standards, and Ordinances (CSO)		FY14-15
Facilities Program		FY09-11, FY11-12, FY12-13, FY13-14, and FY14-15

Sources: Navigant. 2015. "Evaluation, Measurement, and Verification of Energy Efficiency Programs: Evaluation Plan" Energy Efficiency Programs ANNUAL REPORT Volume 1 and Evaluation, Measurement, and Verification of the Los Angeles Department of Water and Power Energy Efficiency Programs ANNUAL REPORT:REPORTING YEAR 2016

These evaluations constitute Sections 3 through 17. In the course of developing these evaluations, LADWP staff requested that Navigant examine the effects of their programming upon the market in the Los Angeles market for energy efficient goods and services within the context of proposed city ordinances that would require energy and water benchmarking of C&I and multi-family buildings, as well as subsequent requirements for greater conservation through retrofits and management.

To examine these effects, Navigant partnered with Research into Action (collectively “the Navigant Team”) to provide the following deliverables:

- Develop a theory of market change that details the logical linkages between activities sponsored by the City of Los Angeles (including LADWP) to observable outcomes characterized by greater adoption of energy efficient goods and services (Section 2.2.1).
- Collect data through transparent and replicable methods regarding market conditions in Los Angeles prior to the enforcement of the proposed ordinances (Section 1.5.4).⁶
- Assess the extent to which the indicators of market change are (or are not) present in the Los Angeles market (Section 2.2.2).
- Develop an energy model (the Electric Resource Assessment Model [ELRAM]) that defines current baseline consumption, forecasts potential savings, and can quantify future savings attributable to market transformation (Section 2.2.3).

Finally, Navigant benchmarked acquisition costs and spending in LADWP’s energy efficiency portfolio level. Navigant provided these initial findings to LADWP in a PowerPoint presentation. A second phase moved to program-level analysis to identify successful designs and processes at the municipal utilities most similar to LADWP in size, goals, and climate. This study compared four utilities, City of Palo Alto Utilities (CPAU), Sacramento Municipal Utility District (SMUD), Austin Energy (AE), and Seattle City Light (SCL) across these energy efficiency program classes:

- Commercial Lighting – CLEO
- Customer Commercial Incentives – CPP
- Prescriptive Residential Rebates – CRP
- Residential Direct Install – HEIP
- Commercial Direct Install – SBDI, LAUSD

This final summary report provides high-level conclusions from these EM&V (evaluation, measurement, and verification), Market Transformation, and Benchmarking efforts. For complete results, please see the following four documents:

- “*Evaluation, Measurement, and Verification of the LADWP Energy Efficiency Programs, Annual Report*,” February 13, 2015 (hereafter referred to as the 2015 evaluation report)

⁶ Complete results from these activities are not in this summary report. For complete results see: Navigant, *Current Energy Efficiency Market Conditions and the Potential for the Transformation*, Final Report, September 7, 2016.

- “*Evaluation, Measurement, and Verification of the LADWP Energy Efficiency Programs, Annual Report 2016*,” July 13, 2016 (2016 evaluation report)
- “*Current Energy Efficiency Market Conditions and the Potential for the Transformation*,” September 7, 2016 (Market Transformation report)
- “*In-Depth Benchmarking Report*,” summer 2015. (Benchmarking report)

1.1 Regulatory Context

Two legislative bills, Senate Bill 1037 (SB 1037) and Assembly Bill 2021 (AB 2021), were signed into law a year apart. SB 1037 requires that California’s publicly owned utilities (POUs) (approximately 40)—similar to the state’s investor-owned utilities (IOUs)—place cost-effective, reliable, and feasible energy efficiency and demand reduction resources at the top of the utility resource loading order, giving priority to the efficiency resource in utility operating plans. Additionally, SB 1037 (signed September 29, 2005) requires an annual report describing utility programs, expenditures, expected energy savings, and actual energy savings.

AB 2021, signed by the governor a year later (September 29, 2006), reiterated the loading order and annual report stated in SB 1037, as well as expanded on the annual report requirements. The expanded report required inclusion of investment funding, cost-effectiveness methodologies, and an independent evaluation that measures and verifies the energy efficiency savings and reductions in energy demand achieved by the energy efficiency and demand reduction programs. AB 2021 additionally required a report every 3 years that highlights cost-effective electric potential savings from energy efficiency and established annual targets for electricity energy efficiency and demand reduction over 10 years.

The California Energy Commission (CEC, or the Commission) was given the mandate to oversee POU SB 1037 and AB 1021 energy efficiency program and EM&V efforts, with the following requirements for CEC:

- Monitor POUs’ annual efficiency progress
- Review POU independent evaluation studies, reporting results, and, if necessary, recommend improvements
- Ensure that savings verification increases the reliability of savings and contributes to better program design

The CEC also was mandated to provide the POUs with EM&V guidelines under which plans⁷ should be submitted.

1.2 Relevant Protocol

The overarching goals of Navigant’s EM&V activities were to provide LADWP unbiased, objective, and independent program evaluations by giving the following:

⁷ SB 1037 and AB 1021 did not require energy efficiency reporting to the CEC for smaller POUs with loads equal to or less than 500,000 megawatt-hours (MWh)/year.

- Useful recommendations and feedback to improve LADWP program operation, tracking, and measure offerings
- Assessment of each conservation program's effectiveness in reaching target populations
- Assessment of the quality of the program tracking data and supporting project application data for impact evaluation purposes
- Increased level of confidence in conservation program results

To achieve these goals, Navigant undertook both impact and process evaluations of the LADWP programs using the following guidelines for Navigant team activities:

- CEC POU EM&V Guidelines
- California Energy Efficiency Evaluation Protocols
- California Evaluation Framework

Navigant also used the following references to supplement the evaluation methods, as applicable:

- US Department of Energy (DOE) Uniform Methods Project (both draft and final chapters)
- National Action Plan for Energy Efficiency (NAPEE) Program Impact Evaluation Guide (for net-to-gross [NTG] issues)

CEC guidelines include both *POU Reporting Schedules* as well as a set of *CEC EM&V Framework of Criteria* specifications by which POU EM&V reporting materials are to be evaluated.

Specific EM&V reporting materials and CEC feedback reports are to meet the following schedules:

- California Municipal Utilities Association's (CMUA's) annual March Report: Every March 15
- POU's E3 Reporting Tool: Every March 15
- EM&V Portfolio-Level Evaluation Plans: For POU's that do formal portfolio-level evaluation plans, reports should be submitted to the CEC as they are completed
- EM&V Evaluation (Impact) Studies: Submit to the CEC as they are completed
- The CEC will provide feedback on the EM&V report directly to the POU staff contact within 60 days of receiving the report
- The Commission will generally base its evaluation of the report on the *Framework of Criteria*; however, feedback on and evaluation of the report will be interactive between Commission staff and POU staff

In terms of specific CEC EM&V Portfolio-Level Evaluation Plan requirements, portfolio-level evaluation plans must contain, at a minimum, the following information on a multiyear basis:

- Description of key customer markets
- Description of efficiency programs

- Evaluation priorities based on relative percentage of savings per program in a portfolio, degree of uncertainty associated with the ex ante savings of each program, and cost of evaluation required by program type
- Utility efficiency budget and percentage allocated for EM&V

For EM&V evaluation impact studies, the CEC guidelines require use of the CEC *Framework of Criteria* to guide the development and execution of EM&V impact studies through the following stages:

- Gross savings methods, including both engineering and billing analysis
- NTG methods
- Sampling and statistical precision
- EM&V reporting requirements

If the POU staff wishes to use different criteria than those set out or omit select criteria, CEC guidelines recommend that POU staff discuss options with Commission staff before the study process is initiated. Additionally, studies must make clear how the objectives of the evaluation impact study are consistent with the program and how the program is consistent with the POU efficiency program portfolio, as documented in the CMUA March Report.

The CEC *Framework of Criteria* guidelines (Part D), as identified in Table 1-2, provides a checklist for submitted POU EM&V reports. Navigant will adhere to the CEC *Framework of Criteria* guidelines in conducting LADWP impact and process evaluations.

Table 1-2. CEC Framework of Criteria Guidelines (Part D)

Contextual Reporting

- ☐ Does the EM&V report clearly state savings values consistent with the associated SB 1037 annual report?
- ☐ Does the evaluation cover a significant portion of the POU's portfolio and clearly describe the programs or savings not evaluated?
- ☐ Does the evaluation assess risk or uncertainty in selecting the components of the portfolio to evaluate?

Overview and Documentation of Specific Evaluation Effort

- ☐ Does the report clearly identify what is being evaluated in the study (part of a program; an entire program; the entire portfolio)?
- ☐ Does the evaluation include an assessment of EUL and lifecycle savings?
- ☐ Does the evaluation report provide documentation of all engineering and billing analysis algorithms, assumptions, survey instruments and explanation of methods?
- ☐ Does the report describe the methodology in sufficient detail that another evaluator could replicate the study and achieve similar results?
- ☐ Are all data collection instruments included, typically in an appendix?
- ☐ Does the report adequately describe metering equipment and protocols, if any, typically in an appendix?

Gross Savings

- ☐ Does the report review the program's choice of baseline?
- ☐ Does the report clearly characterize the population of participants?
- ☐ Does the report clearly discuss its sampling approach and sample design?
- ☐ Does the report state the sampling precision targets and achieved precision?
- ☐ Does the report clearly present ex post savings?
- ☐ Are the results expanded to the program population? If not, the report should state why not and clearly indicate where ex ante savings are being passed through.
- ☐ Does the study clearly explain any differences between ex ante and ex post savings?

Net Savings

- ☐ Does the evaluation include a quantitative assessment of net-to-gross? If not, does the evaluator clearly indicate the source of the assumed net-to-gross value?
- ☐ Does the report clearly discuss its sampling approach and sample design?
- ☐ If a self-report method is used, does the approach account for free-ridership?

EM&V Summary and Conclusions

- ☐ Does the report provide clear recommendations for improving program processes to achieve measurable and cost-effective energy savings?
- ☐ Does the evaluation assess the reliability of the verified savings and areas of uncertainty?

Source: California Energy Commission EM&V Guidelines, POU Energy Efficiency Programs, January 2011

1.3 LADWP Energy Efficiency Program Offerings

Listed below are the LADWP C&I programs evaluated in Navigant's Benchmarking and 2015 and 2016 evaluation reports:

- **The Small Business Direct Install (SBDI) Program** is a free direct install program that targets small business customers under 30 kW in the LADWP service territory. LADWP is partnering with SCG on this program to offer a tri-resource efficiency program aimed at reducing the use of electricity, water, and natural gas. Navigant also compared SBDI to other commercial direct install programs as part of its Benchmarking report.
- **The Customer Performance Program (CPP)** offers rebates for the installation of various energy efficiency measures. LADWP customers can receive a one-time payment for investments in eligible projects that reduce the electrical energy use in their building or facility. Most CPP incentive payments are based on the annual kilowatt-hour savings as calculated or accepted by LADWP. Beyond the financial incentive of lower electric bills, energy conservation projects often improve building operating efficiency and comfort levels for the occupants, as well as help to sustain the environment for the future. Navigant's evaluation of CPP included measures from the Energy Efficiency Technical Assistance Program (EETAP) and Thermal Energy Storage Program. Navigant also compared CPP to other custom commercial programs as part of its Benchmarking report.
 - **The Custom Express Program** is an expansion of the CPP, which is designed to include a simplified rebate menu (Custom Express Program) for specific measures. Currently, the program includes only three measures.
- **The Commercial Lighting Incentive Program (CLIP)** offers incentives to help make a wide variety of high-performance lamps and lighting fixtures cost-effective and targets any size business that still utilizes standard fixtures. Previously, CLIP was called CLEO, the Commercial Lighting Efficiency Offering program. CLIP is designed to be consistent with California's statewide lighting programs, leveraging established contractor networks to offer non-residential customers a full suite of lighting products and services to improve the energy efficiency in their businesses by upgrading/retrofitting core lighting systems. Navigant also compared CLIP to other commercial lighting programs as part of its Benchmarking report.
- **The Chiller Efficiency Program (CEP)** offers incentives for all types of high-efficiency chillers, from air-cooled to water-cooled chillers, with rebates up to \$193 per ton and 100 percent of the incremental cost. CEP is designed to assist large offices, hotels, hospitals/medical facilities, institutional facilities, or any business with a chiller-based air conditioning system.
- **The Savings by Design (SBD) Program** is a California statewide non-residential new construction program in which LADWP partners with Southern California Gas Company (SCG) to offer a uniform, multi-faceted program designed to consistently serve the needs of the commercial building community. SBD encourages energy efficient building design and construction practices, promoting the efficient use of energy by offering upfront design assistance, owner incentives, design team incentives, and energy design resources.
- **The Retro-Commissioning Express (RC_x Express) Program** offers cash incentives to customers who undertake a tune-up of their existing building system equipment to restore equipment to its original performance level as designed, if not higher. Incentives are offered for

measures on a prescriptive menu of options, including replacement or repair of certain lighting sensors, air conditioning economizers, restoration of fan and pump variable frequency drives (VFDs), operations setpoint strategies for supply air, temperature or duct pressure, chilled water and condenser water, operating schedules, and boiler lockout.

- **The Refrigeration Program** offers incentives to encourage retrofit measures and technologies to reduce energy consumption in supermarkets, liquor stores, convenience stores, restaurants, and other businesses. Rebates are offered for commercial food appliances and refrigerator cases, ice machines, reach-in freezers/refrigerators, display cases, and walk-in coolers, as well as other refrigeration equipment. After Navigant's evaluation, LADWP incorporated measures from this program into the Food Service Program. It offers incentives to encourage retrofit measures and technologies to reduce energy consumption in supermarkets, liquor stores, convenience stores, restaurants, etc.
- **The Facilities Program** strives to improve energy efficiency throughout LADWP's facilities with energy efficiency upgrades in heating, ventilation, and air conditioning (HVAC) and lighting. It identifies and assists those LADWP facilities to reduce energy usage, which will result in a reduction in energy consumption and procurement expense for LADWP that would otherwise be borne by LADWP customers.
- **LAUSD** is a direct install program focusing on lighting energy, water, and natural gas efficiency, with single customer—Los Angeles United School District facilities. Navigant did not evaluate this program, but did compare it to other commercial direct install programs as part of its Benchmarking report.

Navigant evaluated or benchmarked the following residential programs:

- **The Low-Income Refrigerator Exchange Program (LIREP)** is a free refrigerator replacement program designed to target customers that qualify for either LADWP's Low-Income or its Senior Citizen/Disability Lifeline Rates. This program leverages a third-party contractor, Appliance Recycling Centers of America (ARCA), to administer the delivery of the program and provides energy efficient refrigerators for this customer segment to replace older inefficient but operational models.
- **The Refrigerator Turn-In and Recycling Program (RETIRE)** offers a \$50 rebate, along with free pick-up, to residential customers to turn in old refrigerators and freezers for eligible units for recycling, which must be fully operational and satisfy certain age and size requirements. LADWP leverages ARCA to administer the delivery of the program.
- **The Home Energy Improvement Program (HEIP)** is a comprehensive, direct install, whole-house retrofit program that offers residential customers a full suite of free products and services to improve energy and water efficiency in the home by upgrading/retrofitting the home's envelope and core systems. While not limited to low-income customers, HEIP aims to serve disadvantaged communities and residential customers. Navigant also compared HEIP to other residential direct install programs as part of its Benchmarking report.

- **Energy Upgrade California (EUCAL)** is a collaborative effort among California counties, cities, nonprofit organizations, IOUs, and POUs to deliver a statewide whole-house residential retrofit energy efficiency program. LADWP partners with SCG's EUCAL to offer incentives to homeowners who complete select energy-saving home improvements on single-family residences or two- to four-unit buildings such as townhouses and condominiums.
- **California Advanced Homes Program (CAHP)** is a California statewide residential new construction program in which LADWP will partner with SCG to offer a uniform, multi-faceted program designed to consistently serve the needs of the residential building community. The program encourages energy efficient building design and construction practices, promoting the efficient use of energy by offering upfront design assistance, owner incentives, design team incentives, and energy design resources.
- **The Consumer Rebate Program (CRP)** offers incentives of up to \$500 or more to its residential customers to promote and advance comprehensive energy efficiency measures, including whole-house solutions, plug load efficiency, performance standards, and opportunities for integration. CRP is designed to offer and promote specific and comprehensive energy solutions within the residential market sector. Navigant also compared CRP to other prescriptive residential rebate programs as part of its Benchmarking report.

Navigant also evaluated the following cross-sector program:

- **The Codes, Standards, and Ordinances (CSO) Program** addresses the needs of the ratepayers of Los Angeles for water and energy conservation and sustainability through direct involvement with code-setting bodies for buildings, fixtures, and appliance codes and standards in the strengthening of water and energy efficiency requirements. This program investigates emerging technologies and new methods of construction that promote conservation and sustainability and advocates for (and in some cases develops) local ordinances to address water and energy savings mandates specific to the requirements of the City of Los Angeles. Most recently, this program provided support to the Mayor's Office and City Council regarding the development of a benchmarking ordinance.

1.4 Overview of This Report

Included in this report are summaries of 15 program evaluations and a market transformation assessment. Each program evaluation includes the following sections:

1. Program Goals & Achievements
2. Impact Results
3. Process Results
4. Recommendations and Actions

The market transformation assessment is divided into the following sections:

1. Logic Model
2. Market Transformation Indicators
3. Baseline for Estimating Energy Savings
4. Conclusions

The benchmarking results are divided by program type:

1. Commercial Lighting – CLEO
2. Customer Commercial Incentives – CPP
3. Prescriptive Residential Rebates – CRP
4. Residential Direct Install – HEIP
5. Commercial Direct Install – SBDI, LAUSD

1.5 Methodology

1.5.1 Process Evaluation of Energy Efficiency Programs

This section describes the key issues considered as well as the approach and methods the Navigant team used to complete the process evaluation activities. More program-specific discussions are included in the following sections.

1.5.1.1 Key Issues

The key issue for process evaluation was to develop a comprehensive and collaborative process evaluation framework to ensure that the process evaluation activities addressed the topics most relevant to LADWP staff and that continuous improvement occurred across three primary performance dimensions:

- **Team Function:** Energy efficiency program/portfolio, evaluation team, and evaluation function (i.e., prioritized topics and quality of results). Navigant assessed LADWP's energy efficiency program and portfolio performance and identified program processes that were performing well, as well as processes that could be improved to increase operational efficiency and program effectiveness.
- **Coordination with LADWP Project Management:** Navigant solicited regular feedback from the LADWP project management team regarding the Navigant team's direction on the project to determine course corrections as needed to keep the evaluation team focused on the topics most relevant to LADWP's program staff and other project stakeholders.
- **Integration of LADWP Feedback into Evaluations:** Navigant integrated the results across these two dimensions into a feedback loop for the entire process evaluation function to ensure improvement of the broader evaluation effort in terms of operational efficiency and quality of results over time.

1.5.1.2 General Data Collection Approaches

The Navigant team conducted process evaluation research across the six energy efficiency programs on a nearly simultaneous basis in order to ensure the following:

- Each program was implemented effectively and efficiently.
- Appropriate information was being collected for ongoing program management decision-making and for program evaluation.
- Program marketing, recruitment, and implementation activities supported LADWP's long-term goal attainment.

The Navigant team used the process evaluation activities to answer a number of important researchable issues. A selection of these specific researchable issues, as well as the research tasks to address each issue, is shown in Table 1-3. The Navigant team developed the final set of researchable issues after close consultation with LADWP staff.

Table 1-3. Researchable Issues – Process

	Review Program Documentation	Tracking System Review	Staff Interviews: LADWP Program Management Group & Engineers	Customer Surveys
Program Logic	X	X	X	
Barriers	X	X	X	X
Administration & Delivery	X	X	X	
Participation & Marketing	X	X	X	X
Participant Satisfaction				X
Attribution / NTG			X	X
Program and Staff Training	X		X	
Information & Education	X		X	X

Source: Navigant

In the following sections, Navigant describes the process evaluation data collection activities referenced in Table 1-3.

Review of Program Documentation

Concurrent with the program staff and implementer interviews, the Navigant team performed a detailed review of available program documents. This included a review of approved program plans, contracts, budgets, operations and procedures manuals, reports to regulators, logic models, and any other relevant documents. Navigant's objectives in performing this review were to learn as much as possible about the

detailed features and benefits of each program prior to designing the primary data collection efforts. The Navigant team also used this review to determine if programs were functioning as designed, and whether implementation costs were being managed properly.

Review of Tracking Systems and Secondary Information

Complete and accurate program tracking data is a cornerstone of effective program evaluation since these systems will be the basis in future program years for key inputs to evaluation (both process and impact) activities. As an important early step of the evaluation effort, the Navigant team reviewed existing program tracking systems. The purpose of the tracking system review was to ensure these systems had gathered the data required to support current and future evaluation activities, as well as allow program managers to monitor key aspects of program performance at regular intervals. Through this effort, the Navigant team looked at each of the fields in the program tracking database or hard copy program files, as well as the completeness and accuracy of the information collected, and compared this to the data needed for effective program management and rigorous impact and process evaluation efforts. Through our review, we assessed which programs/services are being used most frequently, whether appropriate quality assurance procedures were in place, whether the tracking process was functioning appropriately, whether programs were recording enough information to allow evaluators to determine timing of installations, whether programs were oversubscribed too early, and whether there were customer backlogs, among other topics.

In-Depth Interviews with LADWP Program Staff

The process evaluation for each program included in-depth qualitative interviews with LADWP program staff and implementers. The Navigant team used these interviews to develop a thorough understanding of the final program design, procedures, and implementation strategies for each program. The team also used the interviews to identify research topics to include in the customer surveys discussed below and to discuss available program materials (e.g., marketing and outreach materials, print, and radio advertising copy) in support of the evaluation queries.

Customer Surveys

The Navigant team also conducted quantitative telephone surveys with program participants. From a process perspective, we used the surveys to gather information regarding participant satisfaction with program participation and measures, effectiveness of program marketing and outreach activities, perceived barriers to and motivations for program participation, and program influence on other efficiency actions taken, if any.

Evaluation Strategies for Program Elements

The Navigant team developed a sources and uses table (Table 1-4) for each program to show data collection and analytical activities, as well as which program element the activities informed.

Table 1-4. Sample Sources and Uses Table

	Program Logic	Barriers	Administration and Delivery	Participation and Marketing	Participant Satisfaction	Attribution /NTG	Program and Staff Training
Review Program Documentation	X	X	X				X
Tracking System Review	X	X	X				
Staff Interviews (n >= 1)		X	X				X
Participant Survey (n >= 25)		X		X	X	X	

Source: Navigant

In pursuing these strategies, Navigant communicated with LADWP staff on a regular basis throughout the duration of the program evaluation by email and telephone. These informal communications aided in understanding tracking system data and participant perceptions.

1.5.2 Impact Verification of Energy and Demand Savings of Energy Efficiency Measures

This section describes the key issues considered as well as the approach and methods used to complete the impact evaluation activities. Discussions of specific programs follow in the sections below.

1.5.2.1 Key Issues

The key impact evaluation issues were sample selection and the selection of the appropriate level of rigor with which to evaluate gross energy savings and peak demand impacts. For details on sample selection, please refer to the 2015 and 2016 evaluation reports.

The purpose of conducting impact verification, or ex post savings analysis, was to develop more precise and more accurate (i.e., less biased) estimates of both individual measure savings and overall program savings. Navigant used the CEC POU Evaluation Guidelines to inform the selection of the evaluation strategy ultimately used for each measure. This process was done such that ex post savings could be verified across the entire portfolio in a cost-effective and acceptable way, and it is reflected in the evaluation plan. Those guidelines are distilled in Table 1-5.

Table 1-5. CEC POU Definitions of Rigor

Level of Rigor	Approach	When to Use It?
Verification with Deemed Savings	Some method of verification to check measure counts and proper installation. Deemed savings are either applied to the verification findings, or a desk review of the deemed savings assumptions is completed	Appropriate for smaller facilities or projects
Basic Rigor	Project-specific recalculation of energy savings using International Performance Measurement and Verification Protocol (IPMVP) Option A or C	Larger projects or those that have a higher level of uncertainty
Enhanced Rigor	Project-specific recalculation of energy savings using IPMVP Option B or D	Projects that cannot accurately be verified using verification with deemed savings or basic rigor
Other	Methodologies or processes which are outside the above rigor levels defined	Reserved for truly unique situations

Sources: California Energy Commission EM&V Guidelines POU Energy Efficiency Programs, January 2011, page 13; Navigant interpretation

Specifically, the team assessed the measures included in the programs in terms of the following:

- Aggregate size of the measure's impact at the program and portfolio levels
- Degree of site-by-site variation in per-unit savings
- Cost of applying the savings estimation method
- Sampling size and associated sampling error
- Reliability of the measured data
- Length of the evaluation and its timing relative to implementation (e.g., to assess whether billing analysis is feasible)

1.5.2.2 General M&V Approaches

The evaluation team used the following M&V approaches for evaluating the gross savings impacts of these two LADWP programs. These approaches are referenced in the subsequent program-specific chapters and described in detail below.

Engineering Review. For many measures, more rigorous approaches, such as field metering, may not be warranted. In those cases, the team conducted a thorough review of the current ex ante models used to estimate impacts. The results of this review may result in refinements to the current algorithm, the inputs to the algorithm, or an entirely new engineering model.

Onsite M&V. Onsite performance measurement activities were undertaken. Onsite inspections encompassed a range of activities, including the following:

- Simple verification of measure installations
- Confirmation of measure counts, capacities, and efficiencies
- Observation of the quality of installation of the technology
- Collection of nameplate and other performance data
- Observation of control systems and schedules
- Confirmation of baseline conditions (as possible)
- Discussions with building operators about building construction features, occupancy schedules, and energy systems characteristics and operations.

In addition to these onsite inspection and verification activities, larger measures (or those that involve greater uncertainty in ex ante assumptions) received additional M&V work, including the following:

- **Spot Measurements** – Spot measurements are the first and simplest level of onsite performance measurement and include one-time, instantaneous measurements of technology, system, or environmental factors including temperature, volts, amperes, true power, power factor, light levels, and other variables. As a general guide, these measures are used to quantify single operating parameters that do not vary significantly over time or are intended to provide a snapshot in time. They are not intended to capture seasonal or longer term effects. Another way of looking at this approach is that it is useful in assessing the savings of constant performance measures.
- **Interval Metering** – Interval metering is the most sophisticated level of onsite performance measurement and involves real-time monitoring of the energy use of specific end uses over a specified time period. This may involve recording true energy use or “proxy” values such as voltage and amperes from which energy used is computed. Interval metering is often used to measure pre- and post-installation performance to obtain accurate data on measure performance. Typically, this strategy is not deployed over long enough time periods to gauge seasonal effects, so the results of the measurements must be integrated into an analysis model to compute annual and seasonal impacts.

Table 1-6 provides a summary of the evaluation methodologies selected for each of the programs evaluated.

Table 1-6. Evaluation Methodology

EEP #	Program Name	IPMVP Method(s)	LADWP Staff Interviews	Participant Survey	Other Surveys
2	Small Business Direct Install Program	A	√	√	Implementation contractor and subcontractors
14	HEIP	A**	√		
12	Consumer Rebate Program	Varied by measure. Included A and B	√	√	Contractor
6	Custom Performance Program	Varied by measure. Included A, B, and D	√	√	Trade ally
1	Commercial Lighting Efficiency Offer	A	√	√	-
3	Chiller Efficiency	B *	√	√	LADWP Engineering Staff
11	RCx Express	A, B	√		
5	Refrigeration	Phone verification & deemed savings review	√	√	Contractor/Vendor /Distributor
19	Facilities	A, C, and D	√		

*IPMVP Options B refers to using engineering calculations using metered data

** IPMVP Option A was used for the lighting measures in the HEIP program, which make up 97 percent of claimed savings. The remaining measures received onsite verification (as they naturally occurred in the sample set of homes) with engineering reviews. Source: International Performance Measurement and Verification Protocol; <http://www.nrel.gov/docs/fy02osti/31505.pdf>

1.5.3 Evaluation Sampling

Navigant's approach to determining, validating, and verifying gross energy savings was based on obtaining at least 85 percent confidence and 15 percent precision at the program level and 90 percent confidence and 10 percent precision at the sector and portfolio levels. These key accuracy targets are the key drivers behind the sample designs for all LADWP programs for both fieldwork and desk analysis. To meet these targets and provide the most representative data, Navigant's sample designs controlled for confounding factors specific to the end use/measure or program being observed and employed randomized selection to ensure unbiased results to the extent feasible.

For each program evaluation, the Navigant team defined the population based on the program tracking databases provided by LADWP. Information on installed measures, installation dates, key customer characteristics, and estimated savings were the primary data components reviewed for programs when developing the sample design. In some instances, the population available for sampling was limited by the completeness of tracking data or customer contact information available. Where appropriate, the

Navigant team utilized other key program characteristics in determining an appropriate sampling design, such as business types, geographic distribution, or the number of measures or projects per participant. For nonparticipant surveys or field visits, the program tracking database was supplemented with the utility customer database in order to provide comparable information for the development of the nonparticipant sample.

Statisticians have developed many approaches to sample design. Each of these approaches may be best suited for a particular evaluation based on the objectives of each program and the availability of the population data. The Navigant team utilized a variety of sampling approaches depending on the nature of the program and the key areas of interest for each evaluation. Some of the sampling approaches that the Navigant team utilized for process and impact evaluations are listed below:

- **Simple Random Sampling.** Simple random sampling is a method of selecting sample cases out of the population such that every one of the distinct population cases has an equal chance of being selected.
- **Systematic Sampling.** In systematic sampling, each sample unit is chosen at a prescribed interval. This approach is used often and ensures that the sample draw achieves a representative distribution of a particular characteristic, such as ex ante project savings or geographic distribution.
- **Stratified Random Sampling.** In this method, the sample population is divided into subgroups (i.e., strata) based on a known characteristic such as savings level or energy usage. Stratified random samples can produce estimates with smaller coefficients of variation than simple random samples. A sample is then randomly chosen from each stratum in one of three ways: proportional stratification, optimal stratification, or disproportionate stratification.
- **Ratio Estimation.** This sampling method can achieve increased precision and reliability by taking advantage of a relatively stable correlation between an auxiliary variable and the variable of interest. For the evaluation of energy efficiency programs, the most frequently used ratio is the realization rate between ex ante savings and ex post savings.

Stratified samples were used when possible to improve the efficiency of the sample design. Stratification helps improve the representativeness of the sample relative to the range of participants in the whole population, thereby reducing the required size of the sample to meet precision targets. Useful stratification variables were identified based on a review of the program tracking databases, budget considerations, and discussions with utility staff. Stratification can result in a more efficient sample design by disproportionately focusing the selected sample on the program components that contribute the most to overall program savings. As an example, for business programs, the Navigant team frequently strove for a census of projects with the greatest contribution to program savings, with a random sample taken from the other strata based on a stratified ratio estimation method.

As mentioned above, the aim of the sample design for each program was to achieve results to meet or exceed 15 percent precision at the 85 percent confidence level, while also achieving 90 percent confidence and 10 percent precision for each sector and the portfolio. The relative precision of the sample design is calculated using the following formula:

$$\text{Relative Precision} = \frac{t\text{-value} * CV}{\sqrt{n}} * FPCF$$

Where

- n = the desired sample size for the program or stratum
- $t\text{-value}$ = the t -value for the confidence interval (2-sided) with sample size n
- $FPCF$ = the finite population correction factor based on the program or stratum population
- CV = the assumed coefficient of variation (CV).

For nearly all sampling methodologies, one of the key variables that influences the sample size needed to achieve a desired level of confidence and precision is the CV. The CV is calculated as the standard deviation divided by the mean of the variable in question. It is a measure of the variability of the key data point(s) being measured: the higher the variability, the higher the CV, and the higher the sample size needed to achieve the same confidence and precision levels. The CV can be assigned for an entire program or for an individual stratum. The Navigant team adhered to industry standards and CEC protocols in determining an appropriate but conservative CV to use in each program evaluation. In some instances, the use of ratio estimation allows for a lower CV to be assumed since there tends to be less variability around the realization rate of an energy efficiency project rather than the absolute amount of savings.

For a standard assumed CV of 0.5, the formula above shows that a sample size of 25 is needed to achieve 85 percent confidence and 15 percent precision for a program with a large population size (i.e., when $FPCF = 1$). For programs where multiple strata were utilized in the sample, the relative precisions for each stratum were calculated using the formula shown above. The precision for the overall program based on the selected sample size is estimated by calculating the relative standard error for each stratum using the following formula:

$$\text{Stratum relative standard error} = \frac{\omega^2 * CV^2 * FPCF^2}{n}$$

where

- ω = the proportion of overall program savings that is attributable to the stratum.

The square root of the sum of the relative standard error of all strata within an evaluation will return the overall relative standard error for the program:

$$\text{Program relative standard error} = \sqrt{SE_{\text{stratum } 1} + SE_{\text{stratum } 2} + \dots + SE_{\text{stratum } i}}$$

The Navigant team then multiplied the program relative standard error by the appropriate t -value (1.440 for a program with a large population) to determine that the sample design achieves 85 percent confidence and 15 percent precision based on the known population characteristics and assumed CVs. A similar calculation is performed to roll up the program sample designs to ensure that the 90 percent confidence and 10 percent precision criteria are being met at the portfolio and sector levels, as well.

Navigant has developed an in-house sample design and statistical calculation tool to perform many of these calculations. It relies upon Excel's built-in optimization software to select the most efficient sample

size needed to discover a population mean based on statistical characteristics of the sample and the desired confidence and precision criteria. This tool is based on a non-proportional stratification methodology that weights each stratum according to its approximate contribution to the total mean. The tool was utilized prior to data collection to provide a sampling framework for each program. The use of this standardized in-house tool reduces the chances of calculation error.

Table 1-7 provides a high-level overview of the sample framework utilized for each program. For planning purposes, the Navigant team assumed a CV of 0.5 in most instances, which is the minimum assumed value that is compliant with CEC protocols.

Table 1-7. Overview of Final Sample Framework

EEP #	Program Name	Assumed Participant Population	Final Sample Size	Stratification Utilized	Comments
2	SBDI	7,037	15	√	3 strata based on project kWh savings
14	HEIP	1,457	28	√	Stratified by measure category
12	CRP	20,085	74 telephone and 21 onsite	√	Multiple strata by technology
6	CPP FY11-13	329	25	√	5 strata based on project kWh savings
6	CPP FY 14-15	115	24	√	4 strata based on project kWh savings
1	CLEO FY11-13	1,755	25	√	4 strata based on project kWh savings
1	CLIP FY 14-15	16	16	√	2 strata based on project kWh savings
3	CEP	53	16	√	3 strata based on project kWh savings
11	RCx Express	9	9		Census
5	Refrigeration Program	132	27		Door gasket projects were excluded from the sample frame
19	Facilities Program	44	22	√	Stratified first by measure category (HVAC & lighting), then within lighting into two strata by the amount of claimed savings

Source: Navigant analysis

1.5.4 Market Transformation Approach

Market transformation aims to reduce market barriers to enable residents, contractors, vendors, manufacturers, and the City of Los Angeles as a whole to adopt and invest in energy and water efficiency opportunities. As a leader on energy and water issues with extensive stakeholder partnerships, LADWP plays an important role in this process.

To assess the market, the research team conducted interviews with market actors and observers, surveys with C&I and multi-family property owners, a focus group with C&I property owners, a market expert Delphi panel, and a residential population survey. The purpose of these data collection activities is to provide comparison data on energy and water efficiency trends for future periodic market transformation evaluation research.

Below is the methodology for each data collection activity.

1.5.4.1 Market Actor and Observer In-Depth Interviews

The market actor and observer interviews set out to answer the following research questions:

- What efficiency equipment and services are currently on the market?
- Is the cost of efficiency products going down, going up, or staying the same?
- What efficiency opportunities are market actors and observers aware of?
- What efficiency programs and rebates are market actors participating in?
- How important, needed, and used are rebates?
- What marketing efforts do market actors receive and use?
- What efficiency education are market actors receiving?
- What types of demonstration projects are market actors observing?
- Do market actors comply with energy code?
- How aware are market actors and observers of the proposed Sustainable City pLAn (pLAn) and its proposed benchmarking ordinance?
- How feasible do market actors and observers view ordinance compliance and the 15 percent energy goal of the pLAn?

Interviewers from the research team spoke with 17 market actors and 11 market observers for a total of 28 interviews. For the purpose of this study, each group is defined as follows:

- **Market Actors (n=17):** Individuals who engage in the purchase or sale of energy or water efficiency products and/or services for financial gain. The sample frame of market actors was primarily made up of LADWP participants (contractors and property owners).
 - Multi-family property owners or managers (n=2)
 - C&I property owners or managers (n=7)

- Contractors (n=8)
- **Market Observers (n=11):** Individuals who do not engage in the purchase or sale of energy (electricity focus) or water efficient product or services for financial gain but do study, examine, or document current trends.
 - Academics (n=3)
 - Trade association representatives (n=3)
 - Building sustainability advocates (n=3)
 - Journalist (n=1)
 - Regulatory affairs (n=1)

The research team identified interview contacts using the following data sources:⁸

- **Market actors**
 - LADWP participant list
 - Property owners
 - Contractors
 - City of Los Angeles (Mayor's Office of Sustainability) referrals
 - Primary research (e.g., Building Owners and Managers Association [BOMA] meeting attendance)
 - Secondary research on Los Angeles-based C&I and multi-family property owners and contractors
- **Market observers**
 - LADWP referrals
 - City of Los Angeles (Mayor's Office of Sustainability) referrals
 - Secondary research on Los Angeles-based trade association representatives and university researchers studying energy efficiency policy

The research team conducted 28 interviews from August to November 2015. Each interview lasted between 30 and 60 minutes. The team conducted data collection until our contact lists were exhausted.⁹

⁸ For this report, the research team used the individual as the unit of analysis.

⁹ For the purpose of this report, the research team defined "exhausted" as meaning an attempt to reach all relevant individuals multiple times and at various times during the day. The research team left several messages by phone and/or email until either an interview was scheduled or the team reached a dead end (i.e., received a refusal or no communication after several messages attempts).

1.5.4.2 Property Owner and Manager Survey

The property owner and manager survey set out to answer the following research questions.

- How aware are property owners of Los Angeles area efficiency programs (LADWP and SCG)?
- In what efficiency programs and rebates are property owners participating?
- What barriers do property owners face to efficiency program participation?
- How important are rebates to property owners?
- Do property owners encourage efficiency in the workplace (e.g., equipment, maintenance, and behavior)?
- Is the cost of efficiency products going down, going up, or staying the same?
- How aware are property owners of the proposed pLAn and its benchmarking ordinance?
- How prepared are property owners for the benchmarking ordinance?

To inform these questions, the research team conducted online surveys with 107 C&I and multi-family property owners in Los Angeles, classifying the groups as follows:¹⁰

- **C&I Property Owners (n=65):** Individuals who own or manage C&I properties such as retail, office, or production-related properties.
- **Multi-Family Property Owners (n=34):** Individuals who own or manage multi-family properties such as apartment buildings.
- **C&I and Multi-Family Property Owners (n=8):** Individuals who own or manage both C&I and multi-family properties.

Table 1-8 provides an overview of the survey contact sources, eligible contacts, number of completes, and the response rate per source.

Table 1-8. Contact Sources and Response Rates

Source	Eligible Contacts	Completes	Response Rate
InfoDataPlace	10,304	40	0.4%
InfoUSA	1,751	57	3.3%
Hoovers	125	6	4.8%
LADWP	21	4	19.0%
Total	12,201	107	0.9%

Source: Navigant team analysis

The research team fielded the survey between October 23, 2015 and December 2015. Each survey lasted from 5 to 10 minutes. Each respondent who completed the survey received a \$10 VISA gift card.

¹⁰ The research team used the individual property owner as the unit of analysis.

There were a total of 107 completions from the four source lists (see Table 1-8). Of the 107 completions, 65 respondents owned C&I properties, 34 owned multi-family properties, and 8 owned both types of property. The eight respondents who owned both property types answered both the relevant multi-family and C&I program questions, causing them to be counted each time when examining C&I (73) and multi-family (42) responses separately.

1.5.4.3 Property Owner and Manager Focus Group

The commercial property owner and manager¹¹ focus group set out to answer the following research questions:

- What factors do commercial property managers consider when purchasing energy- and water-consuming equipment?
- How are commercial property managers promoting energy and water efficiency?
- What are the characteristics of companies that frequently choose efficient equipment?
- How aware are commercial property managers of the proposed citywide benchmarking ordinance?
- How do commercial property managers think the benchmarking ordinance may affect commercial property managers?
- How feasible do commercial property managers view compliance with the benchmarking ordinance?

To inform these questions, the evaluation team conducted a 90-minute online focus group with five commercial property managers on December 9, 2015. The team worked closely with LADWP to identify and recruit appropriate respondents. Navigant provided a financial incentive to each respondent who completed the group discussion.

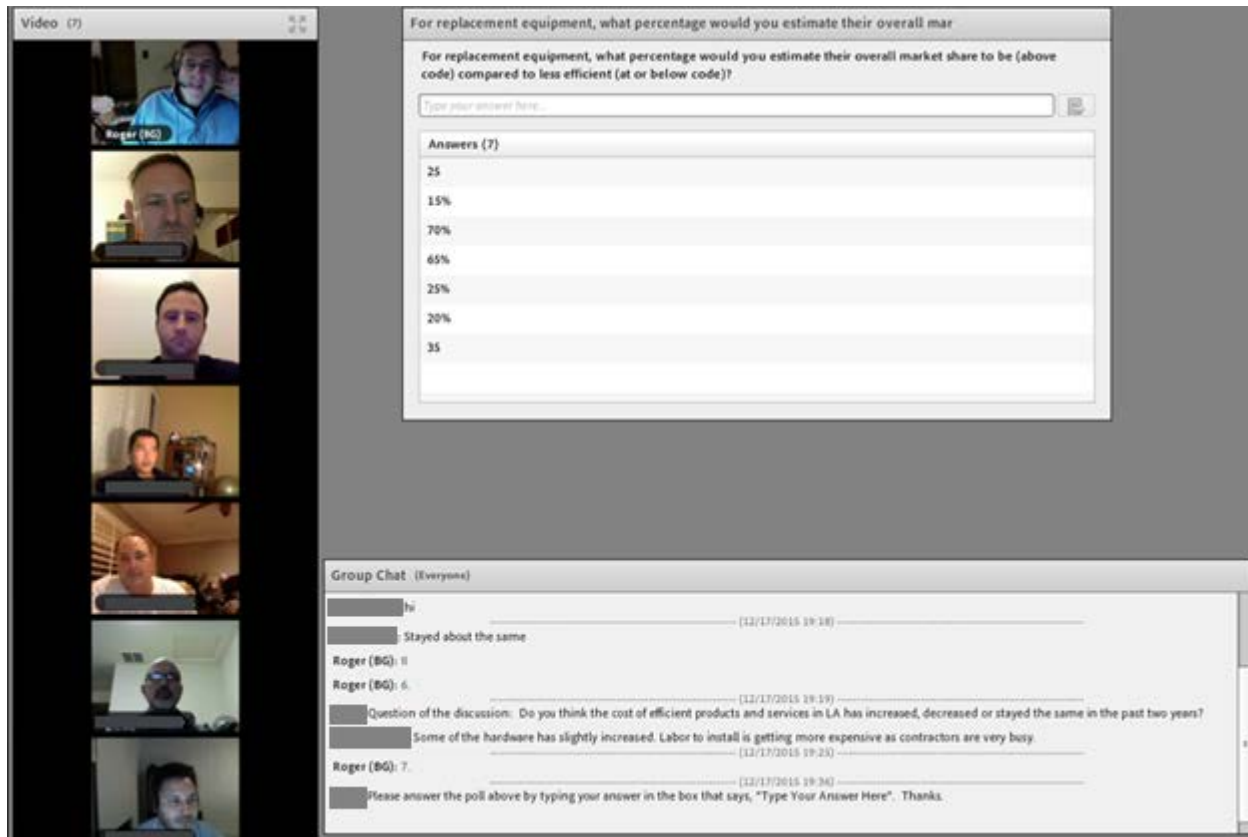
1.5.4.4 Market Observer Delphi Panel

On December 17, 2015, the Navigant evaluation team convened an online Delphi panel of seven energy and water efficiency experts. A Delphi panel is a structured form of communication among a group of subject matter experts in which iterative inquiry yields a forecast of future outcomes. In this Delphi panel, a moderator posed a series of questions to participating panelists and facilitated responses to estimate future levels of efficient measure adoption.

Panelists received a \$300 incentive to participate in the 90-minute online discussion centered on the current status and forecast future of individual indicators of market transformation. Panelists participated by webcam using the IQ2 interface as shown in Figure 1-1. Dr. Roger Straus from the Blackstone Group, Inc. moderated the panel.

¹¹ For the purpose of this report, the authors refer to all respondents as property managers.

Figure 7. Online Delphi Panel Platform



Source: Delphi panel

Recruitment for this Delphi panel targeted market actors (individuals whose profession involves buying or selling within a market) and market observers (individuals who study a market but do not benefit from individual transactions). The Navigant research team chose the seven experts chosen for this study based on recommendations from LADWP Efficiency Solutions staff, the mayor's office (City of Los Angeles) building benchmarking taskforce, secondary research of LA building owners, commercial real estate brokers, and academic market observers. These secondary research lists were used to recruit for other data collection activities as well. The Delphi panel had five commercial real estate owners/brokers with an average of 15 years of experience and two expert market observers. A complete breakdown of the panelists follows in Table 1-9.

Table 1-9. Delphi Panel Composition

Company	Job Title	Industry Role	Industry Experience	% of Properties by Class
UCLA Center for Corporate Environmental Performance	Postdoctoral Scholar	Researches or reports on sector	7 years	N/A
California Energy Commission	Deputy Director	Supports the mission of efficiency	3.5 years	N/A
Los Angeles Commercial Real Estate Group	President & CEO	Owns or sells commercial property	15 years	80% Retail 15% Industrial 5% Class A
Beverly Hills Realty Group	Owner	Owns or sells commercial property	5 years	50% office 50% industrial
SVN	Senior Adviser	Owns or sells commercial property	23 years	10% Class A 25% Class B 65% Class C
The Tenant Group	CEO	Owns or sells commercial property	12 years	50% Class B 50% Class C
Commercial Brokers International	Owner/ Partner	Owns or sells commercial property	18 years	20% Class C 80% Retail

Source: Delphi panelists

1.5.4.5 General Population Survey

The general population survey set out to answer the following research questions:

- How aware are Los Angeles residents of efficiency opportunities (e.g., programs and equipment)?
- How concerned are Los Angeles residents about efficiency?
- What barriers do Los Angeles residents face when taking efficiency actions?

The research team completed 800 surveys with Los Angeles residents, 600 online and 200 by telephone. To ensure the sample reflected the population, the 200 telephone surveys targeted Spanish speakers. Our analysis focused on differences between single-family and multi-family households, where multi-family includes two or more units in the same building.

The team implemented the web survey from November 4, 2015 to December 7, 2015. Respondents took an average of 14 minutes to complete the surveys. Interviewers conducted the phone survey from November 12 to November 25, 2015. The telephone survey lasted 27 minutes, on average. Once collected, data was cleaned and analyzed using Statistical Package for the Social Sciences (SPSS).

During data preparation, the research team applied post-stratification weights to ensure an accurate representation of the population, as telephone and web surveys often encounter difficulties reaching certain sub-populations. Post-stratification weighting mathematically corrects for biases that result from a sample not matching the population.¹² Table 1-10 compares the population of Los Angeles to the unweighted and weighted samples.

Table 1-10. Demographic Characteristics of Sample Compared to Weighted and Unweighted Sample

	City of Los Angeles Population %	Unweighted Sample (n=800)		Weighted Sample (n=797)	
		Count	%	Count	%
Home Ownership/Tenancy					
Rent	37%	376	47%	408	51%
Own	63%	424	53%	389	49%
Age					
18-24 years old	15%	77	10%	119	15%
25-34 years old	22%	240	30%	171	22%
35-44 years old	19%	159	20%	160	20%
45-54 years old	17%	129	16%	140	18%
55-64 years old	13%	106	13%	102	13%
65-74 years old	8%	61	8%	62	8%
75 or older	6%	20	3%	35	4%
Don't know/refused	n/a	8	1%	8	1%
Income					
Under \$50,000	50%	299	37%	407	51%
\$50,000 to under \$75,000	16%	206	26%	122	15%
\$75,000 to under \$100,000	11%	177	22%	69	9%
\$100,000 to under \$150,000	12%	41	5%	79	10%
\$150,000 to under \$200,000	5%	22	3%	33	4%
Over \$200,000	7%	7	1%	34	4%

¹² To create weights, the research team compared the sample with Census data, including home ownership, primary householder's age, income, ethnicity, and home type. The team calculated a weight value within each stratum (the proportion of Census divided by the proportion of sample) for each record. In cases where the respondent could not or refused to answer a question, we assigned a weighted value of one. The team then multiplied the weighting values of the five sampling dimensions to calculate combined weight values for each record. Making this mathematical adjustment changed the sample *n* from 800 (unweighted) to 797 (weighted). The team applied the weighted values to the final dataset and included weighted results in this report.

	City of Los Angeles Population %	Unweighted Sample (n=800)		Weighted Sample (n=797)	
		Count	%	Count	%
Don't know/refused	n/a	48	6%	51	6%
Ethnicity					
White or Caucasian	28%	341	43%	240	30%
Black or African American	9%	44	6%	69	9%
Latino, Hispanic, or Mexican	49%	284	36%	368	46%
Asian or Pacific Islander	12%	78	10%	94	12%
Native American	0%	5	1%	3	0%
Mixed	2%	39	5%	17	2%
Other	0%	5	1%	2	0%
Don't know/refused	n/a	4	1%	4	1%
Home Type					
Single-family	39%	358	45%	286	36%
Multi-family	61%	348	44%	502	63%
Manufactured/Mobile home	1%	94	12%	10	1%

**For the purposes of analysis in the body of the report, manufactured homes are treated as single-family homes.
Source: Navigant team analysis*

1.5.4.6 Lighting Distributor Interviews

The telephone interviews of lighting distributors in the Los Angeles area focused on the following research questions:

- Did distributors participate in LADWP programming?
- What factors influence the purchasing decisions of distributor customers (i.e., non-residential installers and contractors)?
- What conditions would increase demand from these customers for efficient products?
- What are the main barriers to increased adoption of select efficient measures?
- How aware and willing to purchase select efficient measures did distributors perceive their customers to be?

To inform these questions, Navigant staff conducted 15-minute telephone interviews with 10 lighting distributors in the Los Angeles area. One of the respondents also assembled lighting products in addition to providing distribution services.

The sample frame for this survey was a list of 32 lighting distributors taken from Hoover's proprietary database of North American businesses. Each respondent self-identified as serving installers and contractors whose main business was in the non-residential sector. Each respondent received a \$50 gift card for their time.

2. PORTFOLIO RESULTS

This section summarizes the portfolio-level findings from Navigant's impact evaluations, market transformation modeling, and program benchmarking.

2.1 Impact Evaluation Findings

Based on Navigant's program evaluation of 16 major LADWP programs, the overall realization rates for the combined programs are 1.04 and 0.98 for energy and demand, respectively. Table 2-1 provides details by program. These results show a range of realization rates. The energy and demand savings below reflect first-year savings evaluated. Navigant evaluated some programs across multiple years and some programs twice. Consequently, the savings cannot be summed to annual savings.

Table 2-1. Summary of Energy and Demand Savings

Program	Reported Gross Energy Savings (kWh)	Energy Realization Rate	Verified Gross Energy Savings (kWh)	Reported Demand Savings (kW)	Demand Realization Rate	Verified Demand Savings (kW)
SBDI	39,022,352	0.72	28,096,093	1,929	3.08	5,941
LIREP	4,954,870	1.08	5,361,435	N/A**	N/A**	643
RETIRE	3,958,164	0.32	1,230,584	597	0.42	248
HEIP	5,907,033	0.35	2,044,244	4,706	0.24	1,129
CAHP	3,209,011	1.78	5,712,040	1,153	1.92	2,214
EUCA	Process evaluation only					
CRP	4,562,906	2.01	9,171,533	1,875	2.11	3,957
Mass Market Subtotal	61,614,336	0.84	51,615,929	10,260	1.38	14,132
CPP FY11-12 & FY12-13	111,034,358	0.82	90,982,750	26,819	0.40	10,840
CPP FY14-15	54,673,360	0.85	46,527,517	8,847	0.39	3,419
CLEO	86,118,422	1.10	94,726,274	18,753	0.94	17,679
CLIP	4,273,797	1.09	4,669,671	680	0.95	645
CEP	9,429,798	0.97	9,128,056	N/A*	N/A*	852
SBD	497,693	0.92	457,878	19	0.79	15
RCx Express	1,415,573	0.79	1,116,737	0	N/A*	0
Refrigeration	3,782,527	0.93	3,499,127	423	0.43	182
CII Programs Subtotal	271,225,528	0.93	251,108,010	55,541	0.61	33,632
CSO	121,781,298	1.40	170,031,367	13,630	2.22	30,209

Program	Reported Gross Energy Savings (kWh)	Energy Realization Rate	Verified Gross Energy Savings (kWh)	Reported Demand Savings (kW)	Demand Realization Rate	Verified Demand Savings (kW)
Facilities	3,053,946	1.27	3,874,079	737	0.61	451
Cross-Cutting Programs Subtotal	124,835,244	1.39	173,905,446	14,367	2.13	30,660
Total***	457,675,108	1.04	476,629,385	80,168	0.98	78,424

*Program-level demand savings and realization rates are not reported here because of issues with tracked negative demand savings and discrepancies in ex ante values between sources.

**The E3 model did not include demand saving estimates

***Represents total first-year savings from FYs evaluated (see Table ES-1).

Source: Navigant analysis

Process recommendations are summarized in the Executive Summary and Sections 2.2 through 17.

2.2 Market Transformation

The following sections summarize Navigant's *Current Energy Efficiency Market Conditions and the Potential for the Transformation* final report, provided to LADWP on September 7, 2016. Consult that report for full results from data collected as part of:

- Review of Secondary Sources
- Market Actor and Observer In-Depth Interviews
- Property Owner Survey
- Property Owner Focus Groups
- Market Expert Delphi Panel
- General Population Survey
- Lighting Distributor Interviews

2.2.1 Logic Model

The intent of market transformation is to reduce market barriers to such a degree that residents, contractors, vendors, manufactures, and the city as a whole increase their adoption of and investment in energy efficiency, renewable energy, and water conservation opportunities. The purpose of the logic models is to present theories of market transformation for the Los Angeles C&I sector and the multi-family segment of the residential sector. Logic models are a visual representation of elements of market transformation, including inputs, activities, outputs, short-term outcomes, intermediate outcomes, long-term outcomes, and external factors.

A foundational aspect of LADWP's role in market transformation is its market partnerships with numerous stakeholders in the C&I sector and the multi-family segment of the residential sector. This report details these relationships and linkages per the following elements:

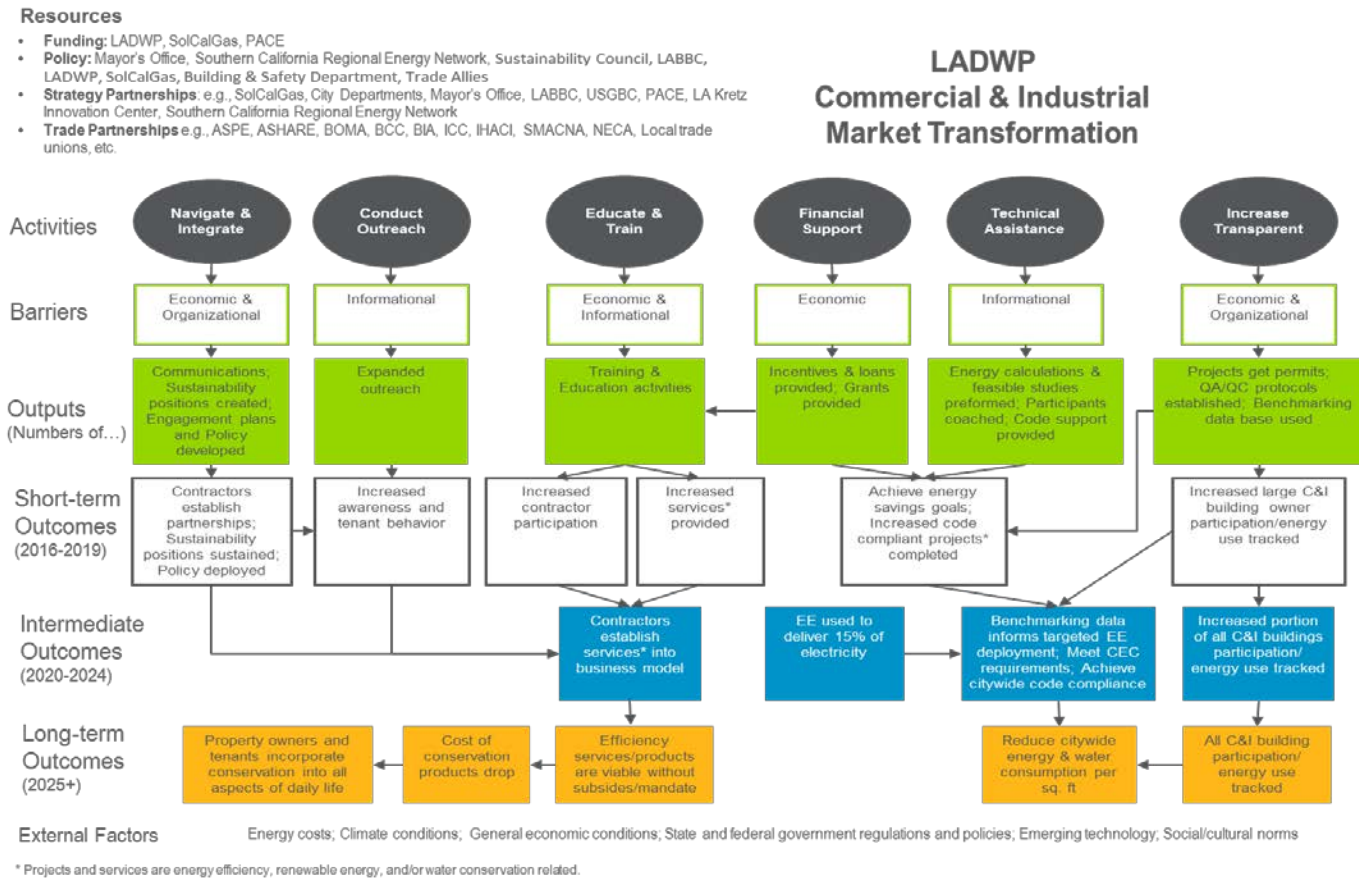
- **Logic model diagram:** A visual representation of elements of market transformation, including inputs, activities, outputs, short-term outcomes, intermediate outcomes, long-term outcomes, and external factors.
- **Resources:** Resources that support and maintain market transformation.
- **Barriers:** Characteristics that help explain the gap between the current level of participation and investment in energy efficiency, renewable energy, and water conservation and the intended outcomes.
- **Activities:** Actions that provide the foundation of market transformation action. On a continuum, activities lead to immediate outputs that, if successful, collectively work toward achievement of anticipated short-term, intermediate, and long-term outcomes.
- **Outputs:** The measurable products or services that result from activities.
- **Short-term, intermediate, and long-term outcomes:** The changes to market structure or market actor behavior that occur once activities overcome, or greatly diminish, barriers. These outcomes encompass market transformation goals and objectives. Outcomes vary depending on the timeframe being assessed and can occur as soon as activities begin and continue after they end.
- **External factors:** Influences that can facilitate or impede the achievement of a market transformation outcome.
- **Market transformation indicators (MTIs):** These indicators are the metrics that will be used to estimate what changes would have occurred without the market transformation efforts.

The following two sections detail the theories of change for the C&I sector and the multi-family segment of the residential sector.

2.2.1.1 Theory of Market Change

Most market transformation initiatives related to the energy efficiency focus on the sponsoring-agency (usually a utility) and its activities to remove market barriers within a specific legal and regulatory context. In Los Angeles, however, LADWP, the sponsoring utility, is part of the local controlling authority. LADWP not only provides programming to “pull” building owners to make efficient retrofits, but also advises city policymakers and enforcers as to the best way to “push” building owners toward this same goal. Thus, the premise of this theory of change is that, as the City of Los Angeles “pushes” down market barriers by providing information and motivation to building owners via benchmarking and improvement ordinances, LADWP can “pull” this same audience with incentives and outreach. Figure 2-1 details the linkages between each element of the logic model.

Figure 8. Logic Diagram for C&I Sector Interventions in the City of Los Angeles



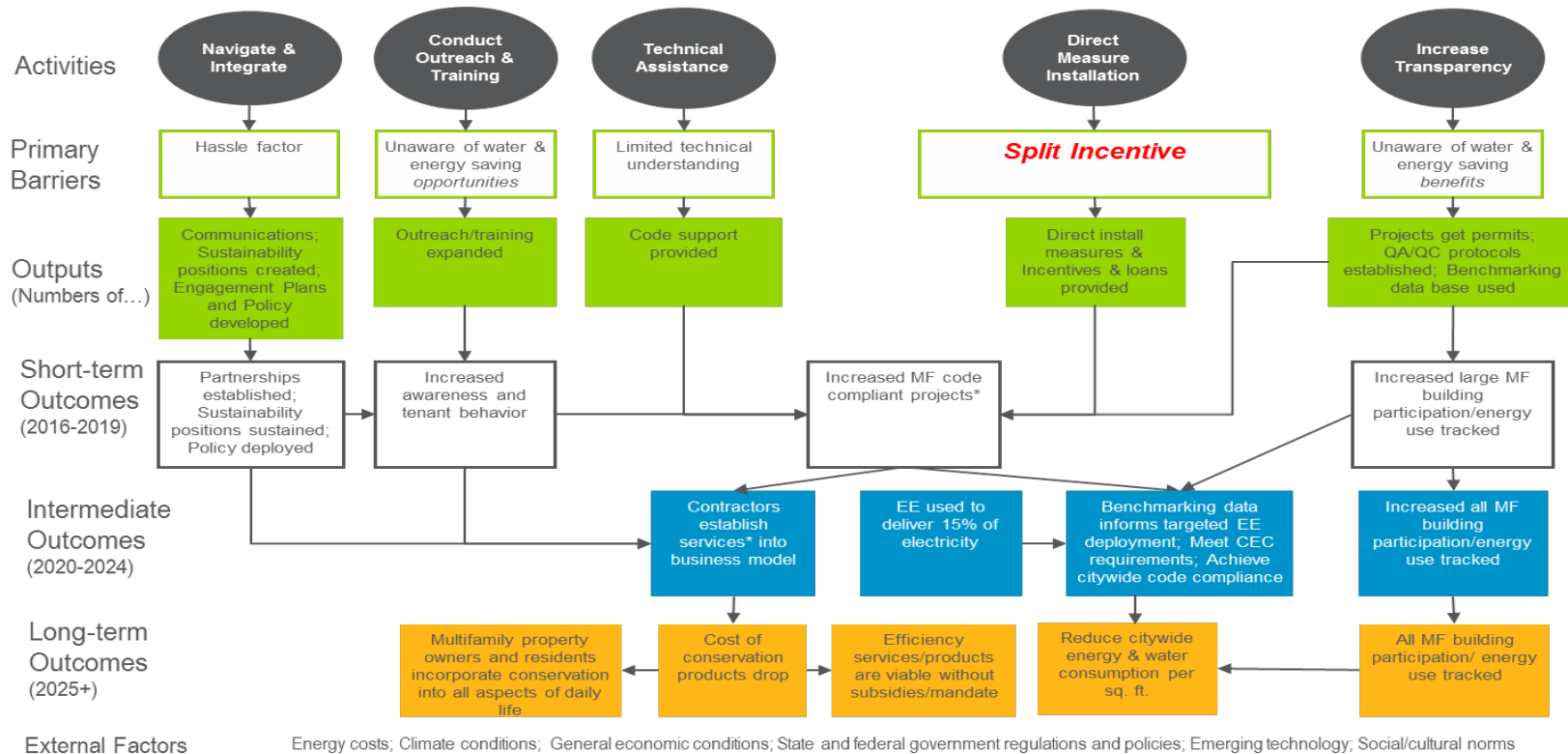
Source: Navigant team analysis, LADWP

The logic for the market transformation of the multi-family segment is similar to that outlined in Figure 2-1, with one significant difference: the split incentive between building owners and tenants. Figure 2-2 details the relevant logical linkages.

Resources

- **Funding:** LADWP, SolCalGas, PACE
- **Policy:** Mayor's office, Southern California Regional Energy Network, Sustainability Council, LADWP, SolCalGas, Building & Safety Department, HCIDLA, HACLA, Trade Allies
- **Strategy Partnerships:** e.g., SolCalGas, City Departments, Mayor's Office, HACLA, LABBC, PACE, LA Kretz Innovation Center, Southern California Regional Energy Network
- **Trade Partnerships** e.g., ASPE, ASHRE, BOMA, IHACI, SMCHNA, NECA, BCC, Local trade unions, etc.

LADWP Multifamily Market Transformation



* Projects and services are energy efficiency, renewable energy, and/or water conservation related.

Figure 9. Logic Diagram for Multi-Family Interventions in the City of Los Angeles

Source: Navigant team analysis, LADWP

2.2.2 Market Transformation Indicators

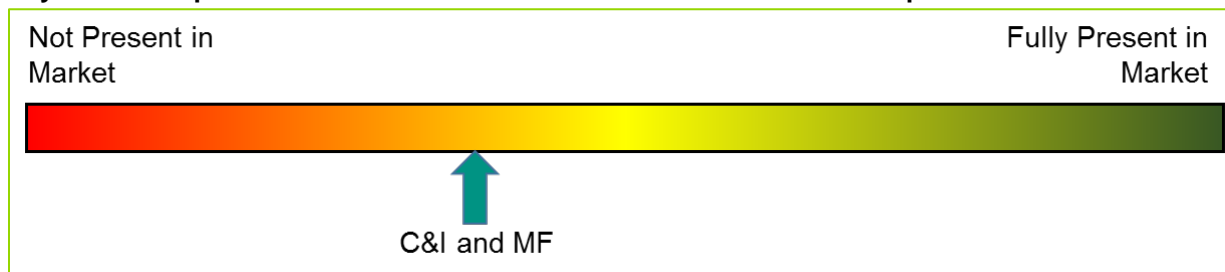
MTIs are the foundation of this market transformation evaluation. The premise of the evaluation is that if the research team can observe these indicators as present in the market through transparent and repeatable methods, then the market will have transformed per the logic models. Any energy savings derived from the ELRAM model would then be attributable to the efforts of the City of Los Angeles and LADWP.

Each of the previous sections provided an assessment of MTIs from the perspective of the respective data collection activities. This section provides an aggregate baseline of market indicator presence (or non-presence) in the Los Angeles market based on the overall findings of the data collection activities. Future research will determine if these indicators are more or less present over time. The following sections provide overall assessments for each indicator for which data was available for the short (2016-2019), intermediate (2020-2024), and long-term (after 2025) outcomes.

2.2.2.1 Short-Term Indicators

These indicators show the initial market changes that would be expected per the theory of market change. These changes should be observable in the first 1-3 years (2016-2019) of the city's/LADWP's initiatives. While some activities outlined in the logic model are already in operation (LADWP equipment rebates) and others are undergoing redesign (LADWP outreach and education), some activities (benchmarking) have not yet launched. Given this staggered start of activities, many of the short-term indicators may not be fully present until the end of 2019.

Key Partnerships Established with Clear Delineations of Roles and Responsibilities



Source: Navigant team analysis

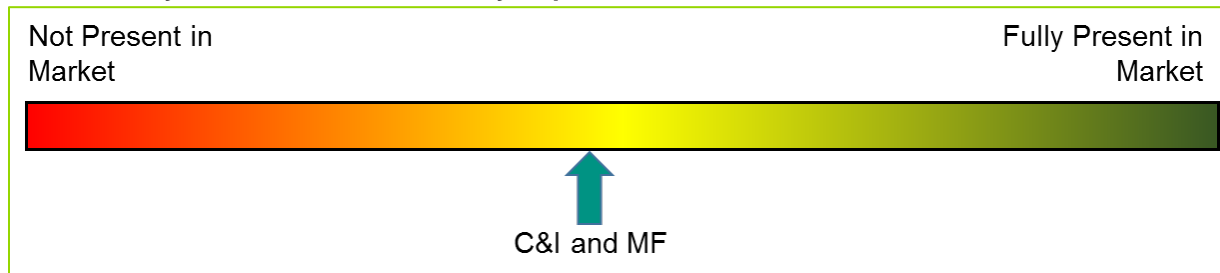
- Partially present.** At the May 7, 2015 kickoff meeting for this evaluation, multiple departments of the City of Los Angeles convened to discuss collaboration and communication regarding energy and water efficiency. Overall, these stakeholders indicated the presence of established partnerships; however, the consensus of that meeting was that roles and responsibilities were not clearly defined for all stakeholders, nor are all stakeholders presently working toward market transformation. Once key stakeholders establish clear roles and responsibilities for staff to support market transformation, this indicator will be fully present.

Future research may track the roles and responsibility for staff working on energy and water efficiency for each department. Further evidence indicating the presence of this indicator could include the following:

- Formal memoranda of understanding among stakeholders defining roles and responsibilities

- Minutes from stakeholder meetings detailing agreed upon roles and responsibilities

Sustainability Staff Present in Each City Department

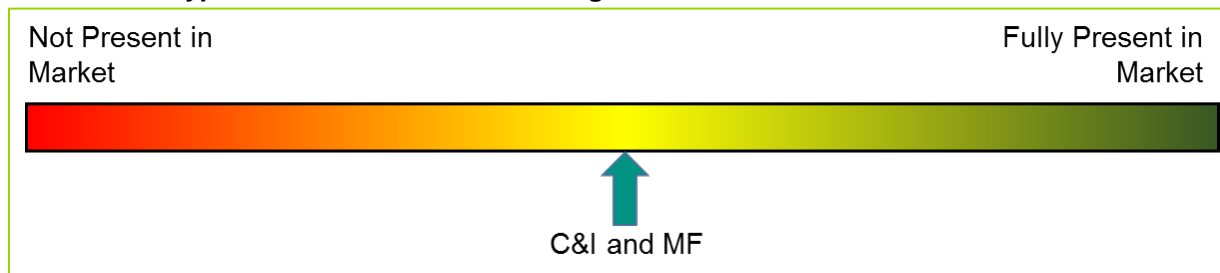


Source: Navigant team analysis

- Partially present.* The same May 7 meeting showed that multiple city departments, including the mayor's office, have personnel collaborating on sustainability issues. At this time, 22 such positions appear to be staffed. Once a sufficient number of positions and long-term funding are implemented, this indicator will be fully present.

Future research may track the number of full-time equivalents (FTEs) dedicated to sustainability and the associated funding sources in each department.

Number and Type of Conservation Policies/Organizations Affected

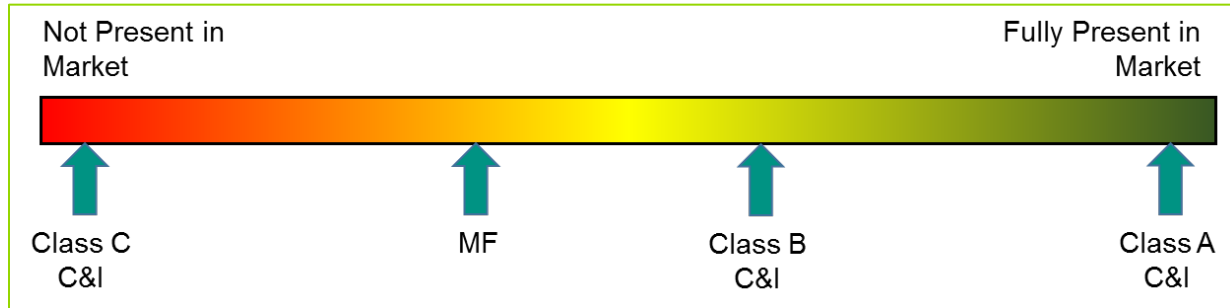


Source: Navigant team analysis

- Partially present.* Secondary research into state building codes and city ordinances documented a number of energy and water conservation policies that may contribute to transforming the market in Los Angeles. In future years, additional policies and affected organizations may indicate full presence of this indicator.

Future research may track the number and type of policies affected over time.

Increased Awareness of Energy Efficiency, Renewable Energy, and Water Conservation Opportunities by Participants and Trade Allies Year-over-Year

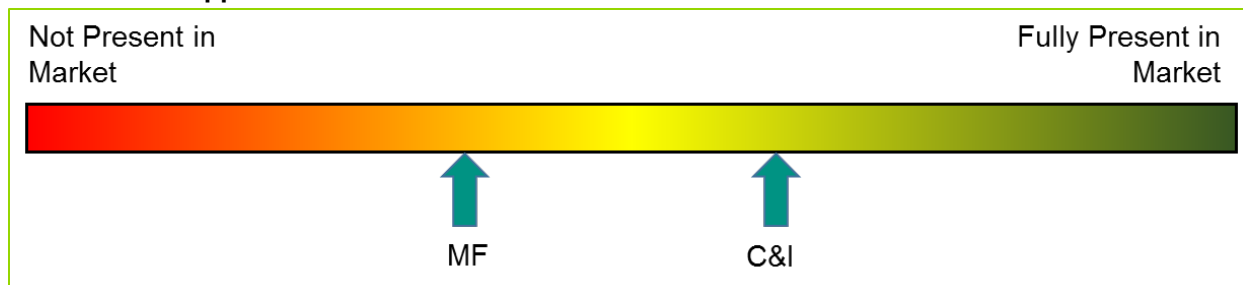


Source: Navigant team analysis

- Partially present.** In-depth interviews with market actors and observers, property owner surveys and focus groups, and the commercial real estate observer Delphi panel measured efficiency awareness. These discussions indicate high awareness among Class A property owners and the trade allies that serve them, with less awareness in Class B and Class C properties. Market actors in the multi-family segment reflected a more moderate degree of awareness. Additional outreach to these less aware classes and segments may result in increased awareness, which will support full presence of this indicator in the market.

Future research may compare these findings to determine the extent that efficiency awareness changes over time among C&I classes, as well as the C&I and multi-family sectors.

Increased Participation by Trade Allies in Energy Efficiency, Renewable Energy, and Water Conservation Opportunities Year-over-Year

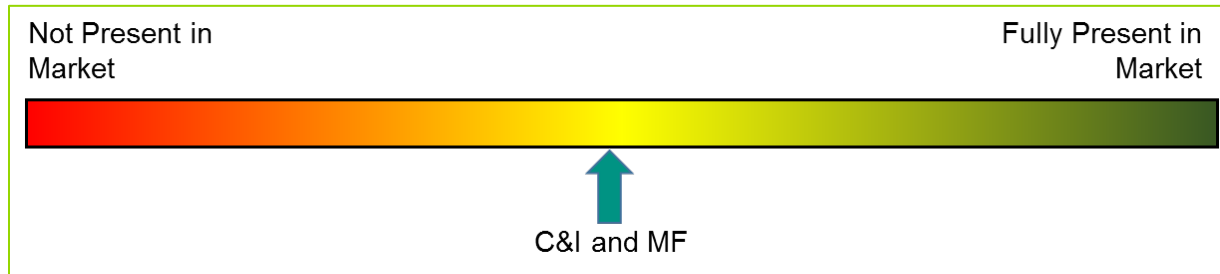


Source: Navigant team analysis

- Partially present.** In-depth interviews with market actors and observers and secondary research into organizations affected by conservation policies indicated high levels of trade ally participation in existing programming, especially in the C&I sector. Similarly, the commercial real estate observers in the Delphi panel suggest that participation by trade allies is higher in the C&I segment than in the multi-family segment. These results may reflect sampling from LADWP program participant lists for the interviews and Delphi panel. Greater outreach to trade allies may engage a larger proportion of trade allies in LADWP programs and efficiency services in general. When a large majority of trade allies are participating in such programs, this indicator will be fully present.

Future research may compare these findings to determine any changes in the level of trade ally participation in efficiency opportunities.

Increased Energy Efficiency, Renewable Energy, and Water Conservation Services/Products by Trade Allies Year-over-Year

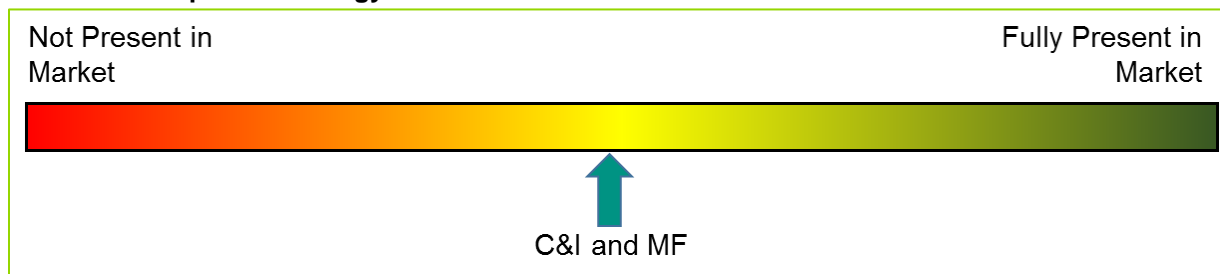


Source: Navigant team analysis

- Partially present.** Secondary research and in-depth interviews with market actors and observers confirm that efficient products and services are offered by Los Angeles area trade allies. Surveyed property owners see energy efficiency as a steadily increasing aspect of the market; however, at a broader level, awareness is moderate. Greater outreach to trade allies and new policies, such as the proposed benchmarking ordinance, may engage a larger proportion of trade allies to offer efficiency products and services. When a large majority of trade allies offer such products and services, this indicator will be fully present.

Future research may compare these findings to determine the extent to which these products and services are available.

Increased Adoption of Energy Efficient Behavior Year-over-Year



Source: Navigant team analysis

- Partially present.** The general population survey of multi-family tenants and the property owner survey indicate a moderate degree of energy efficient behavior. When a majority of property owners and tenants adopt efficiency actions into everyday life, this indicator will be fully present.

Future research may compare these findings to subsequent responses to determine if efficiency behavior adoption increases.

Increase Portion of Large C&I Building Tracked Year-over-Year

- Not determined.** Citywide building energy performance is not currently tracked. This indicator is unlikely to move without implementation of the benchmarking ordinance.

Future research may track this indicator as the benchmarking ordinance is implemented.

Increase Portion of Large Multi-Family Buildings Tracked Year-over-Year

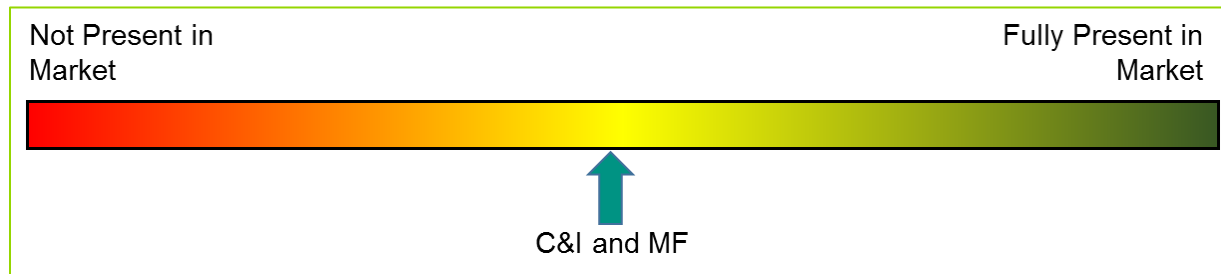
- *Not determined.* Citywide building energy performance is not currently tracked. This indicator is unlikely to move without implementation of the benchmarking ordinance.

Future research may track this indicator as the benchmarking ordinance is implemented.

2.2.2.2 Intermediate-Term Indicators

These indicators show the follow-on market changes that would be expected if the initial outcomes are present. While some of these indicators are partially present in 2016, these indicators should be fully present by the end of 2024.

Trade Allies Establish Services into Business Model



Source: Navigant team analysis

- *Partially present.* Secondary research and in-depth interviews with market actors and observers confirm that efficient products and services are offered by Los Angeles area trade allies.

Future research may compare these findings to subsequent responses to determine the degree that trade allies have incorporated efficiency products and services into their business models.

Increased Targeted Energy Efficiency Offerings to High Energy Users

- *Not determined.* The benchmarking ordinance is expected to increase the visibility of buildings with high energy use, which may allow for targeted program and product promotions. Once program providers (e.g., LADWP) and trade allies are clearly targeting property owners and tenants based on usage, this indicator will be fully present.

Future research may compare these findings to subsequent responses to determine the degree that usage informs targeted efficiency marketing.

City Achieves 100 Percent of California Energy Commission Requirements

- *Not determined.* This evaluation lays the foundations against which future energy efficiency savings will be measured. Section 2.2.3 provides additional detail regarding the use of the ELRAM model to assess these savings.

Future research will provide energy savings estimates (attributable to market transformation) based on changes in awareness and willingness to pay.

City Achieves 100 Percent Code Compliance

- *Not determined.* Property owners and interviewed market actors stated that their building retrofits comply with code when receiving or providing energy efficiency equipment and services. Given the self-interest associated with this response, Navigant recommends a designation of “not determined” until a compliance study is completed. A code compliance study can validate these findings and determine if this indicator is fully present.

Future research will assess the extent to which C&I and multi-family retrofits comply with code due to programs from LADWP and other city departments. Such a building code compliance study would observe measures in situ and interview both installers as well as compliance staff.

City Delivers 15 Percent of Electricity from Energy Efficiency

- *Not determined.* This evaluation lays the foundations against which future energy efficiency savings will be measured. Section 2.2.3 provides additional detail regarding the use of the ELRAM model to assess these savings.

Future research will provide energy savings estimates (attributable to market transformation) based on changes in awareness and willingness to pay.

Increase Portion of All C&I Tracked Year-over-Year

- *Not determined.* Citywide building energy performance is not currently tracked. This indicator is unlikely to move without implementation of the benchmarking ordinance.

Future research may track this indicator as the benchmarking ordinance is implemented.

Increased Portion of All Multi-Family Buildings Tracked Year-over-Year

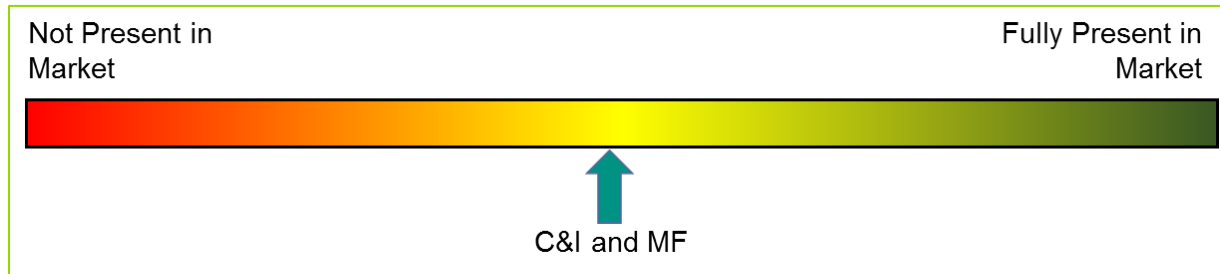
- *Not determined.* Citywide building energy performance is not currently tracked. This indicator is unlikely to move without implementation of the benchmarking ordinance.

Future research may track this indicator as the benchmarking ordinance is implemented.

2.2.2.3 Long-Term Indicators

These indicators show the final changes that would come about with full market transformation. While some of these indicators are partially present in 2016, these indicators should be fully present after 2025.

Increased Conservation Actions (e.g., Behaviors/Purchases) Year-over-Year



Source: Navigant team analysis

- Partially present.** Delphi panel commercial real estate observers, interviewed market actors and observers, and surveyed property owners expect the adoption of energy and water efficient measures to increase in the coming years. According to the Delphi panelists, 75 percent of the building owners in Los Angeles will be engaged in energy and water efficiency by 2025. However, C&I manager focus groups and property owner surveys reported increased conservation is more visible in the C&I sector—particularly Class A buildings—than the multi-family segment. For multi-family tenants, the general population survey and property owner survey indicate energy efficient behavior is currently moderate. When a majority of property owners and tenants adopt efficiency actions and behaviors into everyday life, this indicator will be fully present.

Future research may compare these initial findings to subsequent responses to determine if conservation actions continue to increase and therefore whether this indicator is fully present.

Removal of Subsidies and/or Mandates for Efficiency Services/Products

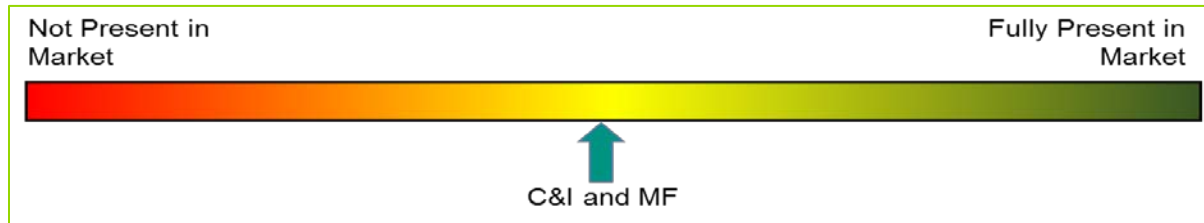


Source: Navigant team analysis

- Partially present.** Commercial real estate observers in the Delphi panel expressed that current market forces are insufficient to drive further penetration in Class C and Class B properties, suggesting there is a continued need for subsidies and/or mandates. Further, interviewed market actors stated that some Class A property owners may be willing to seize a “green premium” without subsidies, but this was not true for most of the C&I segment. The remaining property owners—Classes B and C and multi-family—tend to lag in terms of conservation actions. When a majority of property owners across all classes and both sectors identify consistent increases in conservation actions, this indicator will be fully present.

Future research may compare these initial findings to a number of future subsidies and/or mandates offered to determine whether this indicator is fully present.

Drop In Price of Conservation Products/Services Year-over-Year



Source: Navigant team analysis

- Partially present.* Property owners contacted in surveys and focus groups, as well as interviewed market actors and observers, indicate that prices for conservation products and services have declined in recent years. This contrasts the commercial real estate observers of the Delphi panel, who observed lower costs for equipment but higher labor costs to install them. On balance, this indicator appears partially present.

Future research may compare these findings to subsequent responses to determine whether this indicator is fully present.

Reduction in Energy and Water Consumption Year-over-Year (Energy Reduced by 30 Percent per Sq. Ft. By 2025)

- Not determined.* Understanding of this indicator is dependent upon tracking energy and water consumption. While this information is available to some extent for energy for water consumption, citywide building water utilization is not currently tracked. This indicator requires data that will become available through the benchmarking ordinance.

Future research will use data acquired through the benchmarking ordinance to track this indicator.

100 Percent of Large C&I Buildings Tracked

- Not determined.* Citywide building energy performance is not currently tracked.

Future research may track this indicator as the benchmarking ordinance is implemented.

100 Percent of Multi-Family Buildings Tracked

- Not determined.* Citywide building energy performance is not currently tracked.

Future research may track this indicator as the benchmarking ordinance is implemented.

2.2.3 Baseline for Estimating Energy Savings from Market Transformation

The theory of market change described in Section 2.2.1.1 is dependent both on the city ordinances and increased activity by LADWP in promoting energy efficiency through efficiency program offerings. The Los Angeles City Council is considering these energy efficiency ordinances as of this writing, and LADWP is also in the process of expanding its efficiency program offerings. Savings from these market transformation efforts will begin to accumulate in future years. For the purposes of this report, Navigant

provides an overview of the framework for estimation of these future savings by modeling scenarios of possible activity.

This section discusses data used in assessing market transformation, the savings estimation methodology, and the scenarios of market transformation.

2.2.3.1 Data Used in Assessing Market Transformation

In developing the LADWP adaption of ELRAM, Navigant utilized LADWP-specific data on sales, building characteristics, and historical program achievements along with the latest data set of demand-side management (DSM) measure impacts and costs available from the California Public Utilities Commission (CPUC).

The key indicators for assessing market transformation using ELRAM include:

- Technology-level density values of the efficient and baseline technology options
- Program-level awareness

Technology-Level Density Values

The first key indicator is technology-level density values of the efficient and baseline technology options. To make the ELRAM as accurate as possible, Navigant incorporated the latest estimates of technology densities in the LADWP territory. These estimates come from the 2009 California Residential Appliance Saturation Study,¹³ the 2006 California Commercial End-Use Survey,¹⁴ and the Building Sector Appliance and Equipment Costs and Efficiencies,¹⁵ as well as data from the data collection activities detailed in the full Market Transformation report.¹⁶

Using the ELRAM decision maker algorithm, future energy efficient program participation levels are estimated. These estimates of participation affect technology density values from year to year. An indicator that market transformation is occurring is if actual future technology values are higher than the ELRAM estimates of technology density resulting from energy efficient program participation. The best way to identify future technology density values is through sector-level building and appliance surveys. LADWP could institute these surveys on its own or rely on whenever the CPUC publishes a new building sector appliance and equipment survey update. Market transformation would be indicated if the survey-based estimates of efficient technology densities are greater than the ELRAM-predicted density values.

Program-Level Awareness Values

The second key indicator is awareness of decision makers in LADWP energy efficiency programs. The level of awareness is a key component of ELRAM, used to identify the percentage of building stocks by type of program that could participate in an LADWP energy efficiency program. ELRAM includes an

¹³ California Energy Commission, *2009 California Residential Appliance Saturation Study*. October 2010. Retrieved from <http://www.energy.ca.gov/appliances/rass/>

¹⁴ California Energy Commission, *2006 California Commercial End-Use Survey*. March 2006. Retrieved from <http://www.energy.ca.gov/ceus/>

¹⁵ Energy Information Administration, *2015 Updated Building Sector Appliance and Equipment Costs and Efficiency*

¹⁶ Navigant, *Current Energy Efficiency Market Conditions and the Potential for the Transformation*, Final Report. September 7, 2016

algorithm that allows program awareness to grow over time. However, an indicator of a market being transformed would be if program awareness is growing at a faster rate than the baseline growth predicted by ELRAM.

The baseline ELRAM includes estimates of program awareness, which is identified as the multiple of decision maker technology awareness, and if aware, willingness to install. These baseline estimates are from the California IOUs and may not represent program awareness for LADWP. The survey results discussed earlier in this report are used to estimate current levels of program awareness within the LADWP service territory.

As discussed in Section 1.5.4.5, program awareness for the residential sector was measured through a general population survey of 295 single-family and 502 multi-family households. Table 2-2 identifies the percentage of households by building type and end-use category that are aware of LADWP energy efficiency programs that provide assistance in these areas. Also included in the table are the levels of program awareness as identified in the IOU version of ELRAM. There are differences between the two data sources, but they are generally close, with some being higher and others lower.

Table 2-2. Residential Program Awareness at the End-Use Category

Energy Use Category	Building Type	Sector	Market Transformation Program Awareness	Model Awareness and Willingness
Res-WholeBldg	SFN	Residential	41%	49%
Res-Appliance	MFE	Residential	61%	49%
Res-Appliance	SFE	Residential	72%	49%
Res-HVAC	MFE	Residential	44%	49% to 56%
Res-HVAC	SFE	Residential	51%	49% to 75%
Res-Other	SFE	Residential	54%	49%
Res-BldgEnv	MFE	Residential	48%	49% to 75%
Res-BldgEnv	SFE	Residential	54%	75%
Res-WholeBldg	SFE	Residential	54%	75%

Source: Navigant team analysis

Table 2-3 provides similar information for the commercial sector. The survey questions for the commercial sector respondents were based on specific programs rather than end-use categories. Compared both to the residential results as well as the IOU-based ELRAM data, program awareness is lower.

Table 2-3. Commercial Sector Program Awareness

Program	Sector	Market Transformation Program Awareness	Model Awareness and Willingness
SBDI	Non-Residential	3%	42% to 66%
CPP	Non-Residential	14%	49% to 75%

CLIP	Non-Residential	38%	46% to 91%
SBD	Non-Residential	10%	77%
RCx Express	Non-Residential	18%	75%
Refrigeration	Non-Residential	38%	49% to 66%

Source: Navigant team analysis

2.2.3.2 Savings Estimation Methodology

The framework selected as one of the market transformation assessment tools is an application of Navigant's DSM potentials model known as ELRAM. Navigant developed an LADWP adaption of ELRAM in late 2015 to assess the LADWP claimed savings from C&S support efforts. This same adaption of ELRAM is used to establish a baseline from which to measure future impacts from citywide market transformation.

Navigant used the baseline version of ELRAM, which includes the current estimates of technology densities and the LADWP-specific estimates of program awareness, to estimate future progress toward achieving market transformation. ELRAM includes a forecast of future levels of technology density and program awareness. Changes to the density levels of efficient technologies and changes to the levels of awareness of LADWP efficiency programs compared to the baseline ELRAM predictions for change provide indications of whether or not market transformation is occurring.

LADWP can estimate future savings through comparison of the baseline ELRAM with future versions of ELRAM that include any updates to the technology density values and program-level awareness values. If the future versions of ELRAM using the updated data reveal increases in achieved energy savings when compared to the estimates from the baseline ELRAM, the difference will constitute the overall energy savings for LADWP.

2.2.3.3 Market Transformation Scenarios

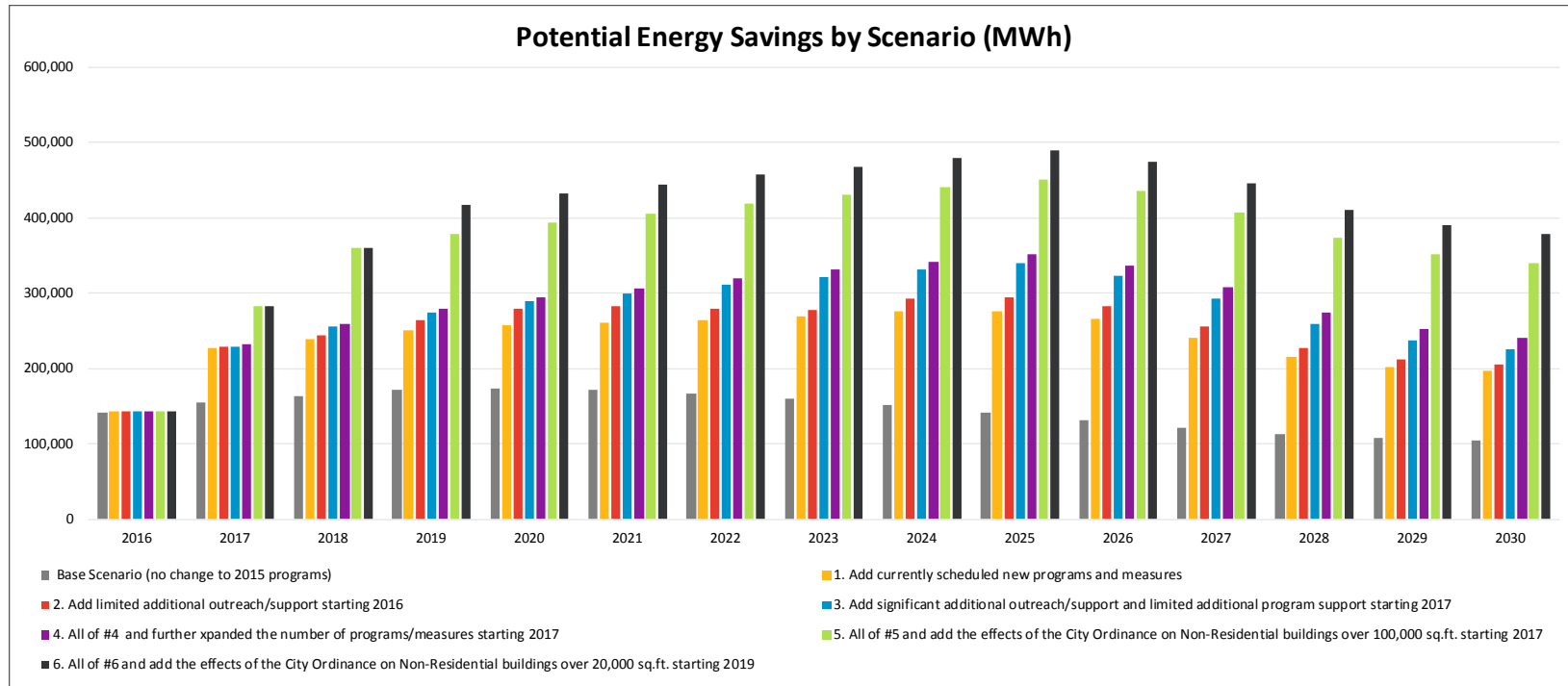
ELRAM can also be utilized to estimate the impacts of various changes to LADWP's efficiency program offerings and the effects of the city ordinance. Seven modeling conditions were set to estimate market transformation effects. These include:

1. Base scenario (no change to 2015 programs)
2. Add currently scheduled new programs and measures to the efficiency program offerings
3. Add limited additional outreach/support starting 2016 by increasing marketing and program support
4. Add significant additional outreach/support and limited additional program support starting in 2017 by further increasing marketing and support, as well as increasing the incentives offered by LADWP
5. All of #4, and further expand the number of programs/measures starting 2017
6. All of #5, and add the effects of the city ordinance on non-residential buildings over 100,000 square feet starting in 2017

7. All of #6, and add the effects of the city ordinance on non-residential buildings over 20,000 square feet starting in 2019

Figure 2-3 and Table 2-4 illustrate the expected energy savings resulting from each scenario run. Each successive scenario increases potential energy savings.

Figure 10. Potential Energy Savings by Scenario (MWh)



Source: Navigant analysis

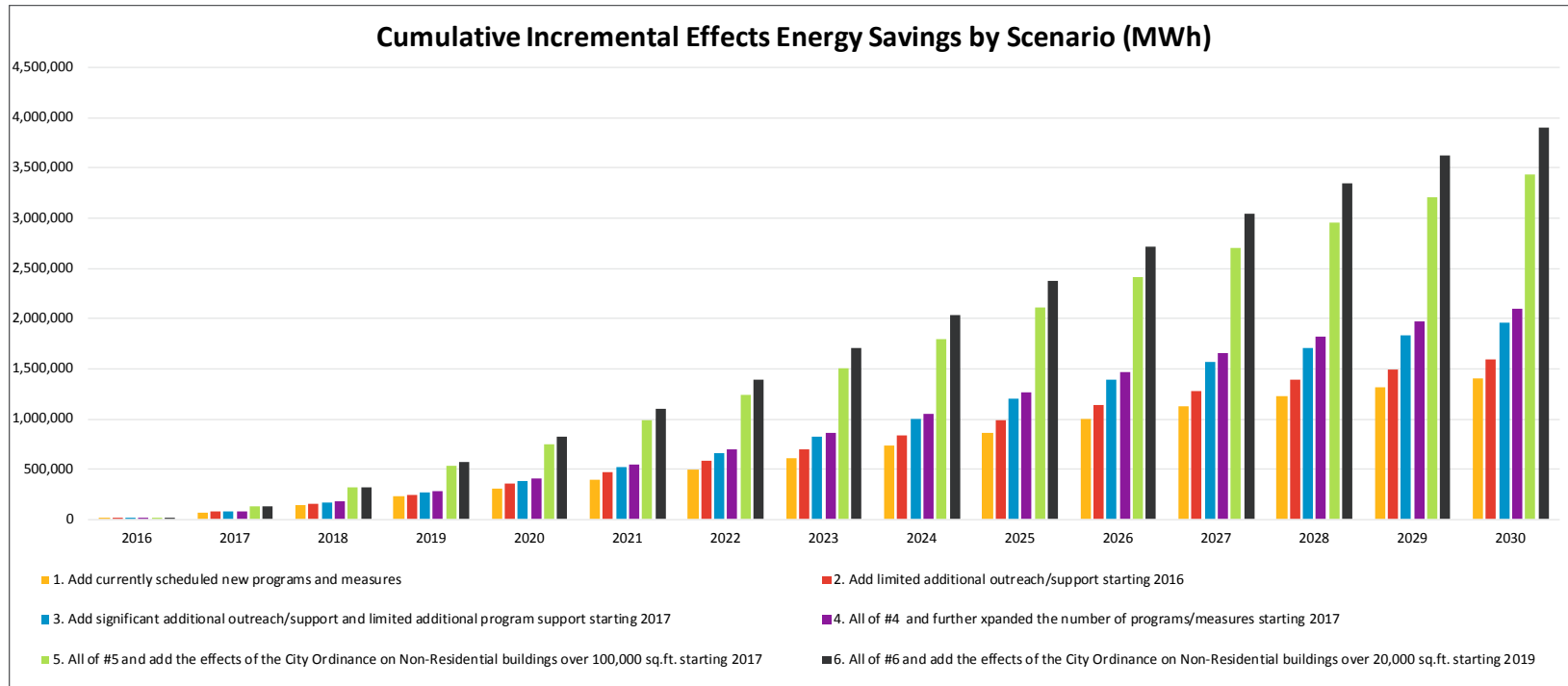
Table 2-4. Potential Energy Savings by Scenario (MWh)

ENERGY SAVINGS (MWh) BY SCENARIO	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Base Scenario (no change to 2015 programs)	141,197	155,852	164,333	171,999	173,779	171,318	166,377	160,213	152,698	142,444	132,319	120,976	113,244	108,512	105,326
1. Add currently scheduled new programs and measures	143,064	227,440	238,515	250,319	257,418	261,774	265,341	269,984	276,298	276,702	266,621	241,087	215,376	202,802	197,692
2. Add limited additional outreach/support starting 2016	144,227	229,849	244,670	263,779	279,048	282,270	280,179	277,855	292,850	295,575	282,680	255,607	227,627	212,325	206,247
3. Add significant additional outreach/support and limited additional program support starting 2017	144,233	229,860	256,252	274,951	289,647	300,387	311,432	321,262	331,162	340,120	324,047	293,737	258,851	237,389	225,219
4. All of #4 and further expanded the number of programs/measures starting 2017	144,233	232,552	260,257	279,869	295,407	307,273	319,791	331,191	342,513	352,708	337,668	308,906	274,591	253,508	241,529
5. All of #5 and add the effects of the City Ordinance on Non-Residential buildings over 100,000 sq.ft. starting 2017	144,233	282,222	359,530	379,102	394,571	406,371	418,832	430,167	441,434	451,573	436,478	407,660	373,290	352,152	340,118
6. All of #6 and add the effects of the City Ordinance on Non-Residential buildings over 20,000 sq.ft. starting 2019	144,233	282,222	359,530	417,442	432,885	444,659	457,098	468,408	479,653	489,771	474,654.1	445,815.2	411,424	390,265	378,209

Source: Navigant analysis

Figure 2-4, along with Table 2-5 and Table 2-6, illustrates the cumulative incremental effects from each scenario run. All of the scenarios significantly increase energy savings when compared to the base scenario. The first scenario estimates the impact of adding the already planned new programs and initiatives that are expected to be in place by the end of 2016. This effort alone increases expected savings by 65 percent in 2030. The biggest impacts are expected to be from the implementation of the city ordinance. In its first phase, which includes non-residential buildings over 100,000 square feet, the expected effects increase savings by nearly 160 percent compared to the base scenario by 2030. When the ordinance expands coverage to include non-residential buildings over 200,000 square feet, the expected effect increases to nearly 180 percent. The effects of the ordinance are modeled to achieve a reduction of about 3 percent of the total electricity consumption of the building.

Figure 11. Cumulative Incremental Effects by Scenario



Source: Navigant analysis

Table 2-5. Cumulative Incremental Effects by Scenario (MWh Change)

CUMULATIVE INCREMENTAL EFFECTS FROM BASELINE BY SCENARIO (MWh)	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
2. Add currently scheduled new programs and measures	1,867	73,455	147,636	225,957	309,595	400,051	499,015	608,786	732,386	866,644	1,000,946	1,121,057	1,223,189	1,317,480	1,409,846
3. Add limited additional outreach/support starting 2016	3,030	77,027	157,364	249,144	354,413	465,364	579,165	696,807	836,959	990,090	1,140,451	1,275,083	1,389,466	1,493,280	1,594,200
4. Add significant additional outreach/support and limited additional program support starting 2017	3,036	77,044	168,963	271,915	387,783	516,851	661,906	822,955	1,001,418	1,199,094	1,390,822	1,563,584	1,709,191	1,838,068	1,957,960
5. All of #4 and further expanded the number of programs/measures starting 2017	3,036	79,736	175,661	283,531	405,159	541,113	694,527	865,505	1,055,320	1,265,584	1,470,933	1,658,863	1,820,210	1,965,207	2,101,410
6. All of #5 and add the effects of the City Ordinance on Non-Residential buildings over 100,000 sq.ft. starting 2017	3,036	129,406	324,604	531,707	752,499	987,552	1,240,006	1,509,961	1,798,696	2,107,826	2,411,984	2,698,669	2,958,715	3,202,356	3,437,148
7. All of #6 and add the effects of the City Ordinance on Non-Residential buildings over 20,000 sq.ft. starting 2019	3,036	129,406	324,604	570,047	829,152	1,102,493	1,393,213	1,701,409	2,028,364	2,375,691	2,718,026	3,042,866	3,341,046	3,622,799	3,895,682

Source: Navigant analysis

Table 2-6. Cumulative Incremental Effects by Scenario (Percent Change)

CUMULATIVE INCREMENTAL EFFECTS FROM BASELINE BY SCENARIO (%)	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
2. Add currently scheduled new programs and measures	1.3%	24.7%	32.0%	35.7%	38.4%	40.9%	43.6%	46.6%	50.2%	54.2%	57.8%	60.5%	62.2%	63.5%	64.7%
3. Add limited additional outreach/support starting 2016	2.1%	25.9%	34.1%	39.3%	43.9%	47.6%	50.6%	53.4%	57.4%	61.9%	65.8%	68.8%	70.6%	72.0%	73.1%
4. Add significant additional outreach/support and limited additional program support starting 2017	2.2%	25.9%	36.6%	42.9%	48.0%	52.8%	57.8%	63.1%	68.7%	74.9%	80.3%	84.4%	86.9%	88.6%	89.8%
5. All of #4 and further expanded the number of programs/measures starting 2017	2.2%	26.8%	38.1%	44.8%	50.2%	55.3%	60.7%	66.3%	72.4%	79.1%	84.9%	89.5%	92.5%	94.7%	96.4%
6. All of #5 and add the effects of the City Ordinance on Non-Residential buildings over 100,000 sq.ft. starting 2017	2.2%	43.6%	70.4%	83.9%	93.2%	100.9%	108.3%	115.7%	123.4%	131.7%	139.2%	145.6%	150.4%	154.3%	157.6%
7. All of #6 and add the effects of the City Ordinance on Non-Residential buildings over 20,000 sq.ft. starting 2019	2.2%	43.6%	70.4%	90.0%	102.7%	112.7%	121.7%	130.4%	139.1%	148.5%	156.9%	164.2%	169.9%	174.6%	178.7%

Source: Navigant analysis

2.2.4 Conclusions

This section provides the research team's conclusions regarding the viability of the theory of market changes, current market direct (per observed indicators) and programming opportunities for LADWP.

2.2.4.1 Logic Model and Theory of Market Change

Utility programming is necessary but not sufficient; a citywide ordinance requiring benchmarking followed by mandatory action is essential for market transformation. Based on the logic models finalized in August 2015 and after completing a series of data collection activities, the research team concludes that the City of Los Angeles is attempting a unique "push-pull" market transformation strategy. The proposed benchmarking ordinance will "push" commercial and multi-family building owners to understand their energy use and improve overall efficiency. The LADWP programs will "pull" these properties into compliance with outreach, education, and equipment and services incentives. Without the ordinance to drive demand, it is unlikely that commercial property owners (of all classes) will be motivated to improve energy efficiency beyond current voluntary efforts. Conversely, without the support of utility programs, ordinance-driven demand will be frustrated by a lack of supply in terms of qualified trade allies and affordable retrofits to meet the ordinance requirements.

Due to the inextricable link between the ordinance and LADWP support, future programming must be designed to deliver energy management expertise and reduction of retrofit cost. Without this program-specific type of support, building owners will push back against ordinances. LADWP must therefore design programs that coordinate with ordinance implementation and enforcement.

In this context, traditional utility program logic (provide information, reduce first cost) will not deliver the market change sought by the current city administration. Only an enforceable ordinance supported by utility programs will motivate the desired action and outcome.

2.2.4.2 Current Market Condition and Trends

While all short-term MTIs are partially present in early 2016, market actors did not evidence an overall willingness to accelerate the adoption of energy efficiency measures. Local utilities currently offer incentive and technical support programs to increase conservation, but participation by building owners does not meet capacity. Without an enforceable requirement to understand and improve energy consumption, it does not seem likely that current market forces will incite building owners or managers to seek out all cost-effective conservation opportunities. The city's enactment of benchmarking and conservation ordinances may serve as such a motivator.

2.2.4.3 Program Enhancement Opportunities

Another key finding is that property class influences both the owners' awareness of efficiency options and their willingness to implement relevant conservation measures and strategies. Future incentive and outreach programming should tailor its offerings to focus on the diverse needs of A, B, and C Class building ownership. By tailoring these offerings, LADWP, as well as the rest of city government, will be able to accelerate marketing transformation in the City of Los Angeles.

2.2.4.4 Baseline Energy Savings Model

Through ELRAM, Navigant has provided a mechanism to quantify current baseline characteristics and can assess future savings from market transformation. When program expansion and the benchmarking and improvement ordinances are in effect, this modeling framework can quantify savings from market. The scenario results provided in the previous section identify what can be expected from various MTIs. As of this writing, awareness and willingness to purchase appear to be low on the part of Los Angeles market actors. This means that there is significant potential for energy savings from a “push/pull” market transformation strategy. As future evaluations track awareness and willingness levels, ELRAM outputs will provide transparent and complete estimates of energy savings.

2.3 Benchmarking

Navigant conducted a benchmarking of study to compare the LADWP programs to peer utilities¹⁷. Phase one of the benchmarking compared acquisition costs and spending at the portfolio level. Navigant provided these initial findings to LADWP in a PowerPoint presentation. A second phase moved to program-level analysis to identify successful designs and processes at the municipal utilities most similar to LADWP in size, goals, and climate. This study compared four utilities—CPAU, SMUD, AE, and SCL—across these energy efficiency program classes:

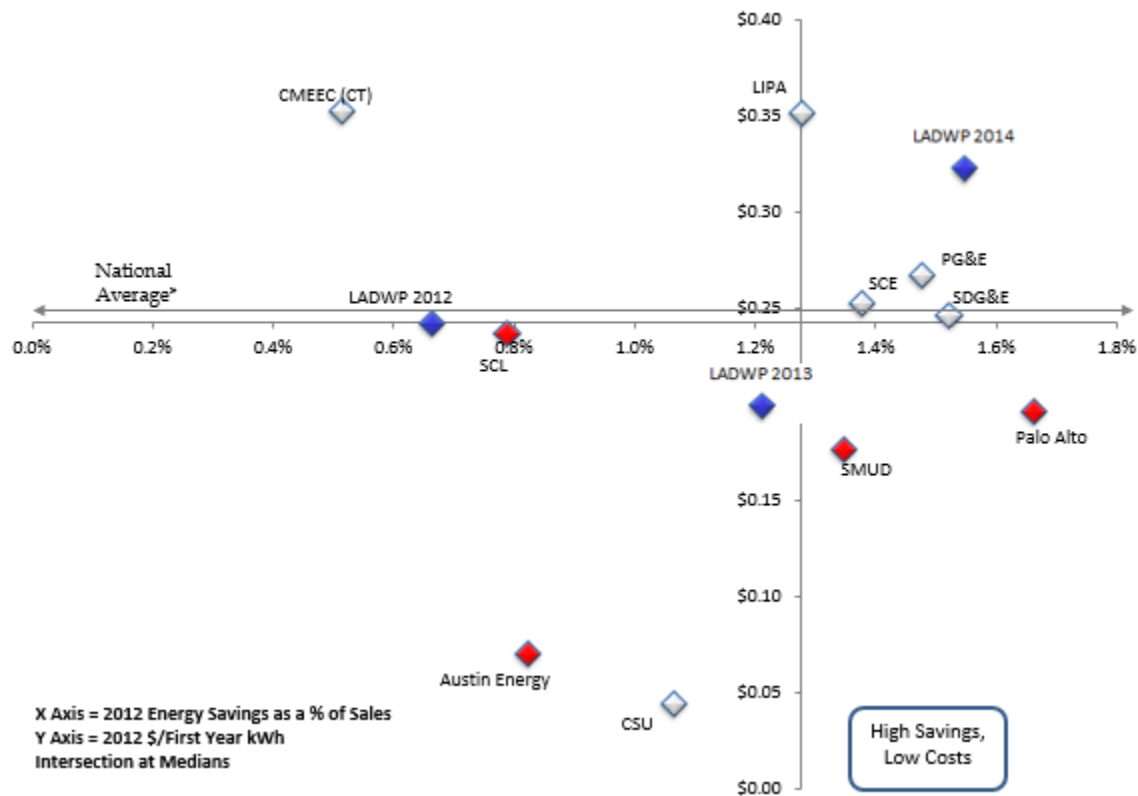
- Commercial Lighting – CLEO
- Customer Commercial Incentives – CPP
- Prescriptive Residential Rebates – CRP
- Residential Direct Install – HEIP
- Commercial Direct Install – SBDI, LAUSD

LADWP programs that fall into each of these classes were compared to programs at the utilities in the comparison group, and the analysis of their differences in program design, implementation, and delivery are discussed in the following program-specific sections.

The phase one benchmarking compared a group of 10 utilities (seven municipal utilities and three IOUs) across savings (normalized by sales) and spending (per first-year kilowatt-hours). Figure 2-5 and Figure 2-6 depict these findings. The axes represent the median values for the cohort, not zero.

¹⁷ This section summarizes Navigant’s “In-Depth Benchmarking report,” provided to LADWP in the summer of 2015.

Figure 12. Commercial & Industrial Energy Savings and Cost Comparison

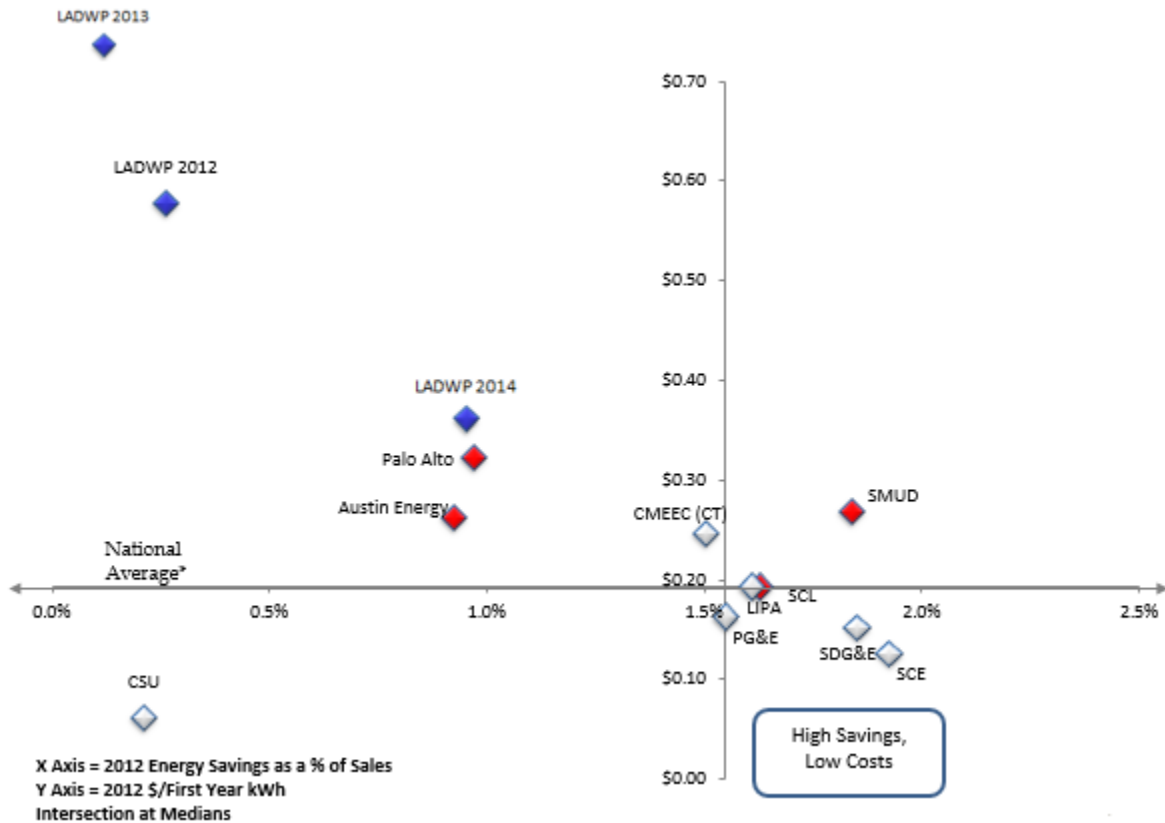


*Commercial, Industrial, and Agricultural Program Administrator Cost of Saved Electricity (2012\$/kWh)

Source: Navigant Analysis

Notably, LADWP's 2012 C&I programming achieved savings at median costs. In the residential sector, performance in 2012 lagged in terms of both savings and costs. However, as Figure 2-6 shows, performance in 2013 and 2014 started to close the gap.

Figure 13. Residential Energy Savings and Cost Comparison

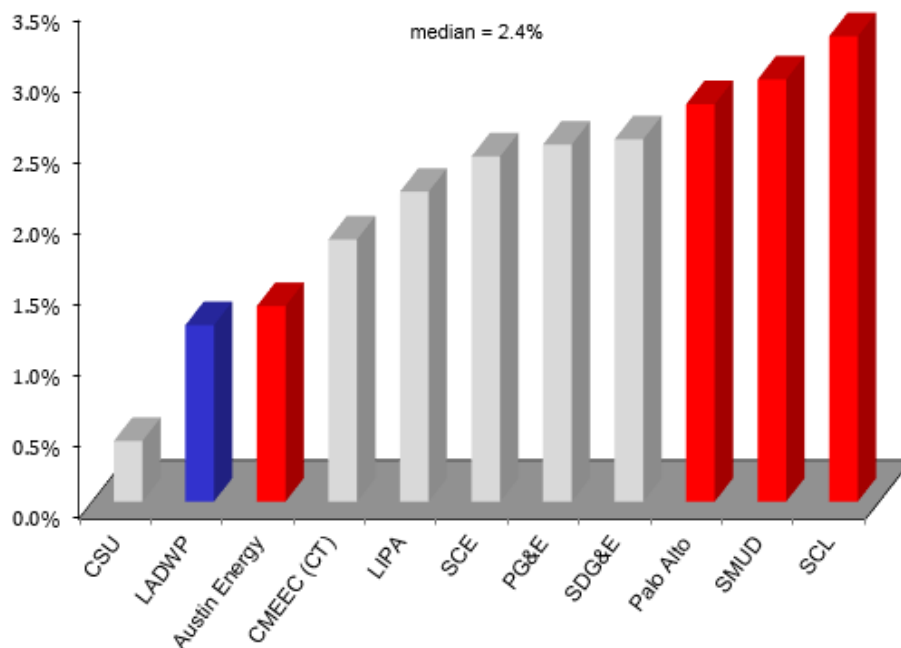


*Residential Program Administrator Cost of Saved Electricity (2012\$/kWh)

Source: Navigant Analysis

Overall, LADWP spends less on DSM (as a percentage of revenue) than the other utilities in the comparison group. This is shown in Figure 2-7.

Figure 14. 2012 Overall DSM Spending as a Percent of Sales



Source: In-Depth Benchmarking Report

Analysis of the program-level costs and savings at just the municipal utilities (marked in red) helped explain these observations. The findings follow:

While LADWP achieves higher C&I savings than the other municipal utilities, the comparison group members achieved lower acquisition costs. LADWP's focus on custom and lighting programs is similar to SMUD's C&I portfolio but lacks elements that the other municipal utilities pursue such as new construction, retro-commissioning, and non-lighting prescriptive commercial rebates. In particular, the savings achieved by the city building code's stringent energy efficiency requirements drive AE's low-cost portfolio savings. The Green Building Program and C&I lighting savings allow AE to offer broader programming to achieve substantial savings from a variety of segments as a result. In the C&I sectors, lighting, custom rebate, and (with growth) new construction programs deliver the majority of C&I savings cost-effectively.

LADWP pays more for residential savings than any member of the comparison group, and no other municipal utility is as dependent on low-income programming for residential savings. SMUD, CPAU, and SCL all leverage a few low-cost/high-saving programs with third-party program implementers to generate savings in a variety of segments, namely upstream lighting and behavioral. The absence of residential lighting and behavior programs limits the savings and increases LADWP's costs compared to other municipal utilities.

Building upon these findings, in-depth benchmarking examined specific programs in the municipal cohort to determine similarities in process and design that may inform LADWP programming decisions. The findings from this are reported as process results for each applicable program in Sections 3 through 17. Navigant used the following Contractor Network Model in Table 2-7 to classify programs.

Table 2-7. Contractor Network Model

Contractor Network Model	Description
Open (Bring-your-own)	A delivery model that allows any contractor or delivery agent to work with customers to complete installations. Minimizes utility staff time. Found most commonly used in programs with more sophisticated customers.
Semi-Open (Trade Ally Network)	Semi-open networks create membership among a pool of contractors, giving the utility greater leverage. In return for driving business to them, contractors must meet and maintain the requirements imposed by the utility. Often these requirements include certifications like BPI (Building Performance Institute) and attending utility trainings.
Semi-Closed (Contractor RFP)	Semi-closed network models allow public contractors to bid for a specific service contract. Once awarded, that contractor is essentially an employee of the utility rather than a voluntary agent. This model includes fewer contractors than open networks.
Closed (Turnkey RFP)	A utility may choose to procure services not just for installation or surveys, but also for outreach, administration, and QC. In these cases, they may solicit a turnkey solution. Turnkey service providers arrange their own installation, which may be performed by private employees or relatively broad open networks.

Source: Navigant Analysis

3. SMALL BUSINESS DIRECT INSTALL PROGRAM

This section presents Navigant's process and impact evaluation of the Small Business Direct Install (SBDI) program during FY13-14. The SBDI program is a free direct install program that targets small business customers under 30 kW in the LADWP service territory. LADWP is collaborating with SCG on this program to offer a tri-resource efficiency program aimed at reducing the use of electricity, water, and natural gas. Measures included in the SBDI program are upgrades to energy efficient lighting system and lamps, such as high-efficiency linear fluorescent lamp conversions; CFL and LED lamp installations; LED exit signs; and water saving measures, such as low-flow showerheads and faucet aerators.

3.1 Program Goals and Achievements

The SBDI program currently contributes 1 percent of the energy and demand savings to LADWP's efficiency portfolio for the program years evaluated, but is expected to grow further. For FY13-14, the SBDI had a program savings goal of 18,500,000 kWh.¹⁸ The program-reported ex ante savings exceeded the goals, with expected savings of 5,900 KW and 28,100,000 kWh for FY13-14. The program had no stated participation goals. As designed, the program has limited market transformational opportunities;¹⁹ however, as the program increases the saturation of high-efficiency lighting, the acceptance of high-efficiency lighting as the base level measures may increase, along with the willingness of customer to accept the higher standards.

3.2 Impact Results

The following subsections detail the impact evaluation findings. For detail on methodology, including onsite data collection and sampling, please see the 2015 evaluation reports.

3.2.1 Gross Energy and Demand Savings

Table 3-1 and Table 3-2 show the program impacts for the FY13-14 populations where realization rates are relative to the impacts reported by LADWP. Final realization rates are calculated with the following equation:

$$\text{Ex Post Impact (kWh or kW)} = [\text{Ex Ante Impact}] * [\text{Realization Rate}]$$

The FY13-14 ex post savings to LADWP tracking data savings ratios for coincident demand and energy impacts are 308 percent and 72 percent, respectively.

¹⁸ LADWP. Energy Efficiency Portfolio Business Plan, FYs 2012/13 & 2013/14, page 19. To gain access to a participating site prior to the program retrofit required that Navigant conduct an evaluation of FY13-14 participants instead of the proposed FY12-13, which would have prohibited conducting a pre-/post-study.

¹⁹ LADWP. Energy Efficiency Portfolio Business Plan, FYs 2012/13 & 2013/14, page 24.

Table 3-1. SBDI Program Gross Energy Impacts

Fiscal Year	Ex Ante Energy Savings (kWh)	Ex Post Energy Savings (kWh)	Energy Realization Rate	Relative Precision
FY13-14	39,022,352	28,096,093	72%	22%

Source: LADWP tracking database and onsite results

Table 3-2. SBDI Program Gross Demand Impacts

Fiscal Year	Ex Ante Coincident Demand Savings (kW)	Ex Post Coincident Demand Savings (kW)	Coincident Demand Realization Rate	Relative Precision
FY13-14	1,929	5,941	308%	55%

Source: LADWP tracking database and onsite results

For the tracking data review and strata realization rates, please see the 2015 evaluation reports. The main drivers for the FY11-12 and FY12-13 realization rates include the following:

- Quantities were not included in the ex ante demand calculation and reported savings. This significantly affect the coincident demand realization rate. However, when quantities are included in the ex ante demand savings, the coincident demand realization rate is 75 percent.
- Navigant verified average pre- and post-retrofit CFs of 0.68 and 0.66, respectively. This is lower than the average deemed CF of 0.8.
- Navigant verified average pre- and post-retrofit annual hours of use of 2,738 and 2,731, respectively. This is lower than the average deemed hours of use of 3,143.

3.2.2 Net Savings

Navigant conducted primary research into NTG effects and found an NTG ratio of 65 percent. Table 3-3 provides the program-level ex post estimates of gross and net energy savings.

Table 3-3. SBDI Ex Post Gross and Net Energy and Demand Savings

Fiscal Year	Gross Ex Post Coincident Demand Savings (kW)	Gross Ex Post Energy Savings (kWh)	NTG Ratio	Net Ex Post Coincident Demand Savings (kW)	Net Ex Post Energy Savings (kWh)
FY13-14	5,941	28,096,093	0.65	3,862	18,262,461

Source: LADWP tracking data, onsite results, and process findings

3.2.3 EUL and Lifecycle Savings

Navigant assessed expected useful life (EUL) and lifecycle savings as a part of this evaluation. The necessary inputs for determining EUL include the estimated median number of years a rebated measure is installed and operable and the technical degradation over time due to time-related and use-related changes in savings for a measure. Navigant reviewed the EUL estimates offered in the measure list and

the E3 calculator against estimates in the Database for Energy Efficiency Resources (DEER)²⁰ database, a secondary source. Table 3-4 presents the EULs Navigant compared by measure type. Navigant ultimately determined the measure list EULs were a conservative estimate between the DEER and E3 calculator estimates and, therefore, used the measure list EULs to calculate lifecycle savings. Specifically, the evaluation team multiplied the EUL value by the estimate of first-year energy savings.

Table 3-4. SBDI Program Measure Expected Useful Life

Measure and Description	EUL: DEER	EUL: FY13-14 E3 Calculator	EUL: Measure List*
Linear fluorescents	11	8	11
CFLs, hardwired	12	3	11
CFLs, screw-in	Varies	3	11
LED lamps	N/A	10	11
Occupancy sensors	8	10	11
LED exit signs	16	10	11

Source: LADWP tracking data, DEER, and Navigant analysis

*EUL used to calculate lifecycle savings

Table 3-5 identifies the lifecycle electric savings of energy from the SBDI program. These values are informed by the tracking data EULs presented in Table 3-4.

Table 3-5. SBDI Ex Post Lifecycle Savings

Fiscal Year	Gross Ex Post Energy Savings (kWh)	Net Ex Post Energy Savings (kWh)	Average Measure Life	Gross Lifecycle Ex Post Energy Savings (kWh)	Net Lifecycle Ex Post Energy Savings (kWh)
FY13-14	39,022,352	18,262,461	11	429,245,872	200,887,068

Source: LADWP tracking data and onsite results

3.3 Process Results

This section presents a summary of process evaluation findings from the 2015 evaluation report for SBDI. For the full process evaluations, including most participant survey results, and findings from interviews with subcontractors, the program manager, and the implementation contractor, please see the 2015 evaluation report.

These are the high-level results from the FY13-14 process evaluation of SBDI:

²⁰ DEER. Technology and Measure Cost Data/Effective and Remaining Useful Life (EUL/RUL) Values. http://www.deeresources.com/files/deer0911planning/downloads/EUL_Summary_10-1-08.xls

- **The SBDI program is performing well overall.** The implementation contractor is effectively implementing the program strategy and customers are satisfied with their overall experience with the SBDI program. The program administration is currently providing energy savings to small business customers while also providing additional work for the program subcontractors.
- **The SBDI implementation contractor currently maintains an up-to-date, comprehensive database of program projects.** The implementation contractor was able to provide requested data in a timely manner and was able to provide all the data necessary for a program process evaluation.
- **The market for the program is becoming increasingly saturated and will continue to become more so as the program continues and the high-efficiency lighting market matures.** According to the program managers and corroborated by the implementation contractor and subcontractors, the targeted population of A1 customers has been served both by previous iterations of the SBDI program and by the CLEO program. As the current SBDI program and CLEO program continue to install and promote the installation of high-efficiency lighting, the market saturation will continue to increase.
- **The program is currently excluding convenience and grocery stores that exceed the upper-usage threshold.** By modifying the program requirements to include convenience stores and small grocery stores that are A2 customers, LADWP will expand the available market of potential customers while still maintaining the original intent of the program. Many convenience stores and small grocery stores that have large amounts of refrigeration have usages over 30 kW per year, but would otherwise be considered small businesses. Convenience and grocery store owners often do not have the capital available to undertake lighting upgrades, and there may be considerable potential savings for this group.
- **The program has addressed the Spanish language barrier and has had some success reaching out to other minority groups.** The program implementation firm has had success in working with community leaders to target specific linguistic and ethnic populations such as its work in the Chinese-American community of Los Angeles. Given the ethnic diversity of the LADWP territory, the program would benefit from continued outreach to other underserved populations.
- **Free ridership is higher for very small and very large projects.** The free ridership rate was lowest for projects that were between 5,000 kWh and 15,000 kWh savings. This may be due to several factors. It is possible that the smaller projects include simpler, lower-cost measures that the participants could have installed themselves (such as screw-in CFL lamps), and the largest projects may have been done in facilities with capital improvement budgets.
- **There is spillover present for participants with smaller initial SBDI program projects.** While the overall program spillover was 1 percent, the spillover for projects less than 5,000 kWh was 5 percent, and the spillover for customers with projects between 5,000 kWh and 15,000 kWh was 3 percent. None of the participants with projects over 15,000 kWh reported installing any additional measures outside of the program.

3.4 Benchmarking Results

SBDI is a completely free program for customers under 30 kW. The primary measures offered are high-efficiency fluorescent lamp conversions, CFL and LED installations, as well as water saving measures

(such as low-flow showerheads and faucet aerators) and gas efficiency measures. LAUSD is also a direct install program focusing on lighting energy, water, and natural gas efficiency, with a single customer: Los Angeles United School District facilities.

Direct install programs may be defined as programs that have zero costs to the customer, as programs where rebate and measure-selection does not involve the customer, or as programs that target hard-to-reach customers who would otherwise not participate in energy efficiency programs. All of the programs in this comparison qualify by at least two of these criteria, as detailed in Table 3-6. CPAU and SMUD staff indicated they do not consider Right Lights Plus or Complete Energy Solutions direct install programs because they recover costs from customers. However, these programs occupy portfolio niches similar to the comparison group. When compared to prescriptive programs where customers face smaller equipment discounts, higher search costs for arranging their own assessments or installation, and usually seek rebates of their own accord, these commercial direct install programs are quite alike.

Table 3-6. Commercial Direct Install Comparison Group Attribute Table

Utility	Program Name	Target Market	Primary Implementer	Contractor Network*	Cost to Customer
LADWP	Small Business Direct Install	Small Commercial	Enerpath, Partnership with SCG	Closed	--
LADWP	Los Angeles United School District	United School District only	Utility Staff, Partnership with SCG	Closed	--
City of Palo Alto Utilities	Right Lights Plus	Small to Medium Commercial, Multi-family	Ecology Action	Closed	Only Equipment After Rebate
Sacramento Municipal Utility District	Complete Energy Solutions	Small to Medium Commercial	Ecology Action	Closed	20%-40% of project costs
Austin Energy	Small Business Lighting	Small Commercial, Small Nonprofit	Utility Staff	Semi-Open	20%-70% of project costs
Seattle City Light	Powerful Neighborhoods	Multi-family (5+ units)	Utility Staff	Closed	--

*See Table 2-7. Contractor Network Model
Source: In-Depth Benchmarking Report

Findings Summary

The partnership between LAUSD and LADWP was not found in other municipal utilities. Within the comparison group, account representatives channel school districts and like institutional customers through commercial programs of the appropriate customer size. These programs, SCL Energy Smart Services or AE Custom Technology program for instance, are invariably medium to large prescriptive commercial or custom commercial programs. Creating a new program for a large institutional customer is

an innovation among comparison utilities. LADWP will prove the advantages or disadvantages of the approach.

The other programs benchmarked here blend from completely free to sharing some costs with the customer. In the same way that residential direct install programs are limited to low-income customers, commercial direct install programs are typically limited to hard-to-reach customers. The design of the CPAU Right Lights Plus, SMUD Complete Energy Solutions, and AE Small Business Lighting programs demonstrate that some small to medium commercial customers would still participate in a cost-sharing program. Allowing those customers to share equipment costs with the utility would lower the cost per kilowatt-hour for SBDI. Per Navigant's recommendation to narrow CLEO's target segment from all non-residential customers to medium and large customers, SBDI may experiment with recovering costs from the small to medium customers for whom the primary barriers are not language-related or a lack of capital, but a lack of knowledge of energy efficiency opportunities and the motivation to pursue them.

A common thread binds both residential and commercial direct install programs together by using free energy assessments to generate and qualify sales leads. This tactic is common to many programs where contractor networks drive customer outreach, but also has its place in free and almost free direct install programs. For many low-income residential customers and hard-to-reach commercial customers, involvement in a direct install program increases their awareness of their energy use and the measures that can lower their bills. The list of measures generated by a free onsite assessment can act as a sales lead for prescriptive rebates. LADWP should ensure its staff auditors utilize face-to-face contact with the customer to recommend measures rebated by programs like CRP and CLEO.

3.5 Recommendations and Action

This section documents the recommendations from Navigant's FY13-14 SBDI program evaluations, including actions taken by LADWP to address them.

Table 3-7. SBDI FY13-14 Recommendations and Actions Taken

SBDI FY13-14 Recommendations	Action Taken
The program should continue to work with minority and ethnic community leaders to increase the participation of traditionally hard-to-reach groups. The program should continue to expand on the success of its work in the Chinese-American community of Los Angeles and should work with other community leaders to reach additional minority, ethnic, or non-English speaking communities that traditionally do not participate in utility programs. This outreach will assure that these types of customers are informed of the benefits of the SBDI program.	LADWP continues to reach out to these communities. Our fact sheets are now in Spanish and Korean with community-based organizations (CBOs) directly marketing these communities.

SBDI FY13-14 Recommendations	Action Taken
<p>The program should ensure that the measure installations are extensive enough that the participant will receive demonstrable energy savings. Since one of the goals of the program is to provide energy-saving measures to the small business customer (in addition to achieving energy savings for the utility), the projects should be extensive enough that the customer's energy bills will be noticeably different. Many customers are reluctant to participate in the program because of the impact on their businesses (such as having to close so that the installation can be completed), so in order to increase the positive word-of-mouth associated with the program, the projects should provide significant energy savings.</p>	<p>LADWP provides participants detailed reports with listed measures and anticipated savings. Its offered products have significantly increased and now include outdoor lighting.</p>
<p>Additional research may be done to determine why the smallest and largest projects have higher free ridership rates. The free ridership rate was lowest for projects that were between 5,000 kWh and 15,000 kWh of savings. Additional research may be able to determine if the participants in the absence of the program would have done the smaller projects or if the direct installation nature of the program hides the true cost of the lighting upgrades from the participants, causing them to overestimate the likelihood that they would have installed the measures. Additional research may also determine if the largest projects were installed in facilities with capital improvement budgets. The results of this research may help the program managers tailor their efforts to reduce free ridership, if they chose to do so.</p>	<p>No update at this time</p>
<p>The SBDI program should consider increasing the maximum megawatt-hour usage threshold for small grocery stores. A typical small grocery store may have higher energy usage than other small businesses but operates under similar capital constraints and is just as unlikely to be able to allocate budget to installing higher efficiency lighting. By allowing A2-level small grocery store customers to participate, the SBDI program will be able to reach a new group of customers who may present extensive opportunities for additional savings.</p>	<p>LADWP increased the monthly electrical demand from 30 kW to 200 kW, which may include A2 and A3 customers.</p>
<p>Add quantities to the reported demand values. LADWP should integrate measure quantities into the reported ex ante demand savings.</p>	<p>No update at this time</p>

SBDI FY13-14 Recommendations

Action Taken

True up project files, tracking databases, and the E3 calculator.

Inconsistent, errant, and incomplete tracking data limits the SBDI program staff's ability to properly identify and report accurate savings.

This not only hinders staff's ability to manage the program, but can also lead to savings being overlooked. Cross-checking and verifying all savings values in the LADWP tracking data against Enerpath's tracking data and the E3 calculator and keeping the systems up-to-date and accurate would mitigate these discrepancies. This will allow for better program management and a potential increase in reported program savings. In addition, this will aid future accounting and evaluation activities. All ex ante savings should be checked and recalculated in order to true up the database values. Navigant's review of Enerpath's tracking data was unable to recalculate the energy and demand savings values. These discrepancies were due to incorrect deemed wattages being assigned by measure code. Navigant also found that Enerpath's database had an additional 932 line items and 43 extra measures than the LADWP tracking database. There are small inconsistencies between LADWP tracking data and the E3 calculator, as well, where Navigant found 1,488 kWh of CFL savings assigned to linear fluorescents. Project file data should also be reviewed to ensure project file data is compiled and input into the tracking data accurately and completely.

Standardize disaggregation of the Enerpath and LADWP tracking

databases. Measure-level tracking data should be disaggregated to a level that would make unique equipment installations their own line item in the tracking database (e.g., project files with two identical measure listed separately with a quantity of one each should be aggregated in the tracking data to one line item with a quantity of two). Once disaggregated, databases should be expanded to include all parameter data, both pre- and post-retrofit, necessary to calculate ex ante savings (e.g., wattages, quantity, hours, IFs, CFs, etc.). Navigant also suggests that each line item in the database have a unique identifier that maps between the two databases, as this will help maintain consistency and help with quality control (QC).

Expand ex ante savings calculation to include ISRs. Navigant suggests LADWP and Enerpath apply an ISR of 0.9 to the ex ante savings calculations based on the results of this study and previous evaluation experience.

Expand deemed parameters to account for ex ante savings calculations

for all measures. Navigant recommends that LADWP update the measure list so that it is comprehensive, including measures SB0193 to SB0202. Navigant identified line items with no deemed wattages provided in the measure list, including all non-lighting measures. Navigant also suggests updating NAICS codes and subsequent mapping, in addition to updating the deemed hours of use, CFs, and IFs. All sources should be cited.

Conduct a pre-/post-study earlier in the fiscal year. Navigant understands the need to log during the peak period, but suggests recruiting sites and installing loggers well before the fiscal year cutoff to allow for longer logged periods and to allow for a larger sample.

SBDI FY13-14 Recommendations	Action Taken
Integrate the implementer into the recruiting process. To avoid losing potential sample sites to early or late retrofits, implementers should be more heavily involved in recruiting so that they are not intermediary but instead more significant/direct players in the evaluation study.	LADWP encourages implementers to be heavily involved in projects from start to finish.
Larger samples should be targeted in future evaluation. Using the coefficients of variations derived from this initial study, a larger (yet still efficient) sample should be pulled to supplement this study's data and results with greater confidence and precision.	No update at this time
As the non-lighting measures of this program grow, focus on non-lighting measures in future evaluations. A more thorough engineering review on non-lighting savings is warranted, as this study almost exclusively focused on high-impact lighting measures.	

Sources: 2015 Evaluation Report, LADWP program managers

4. LOW-INCOME REFRIGERATOR EXCHANGE PROGRAM

This section presents Navigant’s process and impact evaluation of the Low-Income Refrigerator Exchange Program (LIREP) during FY13-14. LADWP offers free pick-up and replacement of older inefficient refrigerators to qualified LADWP customers through the LIREP. The goal of this program is to encourage residents to exchange old, inefficient refrigerators and freezers for new ENERGY STAR models. LADWP designed the program for residential customers who are low-income or Lifeline customers (senior citizens or disabled customers meeting income requirements). This report collectively refers to these residential customers as “low-income customers.” In 2010, LADWP expanded the program to include institutional participants including multi-family and mobile home communities, schools and universities, municipal and civic organizations, and faith- and community-based organizations (CBOs). Institutional participants are eligible to exchange multiple refrigerators through the program. Eligible refrigerators and freezers must be fully operational, properly grounded, and satisfy age and size requirements. LADWP staff manage LIREP. The program is administered by the for-profit implementation contractor ARCA.

LIREP is separate from but complementary to LADWP’s RETIRE program. The two programs are managed and implemented by the same LADWP and ARCA staff but have separate goals and budgets. While the RETIRE program targets any customer who could recycle a refrigerator or freezer, LIREP specifically targets low-income customers and institutional customers who would otherwise be unlikely to replace old, inefficient refrigerators with ENERGY STAR models.

4.1 Program Goals and Achievements

Table 4-1 presents the program achievements and goals for FY13-14 in terms of energy savings, demand savings, and number of refrigerators.²¹ The Energy Efficiency Portfolio Business Plan cites a demand savings goal, but LADWP claimed no demand savings for LIREP in the E3 report prepared for the CEC.²² There are not separate goals for low-income and institutional customers. LIREP was not able to achieve its energy savings goal for reasons that will be explored in this report.

²¹ Both the RETIRE and LIREP programs share the same program manager, LADWP and ARCA staff. As such, the evaluation team determined it would be more efficient to conduct both evaluations at the same time (FY14). This allowed for one round of staff interviews and reduced the burden on staff.

²² “SB 1037 E3 Summary Reports 13-14 Actuals” received from LADWP on December 12, 2014.

Table 4-1. LIREP Summary of FY13-14 Savings

FY13-14	Energy Savings (kWh)	Demand Savings (kW)	Units Collected
Goal	6,800,000	100	—
Ex Ante Savings (Tracking Data)	5,030,000	744	6,200
Ex Ante Savings (E3 Data)	4,950,000	—	6,105

Sources: Energy Efficiency Portfolio Business Plan, E3 Report, and LADWP program tracking data

4.2 Impact Results

The following subsections detail the impact evaluation findings. For detail on methodology, including tracking data review and baseline calculations, please see the 2015 evaluation report.

4.2.1 Gross Energy and Demand Savings

Overall, LIREP achieved a total of 5,361,435 kWh and 643 kW in first-year gross electric energy and demand savings, respectively, for FY13-14. The final realization rate for the gross energy savings for the program is 1.08. Because LADWP did not claim demand savings in the E3 report, there is no realization rate for demand savings.

Table 4-2 presents the verified unit energy savings (UES), installation rate (IR), gross ex post savings, and realization rate for program energy savings.

Table 4-2. LIREP Gross Energy Impacts

Measure	Quantity (Program Tracking Data)	Unit Energy Savings (kWh)	Installation Rate	Ex Ante Energy Savings (kWh)	Ex Post Energy Savings (kWh)	Energy Realization Rate
Institutional Refrigerator (15 ft ³)	247 units	898.2	1.0	NA	221,847	NA
Institutional Refrigerator (18 ft ³)	1,781 units	876.2	1.0	NA	1,560,519	NA
Residential Refrigerator (15 ft ³)	309 units	898.2	1.0	NA	277,533	NA
Residential Refrigerator (18 ft ³)	3,768 units	876.2	1.0	NA	3,301,537	NA
Total	6,105 units	-		4,954,870	5,361,435	1.08

Source: Navigant analysis

Table 4-3 presents the verified deemed unit savings value, IR, gross ex post savings, and realization rate for program demand savings.

Table 4-3. LIREP Gross Demand Impacts

Measure	Quantity (Program Tracking Data)	Unit Demand Savings (kW)	Installation Rate	Ex Ante Demand Savings (kW)	Ex Post Demand Savings (kW)	Demand Realization Rate
Institutional Refrigerator (15 ft ³)	247	0.108	1.0	NA	27	NA
Institutional Refrigerator (18 ft ³)	1,781	0.105	1.0	NA	187	NA
Residential Refrigerator (15 ft ³)	309	0.108	1.0	NA	33	NA
Residential Refrigerator (18 ft ³)	3,768	0.105	1.0	NA	396	NA
Total	6,105 units	-		NA	643	NA

Source: Navigant analysis

The main drivers for this realization rate include the following:

- **The Navigant team calculated a higher ex post UES than LADWP's ex ante UES.** The ex post UES was derived from secondary data related to the unit energy consumption (UEC) of recycled refrigerators, the UEC of the new program refrigerators, and an HVAC interactive factor. Because the evaluation team was not able to identify the source of ex ante savings, it is unclear which of these specific parameters shows the most variation between ex ante and ex post. Based on a review of similar evaluations, it appears the main driver might be the inclusion of the HVAC interactive factor, as described in the 2015 evaluation report.
- **Program tracking data reported more units than claimed through the E3 report.** In addition to a higher UES values, the ex post quantity is greater than the ex ante quantity, pushing the realization rate up. Specifically, the ex post gross savings are based on the 6,200 exchanged units listed in the program tracking data, while the E3 report developed for the CEC only claimed 6,105 units.

4.2.2 Net Savings

Navigant conducted primary research into NTG effects and found an overall NTG ratio of 0.62 for institutional customers and 0.89 for residential customers. Table 4-4 summarizes the program estimates of gross and net energy and demand savings, applying these NTG values. Net energy savings were 4,290,439 kWh and net demand savings were 515 kW.

Table 4-4. LIREP Ex Post Gross and Net Energy and Demand Savings

Participant Category	Gross Annual Ex Post Savings – (kWh)	Gross Annual Ex Post Savings – (kW)	NTG Ratio	Net Annual Ex Post Savings – (kWh)	Net Annual Ex Post Savings – (kW)
Institutional	1,782,366	214	0.62	1,105,067	133
Residential	3,579,069	429	0.89	3,185,372	382
Total	5,361,435	643	0.80	4,290,439	515

Source: Navigant analysis

4.2.3 EUL and Lifecycle Savings

For LIREP, lifecycle savings are based on two stages. In the first year after LADWP replaces an old, inefficient refrigerator, the program savings are based on the difference between energy usage of the existing refrigerator and that of the new ENERGY STAR refrigerator. These savings persist for as long as the existing units would have been in use. However, the program continues to generate savings even after the existing unit would have been replaced, since low-income customers presumably would have purchased a standard efficiency refrigerator instead of a high-efficiency refrigerator when the existing refrigerator failed. Thus, in the years after the existing unit would have failed, the energy savings are equal to the difference between the energy usage of a standard refrigerator and that of the new ENERGY STAR refrigerator. Using the EULs described in the 2015 evaluation report, the Navigant team estimated the lifecycle electric savings presented in Table 4-5.

Table 4-5. LIREP Ex Post Lifecycle Savings

Measure	Years After Participation	Gross Annual Ex Post kWh Savings	Gross Lifecycle kWh Savings	Net Annual Ex Post kWh Savings	Net Lifecycle kWh Savings
Refrigerator (15 ft ³)	Years 1-5	499,379		384,549	
	Years 6-14	54,944	2,991,391	42,310	2,303,533
Refrigerator (18 ft ³)	Years 1-5	4,862,056		3,905,890	
	Years 6-14	591,002	29,629,296	476,482	23,817,789
Total	Years 1-5	5,361,435		4,290,439	
	Years 6-14	645,946	32,620,687	518,792	26,121,321

Source: Navigant analysis

It should be noted that the verified ex post net lifetime savings of 26,121,321 kWh is considerably lower than the ex ante net lifetime savings of 69,368,180 kWh reported in the E3 report. When measuring net lifetime savings, the program realization rate is 0.38. The main drivers for this realization rate include the following:

- **The annual savings for exchanged refrigerators decreases significantly after 5 years.** While the ex post first-year UES was very similar to the ex ante first-year UES, those savings only persist as long as a participant would have retained their old refrigerator. Within 5 years of participating in LIREP, it is expected that the average participant would have replaced his or her old, inefficient refrigerator if they had not participated in LIREP. After that point, the program

savings are based on the difference between the UEC of the high-efficiency refrigerator provided by LADWP and that of an equivalent standard efficiency unit. These savings persist for the measure life of the program refrigerator, 14 years. In comparison, LADWP's ex ante savings assume the first-year UES persists for the entire 14-year measure life.

- **LADWP does not include a NTG ratio when reporting net savings.** The evaluation team found an overall NTG ratio of 0.62 for institutional customers and 0.89 for residential customers, indicating that there is some free ridership decreasing program savings, especially from institutional customers.

4.3 Process Results

This section presents a summary of process evaluation findings from the 2015 evaluation report of LIREP. For the full process evaluations, including the NTG methodology, most participant survey results, and program manager interview findings, please see the 2015 evaluation report.

The following are the main process finding for LIREP.

- **The program did not achieve its annual energy savings goals.** In FY13-14, LADWP reported 4,950,000 kWh in energy savings, compared to a goal of 6,800,000 kWh. There are a number of challenges that kept the program from reaching its goals, the most important being lack of awareness of the program. During FY13-14, the program also had less dedicated staff than in previous years, but plans are in place to fill these positions. In addition, LADWP hired the first supervisor for this program in February 2014. While the supervisor has been helping with day-to-day operations until the planned positions are filled, having a supervisor will help LADWP tackle the challenges listed below moving forward.
- **The current volume of marketing and outreach is insufficient for meeting program goals.** Program and ARCA staff identified awareness as a key barrier from increasing participation and reaching program energy savings goals. Currently, the largest source of awareness by far is word-of-mouth, followed by the LADWP website, neither of which are active outreach activities on behalf of LADWP. Opportunities exist for increasing marketing through in- and on-bill advertisements and email, including with customers' bills. Alternatively, LADWP may want to develop leave-behind materials explaining the program for participants to share with friends and family. Because word-of-mouth is so important, this could help fully leverage this channel and also help overcome potential customers' skepticism that the program is "too good to be true." For institutional participants, outreach to central offices is also an effective strategy for disseminating information to branches and offices. Institutional customers prefer this outreach via email. LIREP program managers are aware of this need and are actively trying to increase marketing and explore retail partnerships. However, program managers are dependent on the Public Affairs group to produce marketing collateral, which is currently a barrier to developing new marketing material.
- **Program participants reported very high levels of satisfaction with their experience with the program.** Overall, the program participants were very satisfied with all aspects of LIREP. Low-income and institutional customers ranked their overall program satisfaction as 9.6 out of 10, on average. Customers were most satisfied with program processes, including the scheduling process, installation, and installation team. There were three customers who were unsatisfied with the refrigerator LADWP provided, which is noteworthy because the program has a history of providing problematic refrigerators. Refrigerator quality did not appear to be a widespread

concern among participants, however. The majority of the customers had already recommended the program, and nearly all said they would recommend it in the future.

- **Overall, the process for scheduling appointments and exchanging refrigerators is functioning smoothly for participants.** According to participants, it was easy to schedule inspection and appointments at convenient times and ARCA teams came at their scheduled times. Institutional participants found the paperwork they were asked to fill out quick and easy. The LIREP program managers were satisfied with their implementer, ARCA. Likewise, ARCA reported getting the rapid support they needed from LADWP to complete timely exchanges. While in the past LADWP had experienced problems with the refrigerators ARCA recommended for the program, the program has adopted higher quality refrigerators, which customers are highly satisfied with.
- **Customers are motivated to participate in the program when they need a new refrigerator.** The results suggest that the majority of both residential and institutional participants enroll in the program because they need a new refrigerator, cannot afford one, and want to save on their energy bill. These results show that LIREP is filling a need that participants frequently cannot fill themselves.
- **LIREP has a goal for demand savings, but claimed no demand savings for the program.** According to the Energy Efficiency Portfolio Business Plan, LIREP has a demand savings goal of 100 kW. The program tracking data did include demand savings, but no demand savings were claimed in the E3 report that the LADWP developed for the CEC.
- **The program tracking data is not well suited to tracking institutional customer participation.** There is no field distinguishing between residential and institutional participants in the program data. Because the institutional customers' data was fit into the same fields developed for residential customers, important data on institutional customers, such as the organization's name or the number of units exchanged, was not clearly tracked. Moreover, the data contained a record of each refrigerator exchanged by a participant, rather than a single record for each institutional participant. This made it challenging to determine the number of units exchanged by institutional customers and identify institutional participants who only exchanged only one refrigerator.
- **The program appears to be exchanging refrigerators that do not qualify per program requirements.** Of the 56 residential customers surveyed, four reported that their existing unit was not functional at the time it was exchanged, eight reported that the exchanged refrigerator was less than 10 years old, and one reported exchanging a primary refrigerator. Per program requirements, none of these should have qualified for the program.
- **Free ridership is not a large concern for the program, but does exist for institutional customers.** At 12 percent, free ridership was low but not zero among residential customers. This indicates that LADWP may be serving some customers who would have replaced their refrigerator without the program. While the evaluation team did not find a quantifiable link between free ridership and residential customers who reported replacing non-working refrigerators, this has the potential to affect free ridership. Moving forward, it is important that the program enforces requirements that replaced units must be functional at the time of pick-up to ensure customers who would otherwise replace their refrigerator do not participate. Further, LADWP should consider opportunities to increase the stringency of program participation requirements to assure that ratepayer dollars do not subsidize free ridership.

4.4 Recommendations and Action

This section documents the recommendations from Navigant's 2015 LIREP evaluation, including actions taken by LADWP to address them.

Table 4-6. LIREP FY13-14 Recommendations and Actions Taken

LIREP FY13-14 Recommendations	Action Taken
<p>Increase marketing and outreach of LIREP to reach savings goals. LADWP and ARCA program managers identified awareness as a key barrier to increasing participation and reaching program energy savings goals. Currently, the largest sources of awareness are word-of-mouth and the LADWP website, neither of which are active outreach activities on behalf of LADWP. Opportunities exist to increase marketing through paper mail and email, including with customers' bills. Alternatively, LADWP may want to develop leave-behind materials explaining the program for participants to share with friends and family. For institutional participants, outreach to central offices is also an effective strategy for disseminating information to branches and offices. The evaluation team understands that increasing marketing will require an allocation of LADWP Public Affairs staffing resources and cannot be directly addressed by program staff. However, if the program is going to reach its savings goals, marketing and outreach will need to expand. The Navigant team recommends elevating this issue with senior staff at LADWP who can secure support from Public Affairs or identify alternative methods for marketing the program.</p>	<p>The LIREP program completed a postcard mailing in March of 2015 to income qualified customers that had not yet participated in the program. We plan to continue to outreach to our customers in the future by a number of different avenues.</p>
<p>Improve tracking data collection. LADWP collects limited data on the units replaced through LIREP. The tracking data did not include fields for unit age, size, or location. ARCA collects most of this data on hard copy applications, so LADWP could request this data be provided to them. LADWP did include data on the replaced units' configuration, but this data did not completely match ARCA's hard copy documentation. Collecting data on the replaced units' model number could help ensure tracking data is correct and would help LADWP staff monitor that ARCA is exchanging qualifying refrigerators. Having this information would also allow LADWP and evaluators to more accurately estimate program savings from the unique mix of units exchanged through their program.</p>	<p>There is no way LADWP would be able to obtain this information for most customers other than ARCA's information. The Multi-Family & Non-Profit customers could place it on the forms we provide, but the information is not always accurate and ARCA will record it anyway so it seems like a duplication of records.</p>
<p>Track low-income residential and institutional customers separately. The LIREP processes are distinct between residential and institutional customers. Likewise, the key data fields for these participants are different, such as organization name and number of refrigerators for institutional customers. Tracking these subprograms separately would make program data and achievements more transparent and understandable.</p>	<p>Under discussion with management.</p>

LIREP FY13-14 Recommendations	Action Taken
<p>Update energy savings assumptions more frequently. The UES value claimed by LADWP appears to be same one used since 2007. According to the Universal Method Protocol recommendations for appliance recycling programs, “deemed savings ... may be used but need to be updated at least every three years to account for program maturation.” While the current ex ante savings were found to be reasonable, the savings for ARPs have been decreasing steadily over time. It will be important for LADWP to update the ex ante savings value for LIREP more frequently in the future so that ex ante savings values do not become overstated.</p>	<p>Under discussion with management.</p>
<p>Monitor program requirements. Twenty percent of residential customers reported that their recycled refrigerator did not meet all of the program requirements, which include restrictions on the functionality, age, size, and usage of the existing unit. Accepting units that are not functional, younger than 10 years, or secondary units all pose a risk to the savings LADWP can claim through this program and be a misallocation of program resources. LADWP should revisit program requirements with implementation staff and more closely monitor data on the recycled units.</p>	<p>Under discussion with management</p>
<p>Conduct more rigorous research into gross program savings. The ex post gross savings verified through this evaluation were based on the best data available to the evaluation team. However, without more detailed data on the refrigerators exchanged through the program, the evaluation team had to rely on impact evaluation data collected for similar programs. While the verified ex post savings are on par with an identical program for Puget Sound Energy, the ex post savings are higher than found for similar programs run by the California IOUs. In addition, the evaluation results indicate that the program is exchanging refrigerators that do not meet program requirements. While this did not factor directly into this evaluation, which relied on UEC data from similar programs instead of program units, this does pose a risk to program savings. To better understand program savings, the Navigant team would recommend one of two paths. First, if LADWP collected more detailed data on the age, size, configuration, and condition of the recycled units, the team could estimate the UEC of the specific units recycled by LADWP. Alternatively, the Navigant team recommends a billing analysis of program participants. A billing analysis should be able to identify savings for residential participants, but would be less well suited to institutional participants whose refrigerator usage is a smaller fraction of total energy usage.</p>	<p>Under discussion with management</p>
<p>Conduct more research into free ridership. LADWP has created an innovative program approach by offering refrigerators exchanges to institutional customers. While this evaluation found that the majority of refrigerators exchanged by institutional participants would not have occurred without the program, free ridership among institutional participants was 38 percent. With the small sample of institutional customers, the evaluation team could not identify any statistically significant trends in what types of institutional customers are likely to be free riders. The evaluation team recommends more extensive research into the topic of institutional free ridership to ensure that LADWP is using program resources to generate as much savings as possible.</p>	<p>Under discussion with management</p>

LIREP FY13-14 Recommendations	Action Taken
<p>Research with near-participants and nonparticipants could be a valuable way to understand the barriers keeping other customers from participating in the program. The program needs to increase program awareness and participation to reach energy savings goals. The Navigant team recommends research with near-participants and nonparticipants as a way to understand their barriers to participation and the best way to reach these customers. This research could take the form of in-depth interviews to explore customers' barriers or focus groups to test outreach methods and marketing messages.</p>	<p>Under discussion with management</p>
<p><i>Sources: 2015 Evaluation Report, LADWP program managers</i></p>	

5. REFRIGERATOR TURN-IN AND RECYCLING PROGRAM

This section presents Navigant's process and impact evaluation of the Refrigerator Turn-In and Recycling (RETIRE) Program during FY13-14. LADWP offers free pick-up and disposal of inefficient refrigerators and freezers (hereafter "refrigerators") and a \$50 incentive for participating in the RETIRE program. The goal of this program is to encourage residents to turn in old, inefficient refrigerators for recycling. LADWP designed the program to be available to residential LADWP customers who own their home's refrigerators, which typically applies to single-family homeowners. However, tenants who own the home's refrigerator can also participate. Eligible refrigerators must be fully operational and satisfy age and size requirements.

The program is administered by the for-profit implementation contractor ARCA. To initiate a pick-up, a customer either calls ARCA or fills out an online request. ARCA determines if the customer is an LADWP customer and if the refrigerator qualifies for the program. If these criteria are met, ARCA schedules a pick-up appointment. ARCA staff comes to the customer's home during the appointment window, verifies the eligibility of the refrigerator, and removes the refrigerator. During the pick-up appointment, ARCA also gives four CFLs to participants. ARCA staff leave an LADWP CRP application with the customer, who then completes the application and sends it to LADWP. LADWP's CRP processes the rebate and mails the check to the customer.

The RETIRE program is separate from but complementary to LADWP's LIREP. The two programs are managed and implemented by the same LADWP and ARCA staff but have separate goals and budgets. While the RETIRE program targets any customer who could recycle a refrigerator or freezer, LIREP specifically targets low-income customers and institutional customers who would otherwise be unlikely to replace old, inefficient refrigerators with ENERGY STAR models.

5.1 Program Goals and Achievements

Table 5-1 presents the program achievements for FY13-14, including the goals and actual savings, as reported in LADWP's program tracking database.²³ As shown in Table 5-1, the RETIRE program was not able to achieve its energy savings goals, although demand goals were met, for reasons that will be explored in this report.

²³ Both the Low Income Refrigerator Exchange and RETIRE programs share the same program manager, LADWP and ARCA staff. As such, the evaluation team determined it would be more efficient to conduct both evaluations at the same time (FY14). This allowed for one round of staff interviews and reduced the burden on staff.

Table 5-1. RETIRE Claimed Savings Summary for FY13-14

FY13-14	Units Collected	Energy Savings (kWh)	Demand Savings (kW)
Goal	N/A	6,200,000	100
Expected (Ex Ante Savings (E3 Data)	1,989	3,900,000	597
Expected (Ex Ante) Savings (Tracking Data)	2,034	4,000,000	610

Source: Energy Efficiency Portfolio Business Plan, E3 Report, and LADWP program tracking data

5.2 Impact Results

The following subsections detail the impact evaluation findings. For detail on methodology, including tracking data review and baseline estimation, please see the 2015 evaluation report.

5.2.1 Gross Energy and Demand Savings

Overall, the RETIRE program achieved a total of 1,230,584 kWh and 248 kW in gross electric energy and demand savings for FY13-14, respectively. The final realization rates for the program are 32 percent for energy and 42 percent for peak demand. Table 5-2 presents the verified UES, IR, gross ex post savings, and realization rates for the program.

Table 5-2. RETIRE Gross Energy Impacts

Measure	Quantity (Program Tracking Data)	Unit Energy Savings (kWh/unit)	IR (Survey)	Gross Ex Post Savings (kWh)	Reported E3 Savings (kWh)	Energy Realization Rate
Refrigerator	1,932 units	616	0.98	1,166,310	-	
Freezers	102 units	643	0.98	64,274	-	
Total	2,034 units	-	0.98	1,230,584	3,958,164	0.32

Source: Navigant analysis

Table 5-3 presents unit demand savings, IR, gross ex post demand savings, and realization rates for the program.

Table 5-3. RETIRE Summary of Ex Post Gross Demand Savings

Measure	Quantity (Program Tracking Data)	Unit Demand Savings (kW/unit)	IR (Survey)	Gross Ex Post Savings (kW)	Reported E3 Savings (kW)	Demand Realization Rate
Refrigerator	1,932 units	0.124	0.98	235	-	-
Freezers	102 units	0.129	0.98	13	-	-
Total	2,034 units	-	0.98	248	597	0.42

Source: Navigant analysis

The primary driver behind the low realization rates of the RETIRE program are the adjustments made to the UES estimates for both refrigerators and freezers, namely the subtraction of the replacement unit's energy consumption from that of the existing unit. See the 2015 evaluation report for more detail.

5.2.2 Net Savings

Net savings for the RETIRE program are 869,000 kWh for energy and 175 kW for demand, based on the NTG ratio of 0.69 for refrigerators and 1.0 for freezers, discussed in the 2015 evaluation report. Table 5-4 summarizes the appliance-level and overall program estimates of gross and net energy and demand savings

Table 5-4. RETIRE Ex Post Gross and Net Energy and Demand Savings

Measure	Gross Ex Post Energy Savings (kWh)	Gross Ex Post Peak Demand Savings (kW)	NTG Ratio	Net Ex Post Energy Savings (kWh)	Net Ex Post Peak Demand Savings (kW)
Refrigerator	1,166,310	235	0.69	804,754	162
Freezer	64,274	13	1.00	64,274	13
Total	1,230,584	248	0.71	869,028	175

Source: Navigant analysis

5.2.3 EUL and Lifecycle Savings

EUL is an estimate of the median number of years that the measures installed under a program are still in place and operable. The E3 report calculator provides EUL estimates of 5 years for refrigerator recycling and 4 years for freezer recycling measures. The Navigant team used these values to calculate lifecycle savings as verified first-year energy savings multiplied by the EUL. Table 5-5 provides the lifecycle energy savings from the RETIRE program.

The Navigant team used the EUL values from the E3 report calculator rather than the LADWP-supplied ex ante EUL value of 5 years for both refrigerators and freezers. The rationale for this decision mirrors the

discussion of the verified UES in the 2015 evaluation report. The E3 calculator was built using the CMUA Technical Resource Manual (TRM) as a source of deemed savings values adopted by the California POU's. While the E3 calculator EUL values are similar to LADWP's custom supplied EUL values, the Navigant team found it more consistent and defensible to use the EUL values adopted by the POU's in the CMUA TRM.

Table 5-5. RETIRE Ex Post Lifecycle Energy Savings

Measure	Gross Annual Ex Post Savings (kWh)	Net Annual Ex Post Savings (kWh)	Measure Life (years)	Gross Lifecycle Savings (kWh)	Net Lifecycle Savings (kWh)
Refrigerators	1,166,310	804,754	5	5,831,549	4,023,769
Freezers	64,274	64,274	4	257,097	257,097
Total	1,230,584	869,028		6,088,646	4,280,866

Source: Navigant analysis

5.3 Process Results

This section presents a summary of process evaluation findings from the 2015 evaluation report for the RETIRE program. For the full process evaluations, including the NTG methodology, most participant survey results, and secondary research findings, please see the 2015 evaluation report.

These are the high-level results from the FY13-14 process evaluation of RETIRE:

- The program did not achieve its annual energy savings goals.** In FY13-14, LADWP reported 3,900,000 kWh in energy savings, compared to a goal of 6,200,000 kWh. There are a number of challenges that kept the program from reaching its goals, the most important being lack of awareness of the program. During FY13-14, the program also had less dedicated staff than in previous years, but plans are in place to fill these positions. In addition, LADWP hired the first supervisor for this program in February 2014. While the supervisor has been helping with day-to-day operations until the planned positions are filled, having a supervisor will help LADWP tackle the challenges listed below moving forward.
- Marketing and outreach are the limiting factor for increasing RETIRE energy savings and reaching program goals.** Program and ARCA managers identified awareness as the most significant barrier to increasing participation and energy savings. Currently, the largest sources of awareness are word-of-mouth and the LADWP website, neither of which are active outreach activities on behalf of LADWP. The website appears to be easy to access for most participants who used it, despite the project manager's concerns that the website might be hard to find. However, increasing marketing through paper mail and email, especially with customers' bills, represents a significant opportunity to reach more customers. Additionally, opportunities exist to leverage appliance retailers and the CRP to market the program toward customers shopping for new appliances. RETIRE program managers are aware of this need and are actively trying to increase marketing and explore retail partnerships. However, program managers are dependent on the Public Affairs group to produce marketing collateral, which is currently a barrier to developing new marketing material.

- **Program participants reported high levels of satisfaction with their experience with the program and indicated they are willing to act as promoters.** Overall, the program participants were very satisfied with all aspects of RETIRE. Customers ranked the overall program as 8.9 on average. Customers were most satisfied with program processes, including the ARCA team that picked up the refrigerator and the scheduling process. Despite a few comments that finding information about the program was difficult, most participants had no problems doing so. While some participants were less satisfied with the time it took to receive their rebates, all participants said they had or would recommend the program. Moreover, nearly two-thirds of participants (64 percent) said they have recommended the program to someone they know. Those who said they had not recommended the program to someone (34 percent) were asked if they would recommend the program in the future. All responded in the affirmative. This reinforces the finding that participants are satisfied with the program and are willing to act as promoters of the rebate.
- **Participants are motivated to participate in RETIRE by the convenience of the program and the environmental benefit.** Around a quarter of survey respondents said that they participated in the program because it was a free or easy way to dispose of their old refrigerator. Another one-quarter participated because they wanted to help the environment. These motivations can help LADWP craft messaging to encourage customers to participate in the program.
- **The process for scheduling appointments and recycling refrigerators is functioning smoothly for those customers who do participate.** According to participants, it was easy to schedule appointments; most units were picked up within 2 weeks; and there were no problems with scheduling a pick-up or the pick-up teams. Overall, the RETIRE program managers were satisfied with their implementer, ARCA. Likewise, ARCA reported getting rapid support from LADWP when needed. The one area that is working less smoothly is rebate processing, as discussed below.
- **On the other hand, the program does not pick up units fast enough for near-participants.** Two of six near-participants interviewed said they were moving and ARCA could not come fast enough, while one had a neighbor respond negatively to them leaving their unit outside. Two others had someone request the refrigerator in the window between when they contacted ARCA and when their pick-up was scheduled. When asked how LADWP could improve the program, nearly all near-participants suggested shortening the time between scheduling and pick-up. Alternatively, some said that clearer communication upfront about program timelines would have helped them participate. For customers such as those who were moving or buying a new refrigerator, it is possible that increased marketing could help them better understand the program so it is not an afterthought when they need to dispose of their existing unit quickly.
- **RETIRE's rebate process is less efficient and effective than those of similar appliance recycling programs.** RETIRE requires participants to mail in a rebate application after the refrigerator is picked up, and LADWP is responsible for sending the check through the Customer Rebate Program. In other programs, ARCA sends the rebate check with no additional action required on the part of the participant. According to ARCA managers and evidenced by participant survey results, LADWP's rebate processing method takes longer than similar programs. Furthermore, CRP staff observed that a disproportionate number of uncashed or "stale" checks that return to LADWP are for RETIRE. This likely occurs because the rebate checks are not sent quickly enough to reach participants who are moving homes.

- **The location data used to infer a refrigerator’s primary or secondary status does not conform to Universal Methods Protocol and is highly inaccurate.** Participants are not given instructions to describe where the refrigerator was operating, nor given an option for “kitchen.” The inaccuracy of this data is further supported by the 78 percent of survey respondents who reported they recycled a primary refrigerator, compared with just 4 percent of the population according to participant-level tracking data. As detailed in the following section of the report, not having this data makes it impossible for LADWP to track the savings generated through the specific mix of units being recycled through the program.
- **It is unclear whether LADWP is effectively targeting secondary refrigerators.** One of the stated objectives of the RETIRE program is to target as many secondary refrigerators as is possible and feasible. The participant survey indicates that 78 percent of recycled refrigerators were primary units, which is higher than found other California impact evaluations, as summarized in the 2015 evaluation report. Without more extensive marketing on the benefits of recycling secondary refrigerators, the program is currently more successful in reaching customers who are replacing their primary refrigerators.
- **Free ridership with the program is relatively low compared to similar programs.** The evaluation team estimated a free ridership rate of 0.30, which is on the low end for appliance recycling programs. Free ridership is a concern for many appliance recycling programs across the country, so LADWP may want to continue monitoring free ridership rate in future years.

5.4 Recommendations and Action

This section documents the recommendations from Navigant’s 2015 RETIRE evaluations, including any actions taken by LADWP to address them.

Table 5-6. RETIRE FY13-14 Recommendations and Actions Taken

RETIRE FY13-14 Recommendations	Action Taken
<p>Increase marketing and outreach of the RETIRE program to reach savings goals. LADWP and ARCA program managers identified awareness as a key barrier to increasing participation and reaching program energy savings goals. Currently, the largest sources of awareness are word-of-mouth and the LADWP website, neither of which are active outreach activities on behalf of LADWP. Opportunities exist to increase marketing through paper mail and email, including with customers’ bills. Survey results suggest that cross-promotion of the RETIRE program and the CRP can be a successful strategy. LADWP should continue to look for ways to leverage this connection to market to customers shopping for new appliances. However, if LADWP wants to achieve the stated objective of targeting more secondary refrigerators, LADWP will also have to increase marketing outside of retail channels to reach customers not already looking to replace primary refrigerators. The evaluation team understands that increasing marketing will require an allocation of LADWP Public Affairs staffing resources, and cannot be directly addressed by program staff. However, if the program is going to reach its savings goals, marketing and outreach will need to expand. The Navigant team recommends elevating</p>	<p>The program sent out a post card to all residential single family residences. The mailings started September 2016 and will continue weekly through December 2016. Additional promotion will continued as directed by LADWP management.</p>

RETIRE FY13-14 Recommendations	Action Taken
<p>this issue with senior staff at LADWP who can secure support from Public Affairs or identify alternative methods for marketing the program.</p>	
<p>Continue to explore retail partnerships. Retail partnerships have been a successful way for ARP programs to reach new participants. By having a retailer pick up the old unit while delivering a new appliance, the partnership helps streamline the customers' experience and save implementation costs. Retail partnerships are becoming increasingly common, and SCE has already started these relationships with Southern California retailers.</p>	<p>Under consideration with program management</p>
<p>Revise how LADWP processes customers' rebates. RETIRE's rebate process is unique among similar Appliance Recycling Programs (ARPs). RETIRE requires participants to mail in a rebate application after the refrigerator is picked up, and LADWP is responsible for sending the check through the CRP. In other programs, ARCA sends the rebate check with no additional action required on the part of the participant. Most participants indicated that they waited nearly 2 months to receive a rebate check. In some cases, participants never received the rebate check, either because they were unaware they needed to apply for the rebate, because they had not bothered to apply for the rebate, or because the rebate had never arrived. Customers who had not received checks or waited a long time were less satisfied with the program. Since word-of-mouth is so important for driving program participant, this could be a risk to future program participation. Moreover, RETIRE rebate checks create relatively more administrative problems for CRP staff than other products. Because RETIRE participants are often in the process of moving households, the checks CRP sends are returned uncashed more frequently than those for other products. While there are some benefits to linking RETIRE and CRP, such as high awareness of CRP among RETIRE participants, LADWP could achieve this benefit through integrated marketing of the two programs. For these reasons, the Navigant team recommends reconsidering the decision to process rebates in-house instead of having ARCA process them. If it is not feasible or desirable to transfer this duty to ARCA, Navigant recommends communicating the rebate fulfillment process to customers upfront so they are not surprised or frustrated when they are not automatically sent a rebate.</p>	<p>The processing of the rebate payments is now with the Efficient Product Marketplace (EPM) program. As of October 1 customers will no longer need to complete an application to receive the rebate. LADWP will use the RETIRE invoices from ARCA to determine the customers who are eligible to receive a rebate. The customer's information will be sent to a 3rd party contractor. The customer should automatically receive a \$50 gift card within 60 days from pickup. The website is being updated. The customer will be given a card stating the above, when their appliance is pick up. The cards are currently being developed.</p>
<p>Clearly communicate pick-up appointment wait time. Near-participants frequently cited the wait time as the primary reason for dropping out of the program, and said they would have allowed more time if they had known. The RETIRE pages on the LADWP and ARCA website should clearly state that customers should expect to wait up to 2 weeks for an appointment, or occasionally longer during the months of peak demand.</p>	<p>LADWP is in the process of updating the website and the appointment wait time will be clearly stated</p>
<p>Improve tracking data collection. LADWP collects limited data on the units recycled through RETIRE. While the data on unit configuration was found to be mostly accurate, this field did not account for whether a unit was frost-free or not. The tracking data did not include fields for unit age or</p>	<p>Data is available from ARCA and can be retrieved if needed. ARCA also has the location of the</p>

RETIRE FY13-14 Recommendations	Action Taken
<p>size, and the data on whether a unit was primary or secondary was not consistent with industry standards. ARCA collects most of this data on hard copy applications, so LADWP could request this data be provided to them. One exception was ARCA's data on unit location, which the Navigant team found did not match the location where the unit was in use. Navigant recommends following UMP guidelines for collecting unit location data. Having information on age, size, location, amps, configuration, and frost-free features would allow LADWP and evaluators to more accurately estimate program savings from the unique mix of units recycled through this program. Without this data, the evaluation team had to rely on secondary data to estimate program savings.</p>	<p>refrigerators they pick up for recycling.</p>
<p>Update ex ante savings and continue to update energy savings assumptions more frequently. The UES value claimed by LADWP was calculated in 2002, over 10 years before this evaluation period. Because of how quickly APR savings have been decreasing and a CPUC decision to change the definition of ARP savings in California, LADWP's ex ante savings are out of line with the rest of California. Without more detailed data on the specific units recycled through RETIRE, the Navigant team recommends that LADWP adopt the ARP savings values provided in the E3 report, which come from the CMUA TRM. Moving forward, the Navigant team recommends that LADWP update the RETIRE program savings more frequently. According to the UMP recommendations for appliance recycling programs, "deemed savings ... may be used but need to be updated at least every 3 years to account for program maturation." To stay up-to-date with changes in the stock of existing refrigerators and regulatory developments in California, the Navigant team recommends updating the ex ante savings each year based on changes to the CMUA TRM.</p>	<p>Under consideration with program management.</p>

Sources: 2015 Evaluation Report, LADWP program managers

6. HOME ENERGY INCENTIVE PROGRAM

This section presents Navigant's process and impact evaluation of the Home Energy Incentive Program (HEIP) during FY14-15. HEIP is a comprehensive direct install whole-house retrofit program that offers residential customers a full suite of free products and services to improve the energy and water efficiency in the home by upgrading/retrofitting the home's envelope and core systems. HEIP serves all residential customers, with an emphasis on serving disadvantaged communities. HEIP includes attic insulation; duct repair; efficient room air conditioners (RACs); efficient toilets, aerators, and showerheads; cover plate gaskets; weather stripping; pipe wrap; and CFLs.

6.1 Program Goals and Achievements

HEIP's savings goals and projected budgets for the evaluation period FY14-15 are presented in Table 6-1.²⁴

Table 6-1. HEIP Projected Program Budget and Impact

	Projected Program Budget		Projected Program Impact		
	Energy	Water	kW	kWh	CO ₂ Avoided
FY14-15	\$4,456,000	\$1,433,000	4,400	7,500,000	4,012

Source: LADWP Efficiency Solutions Portfolio Business Plan FYs 2014/15 - 2019/20, page 29.

6.2 Impact Results

The following subsections detail the impact evaluation findings. For detail on methodology, including the tracking data review and sampling, please see the 2016 evaluation report.

6.2.1 Gross Energy and Demand Savings

Navigant calculated the realization rate for energy and demand savings across FY14-15 for HEIP. The total program energy realization rate was found to be 0.35 and the program demand realization rate was found to be 0.24. Table 6-2 and Table 6-3 show the program impacts by measure.

²⁴ The original evaluation plan for this program stated an evaluation period of FY13-14, but due to an upgrade to the LADWP tracking system and the impact evaluation requirements, FY14-15 was evaluated instead. Additional details are provided in the sample design section of the 2016 evaluation report.

Table 6-2. HEIP Measure-Level Gross Energy Results Extrapolated from the Sample

Measure Category	Measure Count	Ex Ante Energy Savings (kWh)	Ex Post Energy Savings (kWh)	Energy Realization Rate*	Relative Precision at 85% Confidence
Shower Head	1	5,699	5,699	1.00	11.2%
Shower Wand	17	98,397	82,654	0.84	14.7%
Aerator	17	21,984	21,251	0.97	15.5%
Efficient Toilet	12	69,170	69,170	1.00	0.0%
Blower Door Test	2	19,688	9,844	0.50	414.6%
Weather Stripping	11	257,598	242,445	0.94	8.8%
Room AC	5	111,325	129,879	1.17	22.3%
Insulation	4	66,417	65,669	0.99	1.3%
Duct Size Diameter Replacement	1	1,255	0	0.00	0.0%
CFL	52	4,062,450	997,140	0.25	36.4%
Other**	0	11,644	11,644	1.00	0.0%
Total (Unadjusted)	87	4,725,626	1,635,395	0.35	22.1%
Total*** (Adjusted)		5,907,032	2,044,244	0.35	

Sources: LADWP's HEIP FY14-15 tracking database and onsite data collection

*For CFLs, the realization rate is based on discounted future savings accounting for installed bulbs through year three.

**The Other stratum includes the duct repair, cover plates and pipe wrap kits.

***Adjustments based on E3 data factors

The primary drivers of the energy realization rates are CFLs, which contribute 86 percent of the total program savings. Upon receipt of the full fiscal year's data, an investigation of the program data revealed that a single Room AC project dwarfed the measure category and became a primary contributor to program savings. As in the tracking data review in the 2016 evaluation report, the savings from that project were adjusted on both the ex ante and ex post side to ensure that true program savings were being used in the realization rate calculations. The low CFL realization rate of 0.25 is causing the overall low realization rate of 0.35 for energy.

Table 6-3. HEIP Measure-Level Gross Demand Impacts

Measure Category	Measure Count	Ex Ante Demand Savings (kW)	Ex Post Demand Savings (kW)	Demand Realization Rate*	Relative Precision at 85% Confidence
Blower Door Test	2	103	51	0.50	414.6%
Weather Stripping	11	481	453	0.94	8.8%
Room AC	5	167	195	1.17	22.3%
Insulation	4	35	34	0.99	1.4%
Duct Size Diameter Replacement	1	7	0	0.00	0.0%
CFL	52	2,782	112	0.04	36.5%
Other	0	16	16	1.00	0.0%
Total (Unadjusted)	75	3,592	862	0.24	11.5%
Total*** (Adjusted)		4,706	1,129	0.24	

Sources: LADWP's HEIP FY14-15 tracking database and onsite data collection

*For CFLs, the realization rate is based on discounted future savings accounting for installed bulbs through year three.

**The Other stratum includes the duct repair, cover plates and pipe wrap kits.

***Adjustments based on E3 data factors

The CFL demand realization rate was found to be 0.04 and is also the reason for the low overall demand realization rate. The low demand realization rate is due primarily to absent CFs in the tracking system calculations, as described in the following section.

The final column in both tables provides the relative precision on the realization rate. There are two primary reasons for the high precision values for the CFL and Blower Door Test measures:

- Relative precision is calculated as the standard error times the appropriate t-value divided by the realization rate. Since the realization rate is the denominator in the fraction, a lower realization rate results in a larger precision.
- A high coefficient of variation for energy and demand on the verified CFL and Blower Door Test savings was driven by the low verified quantities for both measures and low verified hours of use for CFLs.

For lighting project realization rates, please see the 2016 evaluation report.

6.2.2 Net Savings

No net savings estimate was conducted for this program. Its contribution to market effects are considered in the Market Transformation report.

6.2.3 EUL and Lifecycle Savings

Navigant assessed EUL and lifecycle savings for the high-contributing CFL measures that were verified for the HEIP. The necessary inputs for determining EUL include the estimated median number of years a rebated measure is installed and operable and the technical degradation over time due to time-related and use-related changes in savings for a measure. The DEER²⁵ database, a secondary source, offers estimates of EUL for lighting and water measures. Navigant determined that the DEER EULs are reasonable and suggests adopting them for HEIP to estimate the ex post lifecycle savings. Navigant calculated lifecycle savings by multiplying the EUL value for each measure by the estimate of first-year energy savings. Table 6-4 identifies the EULs for the measures installed through HEIP.

Table 6-4. HEIP Measure Expected Useful Life

Measure and Description	Measure Life: DEER
Indoor Residential CFL	8.7
Outdoor Residential CFL	5.8

Sources: DEER and Navigant analysis

Table 6-5 shows the average measure life applied to the first-year savings to calculate lifecycle savings. The average measure lives reflect the energy-weighted average for each measure within each project.

Table 6-5. HEIP Ex Post Lifecycle Savings

Strata	Gross Ex Post Energy Savings (kWh)	Average Measure Life	Gross Lifecycle Ex Post Energy Savings (kWh)
CFL	997,140	8.7	8,672,951

Sources: Program tracking data and onsite data collection

6.3 Process Results

This section presents a summary of process evaluation findings from the 2016 evaluation report for HEIP. For the full process evaluations, including a program documentation review, most participant survey results, and program manager interview findings, please see the 2016 evaluation report.

The following are the main process findings for HEIP.

- **The HEIP is currently meeting its monthly participant targets.** The program administration is currently providing energy savings to LADWP customers while targeting lower income customers.
- **The program is currently fully staffed for both administrative and field staff.** The program has recently added two additional administrative staff members to assist with rebate processing. Also, because the program uses integrated support services (ISS) team members for field work, the program has adequate field staff to complete the targeted number of audits per month.

²⁵ DEER. Technology and Measure Cost Data/Effective and Remaining Useful Life Values.

http://www.deeresources.com/files/DEER2013codeUpdate/download/DEER2014-EUL-table-update_2014-02-05.xlsx

- **The program is not currently tracking the number of program dropouts and the reason for participant dropouts.** Without this information, the program managers are not able to track trends or changes in the number of dropouts over time.
- **The inability to obtain landlord approval sometimes prevents projects from moving forward.** The program is going to be reassessing the way that it works with property owners, especially multi-family property owners, to better serve the rental market.

6.4 Benchmarking Results

LADWP has the lowest costs per kilowatt-hour savings for low-income programming in the group (\$0.68/kWh). Similarly, AE Free Home Energy Improvement spends \$0.71 per kWh, while CPAU and SCL pay \$1.14 and \$2.41 per kWh savings, respectively. Table 6-6 below compares the primary design features of the residential direct install comparison group.

Table 6-6. Residential Direct Install Comparison Group Attribute Table

Utility	Program Name	Target Market	Primary Implementer	Contractor Network*	Cost to Customer
LADWP	Home Energy Improvement Program	Low-income	Utility Staff	Closed	--
City of Palo Alto Utilities	Residential Energy Assistance Program (REAP) Low-income	Low-income	Synergy Companies	Closed	--
Sacramento Municipal Utility District	Residential Weatherization	Low-income	Undetermined – Program recently announced		
Austin Energy	Free Home Energy Improvement	Low to Moderate Income	Utility Staff	Semi-Closed	--
Seattle City Light	Homewise	Low-income	Seattle City Department of Housing	Semi-Closed	--

*See Table 2-7. Contractor Network Model
Source: In-Depth Benchmarking Report

Findings Summary

The differences among comparison group utilities in residential direct install programs are minor. Aside from a less restrictive target market that potentially overlaps with the EUCA program, HEIP is implemented in accordance with best practices. Navigant recommends no changes.

6.5 Recommendations and Action

This section documents the recommendations from Navigant's 2016 HEIP evaluation, including action taken by LADWP to address them.

Table 6-7. HEIP FY14-15 Recommendations and Actions Taken

HEIP FY14-15 Recommendations	Action taken
<p>Program Documentation: The program should document the deemed savings algorithm and cite all sources for both lighting and non-lighting measures. Upon request, LADWP provided Navigant with the deemed savings values, but without any documentation of the savings algorithm or the source of the savings. The program should develop its ex ante savings algorithm in order to improve the documentation of deemed savings.</p>	
<p>Tracking System: LADWP should provide all deemed parameters in the tracking database for lighting and non-lighting measures. Only energy and demand savings values were provided in the tracking database. Navigant recommends adding missing parameters such as hours of use, HVAC IFs, and demand CFs for CFL measures in the program. Baseline values for all measures except efficient toilets, CFLs, and attic insulation were not documented at all in any data source provided by LADWP. Navigant recommends adding those in the measure descriptions, as well as explicitly stating those in the deemed savings calculations in order to bolster the ex ante assumptions for these measures and enable improved evaluation efforts.</p> <ul style="list-style-type: none"> The program should also include information about participants who dropped out of the program in the tracking database, including information about why the participants dropped out of the program (such as their decision to participate in another LADWP residential program). 	<p>Due to the program being severely under-resource, no action has been taken on any of these recommendations.</p>

HEIP FY14-15 Recommendations	Action taken
<p>Update Savings Algorithms and Deemed Parameters: The program should add and adjust some of its savings parameters based on evaluation findings.</p> <ul style="list-style-type: none"> • CFs were missing from ex ante demand savings calculations for this program. Navigant recommends introducing a CF based on the results of this evaluation study, 0.05 on average. • Similarly, Navigant also recommends introducing HVAC IFs of 1.09 for energy and 1.46 for demand for CFLs in single-family residential homes from the CPUC Potential Goals and Target Study updated in 2015.^[1] • Navigant found annual operating hours was 636 across all sites, 1.74 hours per day, which is only 43 percent of the deemed ex ante hours and on average 4 hours a day.^[2] Navigant recommends that LADWP update its energy savings algorithm and use this value for hours of use in future program years. • Additionally, Navigant calculated a first-year verification rate (VR) of 0.32 weighted by savings for the sample sites and a discounted future savings VR of 0.74 for year three. Navigant recommends applying the discounted VR in the future program years, as it represents a more accurate number of installed bulbs. • Navigant recommends adjusting EUL according to DEER^[3] to 8.7 and 5.8 years for indoor and outdoor CFLs, respectively. 	
<p>E3 Calculator: The E3 calculator should be updated to provide measure-level savings breakdowns for a fiscal year, as well as a transparent process of mapping the tracking database savings to the E3 calculator with the help of a unique identifier at the measure-level.</p>	
<p>Non-Lighting Measures: Navigant suggests focusing on the non-CFL measures in future evaluations. A more thorough engineering review on non-CFL savings is warranted, as this evaluation almost exclusively focused on high-impact lighting measures.</p>	
<p>Landlord Interviews: Navigant suggests conducting interviews with landlords who declined to participate in the program to better understand their decision and to find ways that the program can overcome these barriers to participation.</p>	

Sources: 2016 Evaluation Report, LADWP program managers

^[1] Source: CPUC Potential Goals and Target Study 2015, http://www.cpuc.ca.gov/NR/rdonlyres/F0FFCA2E-EB09-4911-90D4-9E1F9B96FE8F/0/2015PGT_MICS_FULL_BUILD_v090_PUBLICVERSION.xlsx

^[2] DEER Database: 2011 Update Documentation, Itron, Inc., http://www.deeresources.com/files/DEER2011/download/2011_DEER_Documentation_Appendices.pdf

^[3] DEER. Technology and Measure Cost Data/Effective and Remaining Useful Life Values. http://www.deeresources.com/files/DEER2013codeUpdate/download/DEER2014-EUL-table-update_2014-02-05.xlsx

7. CALIFORNIA ADVANCED HOME PROGRAM

This section presents Navigant's process and impact evaluation of the California Advanced Home Program (CAHP) during FY14-15. CAHP is a statewide energy efficiency program implemented by the state IOUs: Pacific Gas & Electric, Southern California Edison, San Diego Gas & Electric, and the SCG. CAHP drives energy and gas savings by incenting construction of buildings, which outperform Title 24 building code. California designed CAHP's approach, a single uniform program administered separately by utilities throughout the state, to provide the building market with a single, consistent set of offerings. California's larger purpose is to help builders prepare for future code changes and achieve the statewide goal of building only zero net energy homes after 2020.

To participate, builders submit the construction plan for their building (or buildings in the case of a tract of single-family homes) to the program implementer. The implementer reviews these plans and calculates an incentive based on their energy performance. For high-rise multi-family buildings, the incentives begin at designs that achieve a 15 percent improvement above Title 24 building code and increase per kilowatt-hour for projects that achieve 30 percent or better. Each project has a maximum \$250,000 incentive cap. For low-rise multi-family or single-family homes, CAHP ties the incentive level to the home performance score. Incentives begin at a CAHP score of 84 or lower.

In the City of Los Angeles, SCG offers the program jointly with LADWP. SCG is the primary implementer of the program and LADWP serves as a financial partner in a supervisory role. This joint effort launched during FY12-13.

7.1 Program Goals and Achievements

The program's FY14-15 savings goals are 1,400,000 kWh and 400 kW, according to LADWP's Efficiency Solutions Group portfolio tracker and program business plan.²⁶ As of June 2015, CAHP had 72 projects in some stage of participation. Of these 72 projects, 28 had their incentive payment commenced or fulfilled, 37 had enrolled in the program, and seven had submitted a letter of interest but were not yet accepted or declined. The projects that received payment and had estimated completion dates during FY14-15—the best indicators available for which projects closed during FY14-15—represent an expected savings of 1,865,502 kWh, 655 kW, and 51,797 therms. Table 7-1 shows what LADWP submitted to the E3 database for FY14-15 savings.

Table 7-1. CAHP Claimed Savings Summary for FY14-15

Program Year	Number of Projects	kWh Savings	kW Savings
FY14-15	28	3,209,011	1,153

Sources: E3 database; LADWP & SCG tracking data

²⁶ LADWP's Key Performance Indicator portfolio tracking spreadsheet shows a kWh savings goal of 1,400,000 and a kW savings goal of zero. The Efficiency Solutions Portfolio Business Plan FYs 2014/15-2019/20 shows a savings goal of 1.4 GWh (1,400,000 kWh) and 0.4 MW (400 kW).

7.2 Impact Results

Since CAHP is a statewide program, Navigant applied the realization rates from IOU evaluations to LADWP's ex ante savings to derive ex post savings. In addition, Navigant forecasted the future contribution of CAHP as part of the Market Transformation report described in Section 2.2.

7.2.1 Gross Energy and Demand Savings

The FY14-15 E3 model reports ex ante savings of 3,209,011 kWh and 1,153 kW. Applying the statewide evaluation realization rates (1.78 for energy and 1.92 for demand)²⁷ produces the ex post figures in Table 7-2 and Table 7-3.

Table 7-2. CAHP Gross Energy Impacts

Ex Ante Gross Energy Savings (kWh)	Ex Post Gross Energy Savings (kWh)	Statewide Energy Realization Rate
3,209,011	5,712,040	1.78

Sources: CPUC, Navigant Analysis

Table 7-3. CAHP Gross Demand Impacts

Ex Ante Gross Energy Savings (kW)	Ex Post Gross Energy Savings (kW)	Statewide Energy Realization Rate
1,153	2,214	1.92

Sources: CPUC, Navigant Analysis

7.2.2 Net Savings

No net savings estimate was conducted for this program. Its contribution to market effects are considered in the Market Transformation report.

7.2.3 EUL and Lifecycle Savings

No EUL or lifecycle savings estimates were conducted for this program.

7.3 Process Results

This section presents a summary of process evaluation findings from the 2016 evaluation report for CAHP. For the full process evaluations, including the tracking system review, most participant survey results, and program manager interview findings, please see the 2016 evaluation report.

These are the high-level results from the FY14-15 evaluation of CAHP:

²⁷ Ibid, P 1-9.

- LADWP’s program managers were unable to obtain participant contact information from SCG for this evaluation.** When Navigant requested this information on behalf of LADWP’s program managers, the program manager at SCG deferred to the Regulatory Affairs group to ensure compliance with SCG’s privacy policy. Tight control over personally identifying information is a recommended practice, but this policy inhibits third-party evaluation on behalf of LADWP. CAHP’s participants are both LADWP and SCG customers, and as a joint administrator and financial supporter of the program, LADWP should have access to customer-specific data such as contact information.
- According to program manager interviews, LADWP does not have access to customer data, project files, or any other information that would enable them to participate in the program implementation.** When asked about LADWP’s ability to access participant building plans and application materials, the SCG program manager deferred to the SCG Regulatory Affairs group, which offered no comment. This does not allow LADWP to review a project application before it is accepted or denied, preserving their existing level of awareness and limited involvement. This relegates their role to paying invoices and reviewing project tracking data to attempt verification of those invoices.
- A lack of an available FTEs impedes LADWP’s ability to represent its urban and municipal perspective in the CAHP statewide team.** Program managers at SCG and LADWP indicate that LADWP’s program manager is presently unable to commit the travel time to attend the CAHP statewide team’s quarterly meetings in San Francisco. This lack of presence inhibits a more active role by LADWP in the administration of CAHP and denudes the statewide team of their expertise.

7.4 Recommendations and Action

This section documents the recommendations from Navigant’s 2016 CAHP evaluation, including actions taken by LADWP to address them.

Table 7-4. CAHP FY14-15 Recommendations

CAHP FY14-15 Recommendations	Action Taken
LADWP should modify its program order agreement with SCG to ensure LADWP’s program managers or third-party evaluators on their behalf can obtain participant contact information in a timely matter. SCG’s rigorous stewardship of personally identifying information impedes third-party evaluation and limits LADWP’s ability to contact its own customers.	No update at this time.
LADWP should require access to project information from SCG in order to facilitate third-party evaluation and familiarize themselves with the program implementation. The role of the LADWP is currently constrained to a review of monthly tracking data and payment of SCG invoices.	No update at this time.

CAHP FY14-15 Recommendations	Action Taken
<p>LADWP should make more FTEs available for CAHP program managers if it wants to play a larger role in CAHP's current administration or build the capacity to administer its own new construction programs. Operating custom commercial programs in LADWP's portfolio requires the majority of the program manager's time. This inhibits the LADWP program manager from inserting herself into the stages of program implementation or participating in the CAHP statewide team regularly. Without more time available, it is unlikely that LADWP's role can grow beyond reviewing the tracking data and paying SCG invoices.</p>	No update at this time.
<p>LADWP should initiate a process for LADWP account executives and Efficiency Solutions staff to identify large potential CAHP projects and advance the information to SCG. Without a significant time investment on behalf of the program manager, LADWP can contribute to CAHP outreach and drive savings by alerting SCG account executives to any potential participants they may not already be targeting. This contribution will also provide a pathway for the LADWP program manager to follow participants through the stages of CAHP and understand the program better.</p>	No update at this time.
<p>SCG should track customer firmographics. Including details of participating builders will help identify how effectively account executives are recruiting projects from a diverse set of builders and how reliant they are on certain subsets of builders. Firmographics will allow third-party evaluation to assess the outreach efforts of account executives and advise on strategies to increase participation.</p>	No update at this time.

Sources: 2016 Evaluation Report, LADWP program managers

8. ENERGY UPGRADE CALIFORNIA PROGRAM

This section presents Navigant's process evaluation of the Energy Upgrade California (EUCa) program during FY13-14. EUCa is a statewide program that provides assistance and incentives for home improvement projects that can reduce energy use and make homes more comfortable. The statewide program is managed locally by utilities and regional energy networks and directed by the CPUC in collaboration with the CEC.²⁸ The program is jointly administered in Los Angeles through a collaboration between LADWP and SCG, with SCG taking the lead role in program administration. The goal of joint program administration is to implement "whole-house" or comprehensive retrofit projects at eligible residential dwellings (including projects that result in efficiency savings for electricity, natural gas, and water) and to improve program cost-effectiveness by leveraging the administration of the program by one utility. In addition to improving cost-effectiveness for the program, LADWP seeks to leverage the statewide program's resources to promote education and awareness of residential whole-house efficiency benefits to its customers. Promoting education and awareness of residential energy efficiency benefits is a key feature of the program's market transformation goal.²⁹

The program includes a targeted marketing approach that focuses on reaching customers of older, high-energy use homes, previous energy efficiency adopters, and new homeowners at the time of transition. For eligible participants, the program offers incentives to homeowners who complete select energy-saving home improvements on single-family residences or two- to four-unit buildings, such as a townhouses or condominiums. The program encourages homeowners to work with qualified participating trade allies to choose from two different incentive options that fit with the homeowner's budget: the Home Upgrade option or the Advanced Home Upgrade option. These options are designed to bundle multiple energy efficiency measures to address whole-house or comprehensive retrofit improvements at a residence. The Home Upgrade option includes building shell measures such as insulation, whole-house air sealing, duct sealing, and furnace and air conditioning equipment replacement. The Advanced Home Upgrade option includes the Home Upgrade measures and adds additional measures such as a whole-house fan, cool roof, hardwire lighting, tankless water heater system, energy efficient windows, and others. In FY13-14, participants were eligible to receive incentives up to \$4,000 based on their calculated energy savings.³⁰

8.1 Program Goals and Achievements

The EUCa program savings goal in FY13-14 was 2,400,000 kWh and 700 kW, which is less than 1 percent of the total energy savings and demand reduction goal of LADWP's efficiency portfolio. The program's budget in FY13-14 was \$2,280,000, which is approximately 1.5 percent of the total budget of LADWP's efficiency portfolio. The program's energy savings and demand reduction goals, along with the program's estimated budget, are projected to remain steady through FY14-15. The program's implementation contractor is ICF International (ICF).

²⁸ California Public Utilities Commission and California Energy Commission, Energy Upgrade California, <http://www.energyupgradeca.org/en/about/california-state-energy-goals> (website accessed February 2, 2015).

²⁹ LADWP. Energy Efficiency Portfolio Business Plan, FYs 2012/13 & 2013/14, pages 69-77.

³⁰ The EUCa program subsequently increased eligible program incentives.

8.2 Impact Results

Navigant did not conduct an impact evaluation of the EUCA program.

8.3 Process Results

This section presents a summary of process evaluation findings from the 2015 evaluation report for EUCA. For the full process evaluations, including secondary research, and program manager and implementer interview findings, please see the 2015 evaluation report.

The key findings for the EUCA program are:

- **While the EUCA's administration is nominally a joint effort on the part of the two utilities, SCG's control over all program processes limits LADWP's insights into implementation effectiveness.** As the lead program administrator, SCG maintains program documents and archives, with implementation contractor ICF maintaining the program tracking database. Contacts from both the program administrator and the implementation contractor provided valuable program documentation and all necessary information to conduct the review. Available information included monthly program reports, contractor training materials, and program manuals.
- **The EUCA program's current process flow creates a barrier to LADWP reviewing project information prior to completion in the program.** The program's current process flow diagram, as described in the 2015 evaluation report and confirmed through telephone interviews, does not allow for LADWP to review customer data or project information prior to the time a project is completed through the program. While additional opportunities for input are planned in the next year, there have been limited opportunities for LADWP to review project-specific files, such as customer applications, energy simulation model estimates, and QC inspection checklists.
- **The current EUCA program is undergoing a transformative planning update through the EUC working group, designed to create strategic market transformation of key target residential markets.** As a stakeholder in the EUC process, LADWP is invited to attend discussions of the EUC working group and provide input into the program planning updates as appropriate.
- **While being addressed through the EUC working group and other program improvements, recent evaluation research found low realization rates and partial free ridership that adversely affected program performance.** The impact evaluation of the California Whole-House Retrofit program³¹ found that participants reported higher than realized savings. The primary cause for this was attributed to the energy simulation software used for modeling baseline usage and program savings. The evaluation found indications of substantial rebound (take back or increased energy usage after implementing energy efficient measures). Recommendations included calibrating the energy simulation software used for the program, conducting targeted marketing to high-usage customers, restructuring incentive levels, and documenting customer decision-making to claim savings only for measures that the customer was not already considering.

³¹ DNV GL, *Whole House Retrofit Impact Evaluation of Energy Upgrade California Programs Work Order 46*, October 31, 2014.

8.4 Recommendations and Action

This section documents the recommendations from Navigant's 2016 EUCA evaluations, including any actions taken by LADWP to address them.

Table 8-1. EUCA FY13-14 Recommendations and Actions Taken

EUCA FY13-14 Recommendations	Action Taken
To better understand the program and customer projects that complete the program, LADWP should request access to project information from SCG and/or ICF , as appropriate.	Access to projects is provided; however, since LADWP is not part of the CPUC, program managers are not allowed to attend program implementation and administration meetings. Program managers only attend quarterly working group meetings for program updates and meet periodically with SCG project managers for program stats.
LADWP should request access to customer project information during the program lifecycle to better understand how ratepayer dollars are used in this program. Obtaining access to customer project information, such as customer applications, energy simulation model estimates, and QC inspection checklists will enable LADWP to gain a greater understanding of program effectiveness.	Limited resources have not allowed for QC inspections and checklist development.
LADWP should continue to stay involved in the EUC working group process in order to influence and stay well-informed of future program changes.	Although the working group meetings give insight to how other utilities are managing the program, these do not specifically address the issues in the LADWP/SCG joint territory. LADWP program managers continue to attend these meetings.
LADWP should review findings and recommendations from recent evaluation research and discuss whether the program has already or is planning to address these findings to the extent feasible within the current program design.	Adjustments were made within the EUC energy savings calculation methodology for much more accurate energy savings.

Sources: 2015 Evaluation Report, LADWP program managers

9. CONSUMER REBATE PROGRAM

This section presents Navigant's process and impact evaluation of the Consumer Rebate Program (CRP) during the 2011-12 and 2012-13 FYs. Through the CRP, LADWP offers rebates for a variety of high-efficiency products to all residential customers. The goal of this program is to promote and advance a wide adoption of energy efficient measures by its residential customers. The program, which is available to both single-family and multi-family customers, currently uses downstream mail-in rebates to incentivize efficient pool pumps, cool roofs, refrigerators, central air conditioners (CACs), RACs, central heat pumps (CHPs), whole-house fans, and window treatments. The program is administered by LADWP staff without third-party implementers.

9.1 Program Goals and Achievements

Table 9-1 shows the energy and demand savings goals and progress toward these goals in FY11-12 and FY12-13 as reported by LADWP. In both program years, the CRP was not able to achieve its savings goals, for reasons that will be explored in this report.

Table 9-1. CRP Claimed Savings Summary for FY11-12 and FY12-13

Fiscal Year	Energy Savings Goal (kWh)	Energy Savings Reported (kWh)	Demand Savings Goal (kW)	Demand Savings Reported (kW)
FY 11-12	4,980,000	2,920,000	1,220	820
FY 12-13	1,810,000	1,640,000	840	530
Total	6,790,000	4,560,000	2,060	1,360

Source: LADWP program staff

9.2 Impact Results

The following subsections detail the impact evaluation findings. For detail on methodology, including onsite data collection and sampling, please see the 2015 evaluation report.

9.2.1 Gross Energy and Demand Savings

Overall, the CRP achieved a total of 9,171,533 kWh and 3,957 kW in gross electric energy and demand savings, respectively, between FY11-12 and FY12-13. The final realization rates for the program are 2.01 for energy and 2.11 for peak demand. Table 9-2 presents the IR, UES, gross ex post savings, and realization rates for program energy savings. Realization rates for energy savings ranged across program measures from 0.92 for cool roofs and whole-house fans to 800 percent for dual pane windows, with an overall realization rate of 2.01.

Table 9-2. CRP Gross Energy Impacts

Measure	Quantity (Program Tracking Data)	IR (Survey and Onsites)	Verified Deemed Unit Savings Value	Ex Ante Energy Savings (kWh)	Ex Post Energy Savings (kWh)	Energy Realization Rate
CAC	856 units	1.00	585.22 kWh/unit	442,211	500,948	1.13
CHP	28 units	1.00	454.02 kWh/unit	15,536	12,713	0.82
Cool Roof	250,015 /ft ²	1.00	0.03 kWh/ft ²	-	7,500	-*
Dual Pane Windows	302,272 /ft ²	1.00	4.32 kWh kWh/ft ²	163,277	1,305,815	8.00
Pool Pump and Motor	3,856 units	1.00	901.34 kWh/unit	1,916,426	3,475,586	1.81
Refrigerator	13,346 units	0.97	294.54 kWh/unit	1,956,490	3,804,107	1.94
RAC	470 units	0.60	224.00 kWh/unit	68,966	63,168	0.92
Whole- House Fan	4 units	1.00	424.00 kWh/unit	-	1,696	-*
Total				4,562,906	9,171,533	2.01

Source: Navigant analysis

*Realization rate could not be computed because the reported E3 savings value = 0. Not all totals sum due to rounding.

Table 9-3 presents the IR, UES, gross ex post savings, and realization rates for program demand savings. Realization rates for demand savings ranged across program measures range from 91 percent for RACs to 800 percent for dual pane windows, with an overall realization rate of 211 percent.

Table 9-3. CRP Gross Demand Impacts

Measure	Quantity (Program Tracking Data)	IR (Survey and Onsites)	Verified Deemed Unit Savings Value	Ex Ante Demand Savings (kW)	Ex Post Demand Savings (kW)	Demand Realization Rate
CAC	856 units	1.00	1.98 kW/unit	968	1,729	1.79
CHP	28 units	1.00	0.91 kW/unit	24	26	1.08
Cool Roof	250,015 /ft ²	1.00	0.0001 kW/ft ²	-	25	- *
Dual Pane Windows	302,272 /ft ²	1.00	0.29 kW/ft ²	110	877	8.00
Pool Pump and Motor	3,856 units	1.00	0.15 kW/unit	335	562	1.68
Refrigerator	13,346 units	0.97	0.05 kW/unit	340	645	1.90
RAC	470 units	0.60	0.32 kW/unit	99	90	0.91
Whole-House Fan	4 units	1.00	0.78 kW/unit	-	3	-*
Total				1,875	3,957	2.11

Source: Navigant analysis

*Realization rate could not be computed because the reported E3 savings value = 0. Not all totals sum due to rounding.

The main drivers for the CRP realization rates include the following:

- **The primary driver behind the high realization rate of the CRP is the adjustments made to the baseline assumptions used (i.e., early vs. natural replacement).** For the program's two highest savings measures, pool pumps and refrigerators, over half of sampled projects were found to be early retirement rather than natural replacement.
- **The misalignment between program tracking data and E3 calculator values contributed to a lesser degree.** This was most evident for windows; in what may be an error in converting units, the deemed E3 savings values are 10 times higher than the tracking data savings.
- **As part of this evaluation, Navigant conducted secondary research into the measures that make up the largest percent of program savings (refrigerators and pool pumps),** as well as the measures that are not deemed in E3. This research indicated that the E3 deemed savings values are reasonable for the mix of refrigerators and pool pumps included in the program. This

research also suggested that LADWP's program tracking data savings value for cool roofs was reasonable. However, the E3 report did not include either cool roofs or whole-house fans, so LADWP did not actually claim savings for these measures.

9.2.2 Net Savings

Navigant conducted primary research into NTG effects and found an overall NTG ratio of 49 percent. Net energy savings were 4,494,000 kWh and net demand savings were 1,939 kW.

Table 9-4. CRP Ex Post Gross and Net Energy and Demand Savings

Gross Annual Ex Post kWh Savings	Gross Annual Ex Post kW Savings	NTG Ratio	Net Annual Ex Post kWh Savings	Net Annual Ex Post kW Savings
9,171,533	3,957	0.49	4,494,051	1,939

Source: LADWP tracking data and Navigant analysis

9.2.3 EUL and Lifecycle Savings

EUL is an estimate of the median number of years that the measures installed under a program are still in place and operable. The E3 calculator offers estimates of EUL, which Navigant used to calculate lifecycle savings by multiplying this value by the estimate of first-year energy savings. For cool roofs, the 30-year measure life comes from "2013 California Building Energy Efficiency Standards: Residential Roof Envelope Measures," October 2011.³² Table 9-5 provides the lifecycle electric savings of energy from the CRP.

Table 9-5. CRP Ex Post Lifecycle Savings

Measure	Gross Annual Ex Post kWh Savings	Net Annual Ex Post kWh Savings	Measure Life	Gross Lifecycle kWh Savings	Net Lifecycle kWh Savings
CAC	500,948	245,465	18	9,017,064	4,418,361
CHP	12,713	6,229	18	228,834	112,129
Cool Roof	7,500	3,675	30	225,000	110,250
Dual Pane Windows	1,305,815	639,849	20	26,116,300	12,796,987
Pool Pump and Motor	3,475,586	1,703,037	10	34,755,860	17,030,371
Refrigerator	3,804,107	1,864,012	14	53,257,498	26,096,174
RAC	63,168	30,952	9	568,512	278,571
Whole-House Fan	1,696	831	20	33,920	16,621
Total	9,171,533	4,494,051		124,202,988	60,859,464

Source: Navigant analysis

³² Available at:

http://www.energy.ca.gov/title24/2013standards/prerulemaking/documents/current/Reports/Residential/Envelope/2013_CASE_R_Roof_Measures_Oct_2011.pdf

9.3 Process Results

This section presents a summary of process evaluation findings from the 2015 evaluation report for CRP. For the full process evaluations, including the NTG methodology, most participant survey results, program manager and trade ally interview findings, please see the 2015 evaluation report.

These are the high-level results from the FY11-12 and FY12-13 process evaluation of CRP:

- **The CRP is understaffed, which affects the participation rate and the ability of the program to reach goals.** Traditionally, the program has had two managers and five support staff. The program lost one of those staff positions, while another administrative program staff member has been out on leave on and off. Despite having one less position, CRP staff were tasked with implementing the Charge Up L.A.! program and the EUCA program. The program managers have to help process applications, which leaves them little time for steps to help improve or grow the program, such as updating the product mix and incentives, engaging with retailers or contractors, or developing marketing materials. The program staff and management want to spend more time engaging with retailers and contractors but cannot do so because they are needed to process applications.
- **Program participants reported high levels of satisfaction with their experience with the program.** Overall, the program participants were very satisfied with all aspects of the CRP. Customers are most satisfied with the measures they installed and the program rebate and are slightly less satisfied with the electricity and money saved. Despite a few comments that the application and rebate processing time could be improved, two-thirds of participants have already recommended the program, and nearly all say they would consider participating again in the future.
- **Customers are motivated to participate in the program when they need to purchase new equipment, and the barriers to participation among program participants are low.** Current program participants generally found the application process easy, and nearly all say they would consider participating again in the future. Thus, **the biggest barriers to participation seem to be lack of awareness of the program.** Marketing and outreach for the program are limited, and most participants do not remember receiving information from LADWP about the program.
- **There are many opportunities to increase program participation in the future through expanded marketing and outreach, if desired.** LADWP is currently not doing much marketing of the CRP and does not engage retailers or contractors to promote the program. Despite this, nearly half of customers heard about the program through retail staff, retail store signage, or a contractor. This implies retailers and contractors are an important channel for increasing program awareness that the program staff could tap to increase participation the future. For example, multiple contractors said they could sell more energy efficient projects if LADWP supplied them with program marketing collateral. Furthermore, there are many contractors who do not yet know about the program that the program could reach out to. On the other hand, most customers reported that they wanted to hear about the program directly from LADWP through bill inserts, mailings, or email. This means LADWP has another lever available—more direct marketing—to increase participation. Finally, the program could reach a wider population of participants with applications in Spanish or other languages.

- Free ridership for this program is high, but in line with other single-measure rebate programs.** Program free ridership was estimated to be 58 percent, meaning over half of savings due to program measures would have been realized without the program. Free ridership is a challenge for the downstream single-measure program, as the barriers to participation are very low for customers planning on buying an efficient product. One thing LADWP could try to do to decrease free ridership is increase program marketing to try to reach customers who are not already making a purchasing decision. This was supported by contractors who said they could sell higher efficiency program projects with marketing support from LADWP. LADWP may want to reassess minimum thresholds for qualifying equipment, especially for refrigerators. Free ridership was high for refrigerators, as has been found in other evaluations. This is because of the high market penetration of ENERGY STAR refrigerators. Moving to only incenting Consortium for Energy Efficiency (CEE) Tier 2, Tier 3, or ENERGY STAR Most Efficient refrigerators could help alleviate this. As shown in the secondary research, the other major California utilities have moved to mostly CEE Tier 2 and higher.
- The overlap between CRP and LADWP's EUC program is not confusing customers or contractors.** Most CRP participants had not heard about the EUC program. Among those who had, none had considered participating in EUC, as they were not interested in a whole-house project. The contractors were also not confused by the overlap between CRP and EUC and thought customers liked having the option between the two programs. The one contractor interviewed who had participated in EUC preferred CRP as the easier option. These results indicate that CRP is complementing rather than undercutting EUC, although this question should be further explored in the upcoming EUC evaluation.
- The information contained in the program tracking database is not consistent with the reported savings from the E3 models.** The program tracking data accounts for 98 percent of the E3-reported kilowatt-hours and 69 percent of the kilowatts. There are considerable variations in the two databases in terms of the quantity of measures installed, the measure types available in the databases, and the savings associated with the included measures. There does appear to be some ambiguities related to whose responsibility it is to make sure program tracking data savings match what has been deemed in the E3 model. Because the program tracking data does not match current E3 savings values, when CRP program managers track progress toward energy goals, they are not actually managing toward the savings amount that will be reported to the CEC.
- While CRP includes more prescriptive rebates than IOUs, the measure requirements and incentive levels are generally in line with SMUD and the IOUs.** The refrigerator and RAC measure rebates are most similar to comparable utilities. CRP's rebate for pool pumps is quite a bit higher than other California utilities, and the whole-house fan and cool roof prescriptive incentives are also higher. The biggest difference between CRP and other California utilities is windows; of the utilities reviewed, none offered prescriptive rebates for windows.

9.4 Benchmarking Results

Table 9-6 below details what customer segment the residential rebate programs in the comparison group serve and differences in how they are served.

Table 9-6. Prescriptive Residential Rebate Comparison Group Attribute Table

Utility	Program Name	Target Market	Primary Implementer	Contractor Network*	Refrigerator Rebate CEE Tiers (amount)
LADWP	Consumer Rebate Program	Single-family, Multi-family	Utility Staff	Open	1+ (\$65)
City of Palo Alto Utilities	Smart Energy Rebates	Single-family	Utility Staff	Open	3 (\$50)
Sacramento Municipal Utility District	Appliance and Equipment Efficiency	Single-family, Multi-family (<3 units)	Utility Staff	Semi-open, Listed By # Of Jobs	2+ (\$75)
Austin Energy	Appliance Efficiency	Single-family, Multi-family (<4 units)	Utility Staff	Semi-open, Website Listed	--
Seattle City Light	Appliance Rebates	Single-family, Multi-family (<4 units)	Utility Staff	Semi-open, Third-Party Listing	1+ (\$50)

*See Table 2-7. Contractor Network Model
Source: In-Depth Benchmarking Report

The prescriptive residential rebates programs in the survey vary in two main ways. The measure mixes offered by LADWP, SMUD, and AE were more extensive than those offered by CPAU or SCL, whose programs focus only on appliances. Because SMUD and AE offer HVAC, cool roofs, or other contractor-centric measures, they provide a listing on their websites to help customers and incent participation from contractors, which LADWP does not. In the other areas examined—program logic, implementation, and administration—the comparison programs shared the same framework as CRP, except with an explicit boundary between small and large multi-family at 3-4 units.

9.5 Recommendations and Action

This section documents the recommendations from Navigant's 2016 CRP evaluation, including any action taken by LADWP to address them.

Table 9-7. CRP FY11-12 and FY12-13 Recommendations and Actions Taken

CRP FY11-12 and FY12-13 Recommendations	Action Taken

CRP FY11-12 and FY12-13 Recommendations	Action Taken
<p>Increase administrative staff for the CRP, at least temporarily while permanent staff are on leave, to increase program participation. This will allow the program to decrease the amount of time needed to process rebates. Moreover, it will allow program managers to spend more time focusing on planning and expanding the program. Program managers would also have more time to make sure the program offerings are relevant with EUC and Title 24, develop marketing materials, and engage with retailers and contractors. In addition, having access to field staff could help the program understand whether hard-to-determine measures are eligible for a rebate, which could decrease the time administrative staff spend working through eligibility with customers.</p>	<p>The administration staff has taken over the CRP Trust Fund Reconciliation task, however, this was a task previously assigned to the CRP senior utility service specialist (USS). The relief to program managers has not been provided. Program managers are still writing/ mailing correspondence. The senior USS has met several times with the administrative staff to discuss eminent need for support, but progress has not been made.</p>
<p>Take steps to align the E3 and the program tracking database. Because the program staff intend to use deemed savings values for program measures, the per unit savings values included in the E3 report are the appropriate, CMUA-approved deemed savings value to use. For this reason, the evaluation team used the deemed savings values included in FY11-12 and FY12-13 E3 calculator as the basis for the ex post savings in this report. Moving forward, LADWP should update the savings values in the program tracking database to match the most current E3 deemed savings and cost for each measure. The program may also want to consider additional steps to ensure database alignment over time, such as tracking measures in the same units and at the same level of granularity as in the E3 calculator. This will help program staff calculate ex ante savings values that align with current CMUA deemed savings values and track progress toward achieving goals using the savings metric that will be reported to the CEC. In addition, the E3 report should be updated to include all small custom measures such as cool roofs and whole-house fans. As part of this effort, LADWP should communicate whose responsibility it is to keep program tracking data savings values updated.</p>	<p>Savings metrics and revisions are still pending engineering support.</p>

CRP FY11-12 and FY12-13 Recommendations	Action Taken
<p>Consider revisiting baseline assumptions underlying program savings values. The savings values LADWP are claiming for CRP are much closer to the E3 natural replacement than early retirement savings values. This evaluation found that a large percentage of customers replaced functional, inefficient equipment when they purchased program measures. Because the baseline for these installations is early retirement rather than natural replacement, the evaluation team verified higher gross savings than LADWP reported to the CEC. LADWP may want to adjust their reported savings by assuming a percentage of their rebated measures are early retirement. Alternatively, LADWP could try to collect this information from participants to better calibrate their baseline assumptions. Because of the large impact this could have on program savings, the Navigant team believes this could be an important area for future research. By contacting a larger number of customers more immediately after they purchased the program measures, future evaluation work could help corroborate the findings from this evaluation and build enough information to suggest new baseline assumptions. As described in the next recommendation, more recent version of the CMUA's E3 calculator does not include deemed early retirement savings values for all measures. For these measures, LADWP should continue to claim natural replacement savings unless future research corroborates that an early retirement baseline is warranted.</p>	<p>Savings metrics and revisions are still pending engineering support.</p>
<p>Update future ex ante savings values to match current versions of the CMUA TRM E3 calculator. Since the FY11-12 and FY12-13 programs ended, the CMUA has released an updated Technical Resource Manual (TRM) and E3 calculator based on this TRM, for use in current program years.[1] Each year, the program should review changes in the CMUA's deemed savings values and E3 calculator, and update ex ante savings values to reflect these changes. <see report for more detail on this recommendation></p>	<p>Still pending engineering support.</p>

CRP FY11-12 and FY12-13 Recommendations	Action Taken
<p>Consider improving data records for past program participants. The program staff do not have easy access to comprehensive lists of program participants. This data is important for evaluation purposes, but can also be valuable for program managers. For example, program participation records with phone number information would allow program managers to perform QC to make sure program measures such as pool pumps were properly installed. Alternatively, program managers could use records of past participants to understand program penetration across the LADWP service territory or identify potential participants in future programs. Program staff should also consider tracking model numbers for all products in this database. The program should also track the quantities of units installed in each project, using the unit of measure that is used in the E3 report so that the program can easily map program measures to the appropriate E3 savings value. Finally, if there was a field in the tracking data for contractors, this could help LADWP track and engage with contractors who help customers to participate in the program.</p>	<p>Customer Connect is the rebate program database where past participation history is stored. Customized reports require IT support and all IT resources have been dedicated to customer billing. LADWP hopes to receive support once the billing settlement has been resolved.</p>
<p>To increase program participation, consider direct marketing and engagement with retailers and contractors. If LADWP wants to increase program participation, two available levers for driving participation are direct marketing to customers and working with retailers and/or customers. Most participants do not remember receiving any marketing material about the program from LADWP, but say they would most prefer to hear about the program through a mailing or email directly from LADWP. Most current participants are hearing about the program through retail store staff, retail store signage, or contractors, even though program staff are not actively engaging these channels. Moreover, contractors think they could convince more customers to participate in the program with marketing support from LADWP. Finally, LADWP may be able to increase participation among Spanish speakers by developing a program application in Spanish.</p>	<p>Limited resources and increased participation have prevented the efforts to market and increase program participation. Despite the lack of marketing efforts, participation has increased at an overwhelming rate creating a need to increase the CRP Trust Fund amount and transfer some CRP measures to the EPM (Efficient Product Marketplace) program.</p>

CRP FY11-12 and FY12-13 Recommendations	Action Taken
<p>Consider monitoring the quality of pool pump installations. If variable speed pool pumps are not programmed to run in low speeds (to keep energy consumption down) at sufficiently long run times (to keep pools clean), LADWP and its customers may not realize full savings from these installations. In three out of the ten pool pump site visits, the evaluation team found issues with installation and programming. One customer reported having to re-program the pump because their pool turned green after installation. The on-site data at another pump suggested that the retrofit pump was programmed to consume more energy than would be expected with a two-speed pump, while a different pump in the on-site sample had valves and a filter crack after installation. Using qualified contractors could reduce these risks and may decrease potential confusion or competition between CRP and EUC, since EUC requires that qualified contractors install the pool pumps.</p>	<p>The Certified Pool Pump Replacement Program was designed to obtain maximum energy savings to replace inefficient single-speed pool pumps. In addition, the program requires pool pump motor and settings to be programmed and calibrated by a certified professional to maximize energy savings. Certification is verified by the program managers and some projects are inspected.</p>
<p>Consider developing an exit strategy for prescriptive window rebates. Of all the CRP measures, windows appear to be the most out of line with other California utility programs. None of the IOUs or SMUD offer prescriptive rebates for windows, which are only covered through EUC. Title 24's stricter U-factor for windows will only make it harder to claim cost-effective savings through windows. Moreover, free ridership was considerably higher for windows than the other CRP measures, indicating that most participants do not need a rebate to install dual pane windows.</p>	<p>Windows are still offered as a standalone measure. Rebates for windows are also offered through EUCA – partnership with SoCal Gas as part of the Advanced Whole House program criteria.</p>
<p>Consider increasing the minimum efficiency for refrigerators. Program free ridership was high for refrigerators, as have been found in other evaluations. This is because of the high market penetration of ENERGY STAR refrigerators. Moving to only incenting CEE Tier 2, Tier 3, or ENERGY STAR Most Efficient could help alleviate this. The other major California utilities either only offer rebates for CEE Tier 2 and higher, or offer a much lower rebate for ENERGY STAR refrigerators that are not at least CEE Tier 2.</p>	<p>Refrigerators are no longer a part of the CRP program. Rebates for ES refrigerators are now offered through EPM</p>

CRP FY11-12 and FY12-13 Recommendations	Action Taken
<p>The Navigant team should address the program managers' program design questions in more depth during the planned 2015 benchmarking research. The program managers expressed interest in more information about program design and implementation from similar utilities to help them with challenges they face. During the planned CRP benchmarking research in 2015, the evaluation team should try to gain a deeper understanding of the following topics:</p> <ul style="list-style-type: none"> • Overlap and coordination between single-measure and whole-house programs • Product offerings and incentive levels, especially in light of Title 24 and other regulations • Methods for efficiently verifying measure eligibility for cool roofs, CACs, refrigerators, pool pumps, and windows • Baseline assumptions used by similar utilities 	<p>These topics are still pending for discussion.</p>
<p>If rebate processing time continues to be a concern, the Navigant team believes an in-person process mapping session with all program staff could help identify ways to streamline application processing. A process mapping session is an opportunity for all staff to collaboratively explore a program element in detail, identifying pinch points and brainstorming ways to improve processes. By including all program staff, this session also ensures there is a common understanding of all processes—and the constraints affecting these processes—throughout the staffing chain.</p>	<p>Rebate processing time is a concern due to payment delays (trust fund limit) and increased participation with staff shortages. The rebate streamline has been solidified but there are tasks that can be eliminated to improve processing time such as those that could be handed off to the administrative staff. Additionally, the rebate processing computer software (Customer Connect) that program managers use is cumbersome and this creates an additional time constraint.</p>
<p>A more in-depth logic model development including higher-level staff at LADWP. While the program theory supports the short-term objectives of achieving energy savings, it is unclear how the program will meet long-term objectives with current resources. The Navigant team could work with a more comprehensive set of stakeholders to better document how the program intends to achieve these outcomes and where more resources or different activities are needed to achieve these outcomes. This could take the form of an in-person workshop or a series of interviews.</p>	<p>Management will decide if this is practical</p>

CRP FY11-12 and FY12-13 Recommendations	Action Taken
<p>Research with non-participants could be a valuable way to understand the barriers keeping other customers from participating in the program. Program participants are very satisfied and plan to participate in the future, so the key to increasing program participation will be by reaching new groups of customers. This research could take the form of a general population customer survey, which could help collect data on the market penetration of various technologies. Alternately, focus groups would be useful to test various marketing campaigns or program offerings LADWP is considering. In-store intercepts would be a way to catch customers after they have purchased a new appliance and understand why they did not choose the high-efficiency option.</p>	<p>Management will decide if this is practical</p>
<p>Consider time-of-use metering for retrofit pool pumps. In future evaluations, metering program pool pumps could help determine whether participants are realizing full savings from their pool pumps without using qualified pool pump contractors. Preliminary data collected in this evaluation suggest that some retrofit pumps might not be programmed optimally, allowing them to run at low speeds for sufficient durations to keep energy consumption down and pools clean.</p>	<p>The Certified Pool Pump Replacement Program requires programing by a certified installer to accommodate TOU settings.</p>

Sources: 2015 Evaluation Report, LADWP program managers

10. CUSTOM PERFORMANCE PROGRAM

This section presents two Navigant's evaluations of the Custom Performance Program (CPP), one of FY11-12 and FY12-13, the other during FY14-15. CPP offers incentives to non-residential customers for energy-saving measures not covered by existing prescriptive programs. Rebated measures address equipment controls, industrial processes, and other energy-saving strategies exceeding Title 24 or industry standards, such as carbon monoxide (CO) monitoring systems, hotel guest room controls, variable speed drives, and cutting-edge and high-efficiency lighting technologies.

As a part of the FY14-15 CPP evaluation, Navigant also undertook an evaluation of the new EETAP, which supports CPP. EETAP is designed to provide technical and economic modeling and analysis services to customers for comprehensive energy efficiency projects. Specifically, this program offers energy audits, analysis of energy efficiency measures, economic analyses, and recommendations to participate in other energy efficiency program offerings.

10.1 Program Goals and Achievements

According to the program database provided to Navigant, CPP achieved 165,707,717 kWh and 35,666 kW of savings during FY11-12, FY12-13, and FY14-15. This total differs from the claimed savings in the E3 database. The difference—discussed at length in the 2016 evaluation report—is possibly due to projects credited after the time the database was provided. EETAP did not complete any projects during FY14-15. Table 10-1 presents CPP's achievements for FY11-15, including the number of projects and savings.

Table 10-1. CPP Savings Summary for FY11-12, FY12-13, and FY14-15

Fiscal Year	Number of Projects	Tracking System Incentives (\$,000)	Tracking System kWh Savings	Tracking System kW Savings
FY11-12	133	5,158	46,579,671	7,986
FY12-13	196	7,800	64,454,686	18,833
FY14-15	115	6,758	54,673,360	8,847
Total	444	19,716	165,707,717	35,666

Source: 2015 Evaluation Report; 2016 Evaluation Report; LADWP tracking data and Navigant analysis

CPP's goals for FY11-12, FY12-13, and FY14-15 are listed in Table 10-2. EETAP does not have any goals because its savings are credited to CPP. CPP has aimed to achieve these energy savings by incentivizing replacement or retrofits of inefficient equipment that is not incentivized through other LADWP programs. In the longer term, CPP aims to include upgraded energy efficient equipment in every retrofit or expansion project in the LADWP service territory. Other long-term objectives include achieving full compliance with AB 2021;³³ helping LADWP customers reduce energy consumption (thereby increasing their profit margins and reducing greenhouse gas emissions), and creating green jobs and increasing the economic vitality of the greater Los Angeles area.

³³ California Assembly Bill 2021

Table 10-2. CPP Program Goals for FY11-12, FY12-13, and FY14-15

Fiscal Year	Goal (kWh)	Goal (kW)
FY11-12	55,189,522	N/A
FY12-13	63,500,000	4,900
FY14-15	68,300,000	18,800

Source: April 2015 Portfolio Business Plan³⁴

As shown in the table above, ex ante CPP savings fell short of the FY11-12 target. Program staff indicated this is due to the program manager being unavailable for the last few months of that program year for personal reasons. Although other staff assumed the manager's responsibilities, they were unable to process payments for several large projects before the end of the program year. The result was an apparent shortfall in ex ante savings for that program year, even though the program actually installed a sufficient number of measures to meet the annual goal. CPP exceeded its FY12-13 target, but again did not meet the target in FY14-15. This due to low realization rates in the program, but also due to a decrease in project processing by LADWP staff, detailed in the 2015 evaluation report.

10.2 Impact Results

The following subsections detail the impact evaluation findings. For detail on methodology, site-specific evaluation plans, and issues arising from discrepancies in CPP tracking data and E3 reported data, please see the 2015 and 2016 evaluation reports.

10.2.1 Gross Energy and Demand Savings

Navigant estimates that the program achieved a total of 165,707,718 kWh in gross electric energy savings over the evaluation period. This represents a realization rate of 83 percent relative to the ex ante program savings. With 85 percent confidence, the precision on this estimate is less than ± 10 percent. (See the 2015 and 2016 reports for strata-level precision.) The total verified gross energy savings and realization rates are shown by stratum in Table 10-3 and Table 10-4.

³⁴ Los Angeles Department of Water & Power Efficiency Solutions Portfolio Business Plan FYs 2014/15-2019/20

Table 10-3. CPP FY11-12 and FY12-13 Gross Energy Impacts

Stratum	Ex Ante Gross Energy Savings (kW)	Ex Post Gross Energy Savings (kW)	Gross Demand Realization Rate	Energy Relative Precision at 85% Confidence
Large	25,924,006	15,979,844	0.62	33.7%
Medium	21,132,397	15,846,872	0.75	47.9%
Small	19,046,252	14,857,888	0.78	37.5%
Very Small	16,705,282	16,796,023	1.01	1.6%
Street Lighting	28,226,421	27,502,124	0.97	4.7%
Total	111,034,358	90,982,750	0.82	10.0%

Sources: 2015 Evaluation Report, LADWP program managers tracking data and Navigant analysis

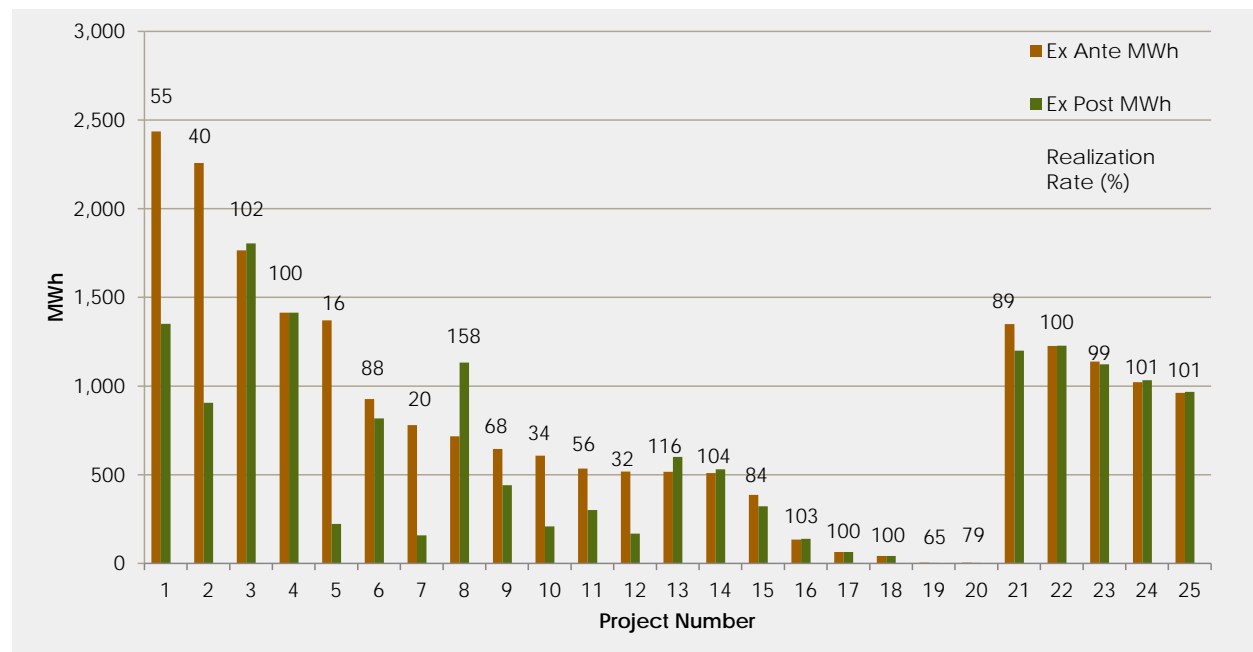
Table 10-4. CPP FY14-15 Gross Energy Impacts

Strata	Ex Ante Gross Energy Savings (kWh)	Ex Post Gross Energy Savings (kWh)	Gross Energy Realization Rate	Energy Relative Precision at 85% Confidence
Large	17,050,621	12,798,606	0.75	0.0%
Medium	17,364,962	13,221,134	0.76	23.9%
Small	5,463,480	5,927,591	1.08	38.2%
Street Lighting	14,794,297	14,580,186	0.99	1.3%
Total	54,673,360	46,527,517	0.85	7.7%

Sources: 2016 Evaluation Report, LADWP program managers tracking data and Navigant analysis

A summary of the impact sample with energy savings results is shown in Figure 10-1 and Figure 10-2. The wide spread of realization rates is largely due to the use of the Standard Performance Contract (SPC) Customized Calculation Tool (CCT) software in the ex ante savings calculations, whereas direct measurements and facility data logs were used to determine the ex post savings.

Figure 15. CPP FY11-12 and FY12-13 Impact Sample Energy Savings by Project



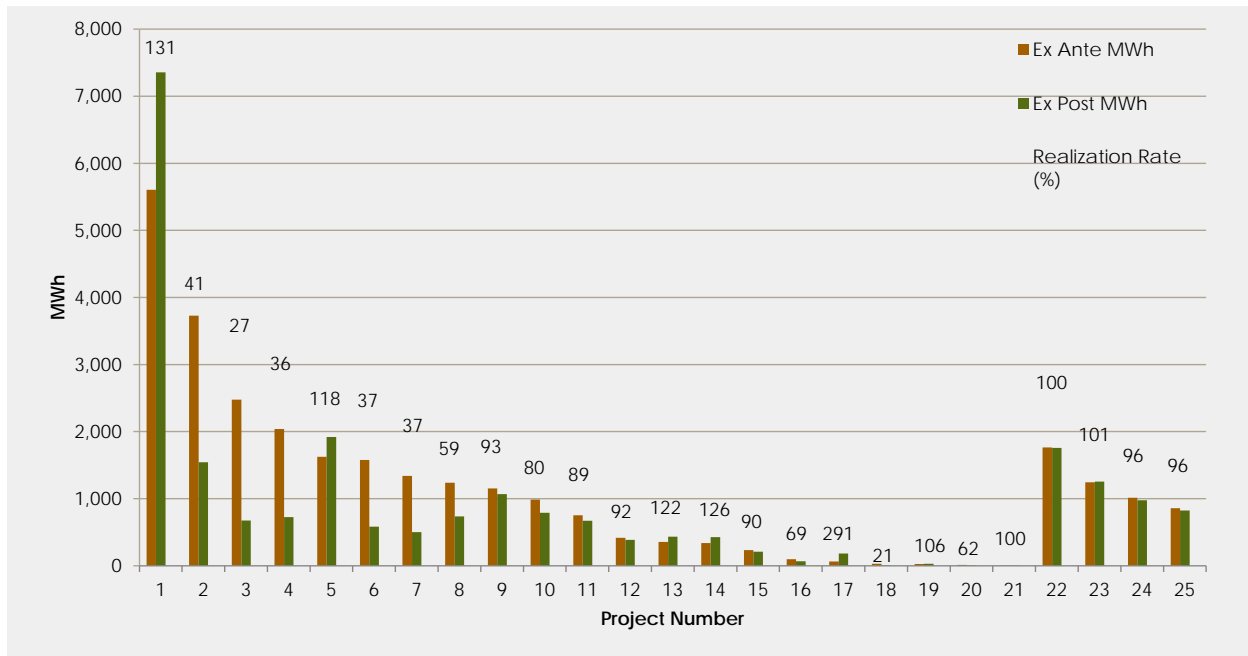
Source: 2015 Evaluation Report, Navigant Analysis

For site-specific explanations of any realization rates that vary from the ex ante savings by more than 25 percent, please see the 2015 and 2016 evaluation reports. In FY11-12 and FY12-13, the realization rates varied heavily by measure type between the CCT and Navigant's analysis:

- Chiller savings were largely overestimated by the CCT. The tool appeared to estimate load based on building square footage, and the average load values produced were substantially larger than the installed chillers were capable of producing at full load in some cases.
- Savings from VFDs on air handling units (AHUs) were highly dependent on hours of operation. These hours are manually entered by the CCT user, and very few schedules matched what was reported onsite.
- Several VFDs were not controlled in a temperature-dependent manner, which would be typically expected by the CCT. This resulted in wide variations in savings from the ex ante values.
- Garage fan CO sensor savings were sometimes higher than the ex ante values, although, for parking areas with 24/7 access, they tended to be close to the ex ante values, and overall realization rates for these measures were within the expected range. However, Navigant also used baseline motor powers lower than the ex ante values in some cases so the realization rate of these measures was not increased significantly overall.
- LED lighting in refrigerated cases had reported demand three orders of magnitude higher than would be expected for energy savings reported for these project types. These sites claimed

demand savings around 638 kW, but based on the fixtures replaced at the two sites, the savings were closer to 638W. This is likely an error in data input.

Figure 16. CPP FY14-15 Impact Sample Energy Savings by Project



Source: 2016 Evaluation Report, Navigant Analysis

In FY14-15, the largest drivers of the overall low realization rate were that the two largest projects both had low realization rates. While the largest project was driven by changes in production that could not have been predicted by the program, the ex ante savings for the second largest project were too high due to the lack of weather normalization in the calculations. Additionally:

- The largest project included in the sample involved process upgrades and savings that were normalized to annual production. Production at the facility had dropped significantly, resulting in substantially decreased savings.
- The second largest project used trend data in ex ante calculations but did not normalize operations to annual weather, resulting in significant overestimation of savings.
- The third site performed an upgrade to its central plants, which serve numerous other areas. However, the upgrades are designed to take advantage of variable pump flow in the dependent systems, of which project 5 is one, and not all of which have been completed. The facility will not be able to take full advantage of the upgrades in this project until all of the additional systems have been upgraded. Also, some of the savings on project 5 are due to changes in project 3, and so Navigant combined these two projects for the purposes of calculating overall program realization rates.
- The low savings at the third site were also driven by a decreased delta T of cooling water. There was an additional project at the facility to upgrade the chillers that was included in the former chiller program. The decreased delta T may have resulted in increased savings on this chiller

project; however, because this database was not included in the population evaluated by Navigant, savings due to the chiller project are not accounted for here.

- Some of the sites did not appear to include weather normalization. However, without the full eQUEST models, Navigant cannot definitively determine the extent to which this was a problem.
- Baseline load assumptions in several cases were unreasonably high. This was true for several calculation methods.
- Run hours for equipment did not always match what was found onsite. In particular, some project savings were estimated using the CCT run hours that were higher than what was reported by facility staff.

The program achieved 14,260 kW in gross demand savings. This represents a realization rate of 0.40 relative to the ex ante program savings. Table 10-5 and Table 10-6 show the demand savings from both the 2015 and 2016 evaluation reports.

Table 10-5. CPP FY11-12 and FY12-13 Gross Demand Impacts

Stratum	Ex Ante Gross Demand Savings (kW)	Ex Post Gross Demand Savings (kW)	Gross Demand Realization Rate	Demand Relative Precision at 85% Confidence
Large	3,394	1,929	0.57	84.3%
Medium	2,336	1,631	0.70	66.1%
Small	1,660	1,059	0.64	141.5%
Very Small	13,056	56	0.00	1007.9%
Street Lighting	6,373	6,166	0.97	4.8%
Total	26,819	10,840	0.40	18.3%

Source: LADWP tracking data and Navigant analysis

Navigant was unable to reach the precision goal of 15 percent, due primarily to the two refrigerated case lighting projects in the extra small stratum with extremely low realization rates. For these two projects, the ex ante savings in the database appeared to be a mistake and probably should have been reported in watts rather than kilowatts. For more detail on project-level realization rates, please see the 2015 evaluation report.

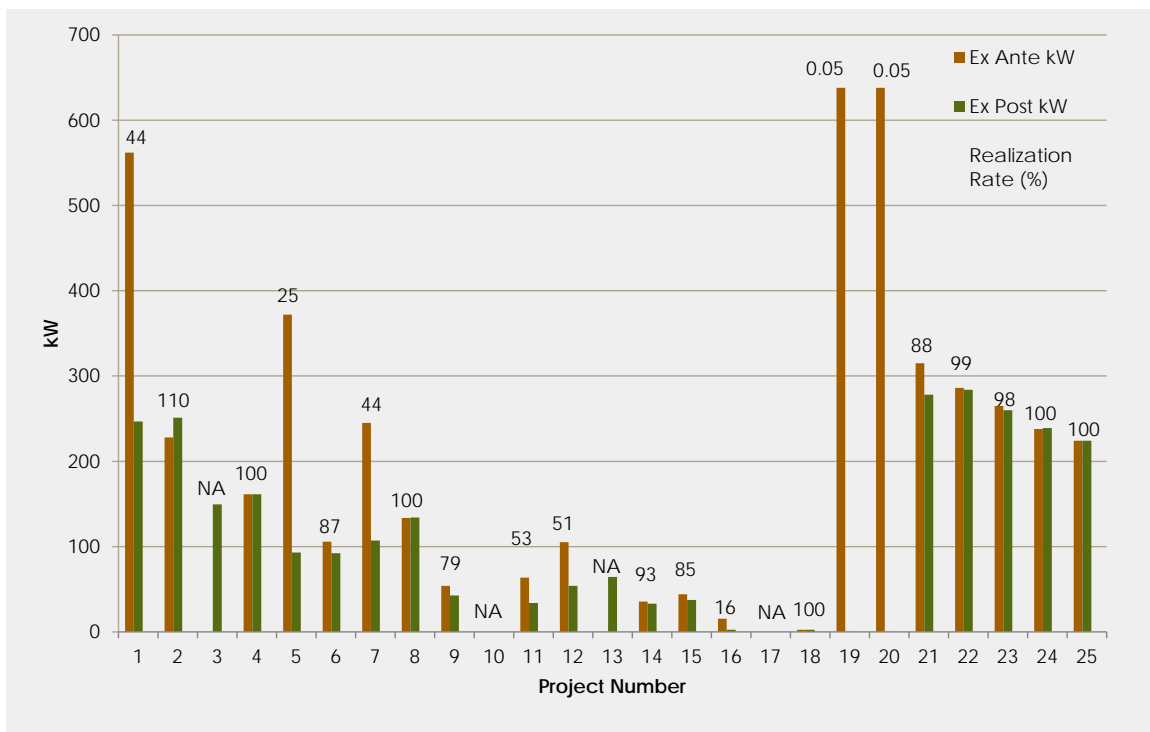
Table 10-6. CPP FY14-15 Gross Demand Impacts

Stratum	Ex Ante Gross Demand Savings (kW)	Ex Post Gross Demand Savings (kW)	Gross Demand Realization Rate	Demand Relative Precision at 85% Confidence
Large	1,645	955	0.58	55.8%
Medium	2,885	1,862	0.65	39.6%
Small	867	602	0.69	52.3%
Street Lighting	3,449	0	0.00	N/A
Total	8,847	3,419	0.39	24.3%

Sources: 2016 Evaluation Report, LADWP program managers tracking data and Navigant analysis

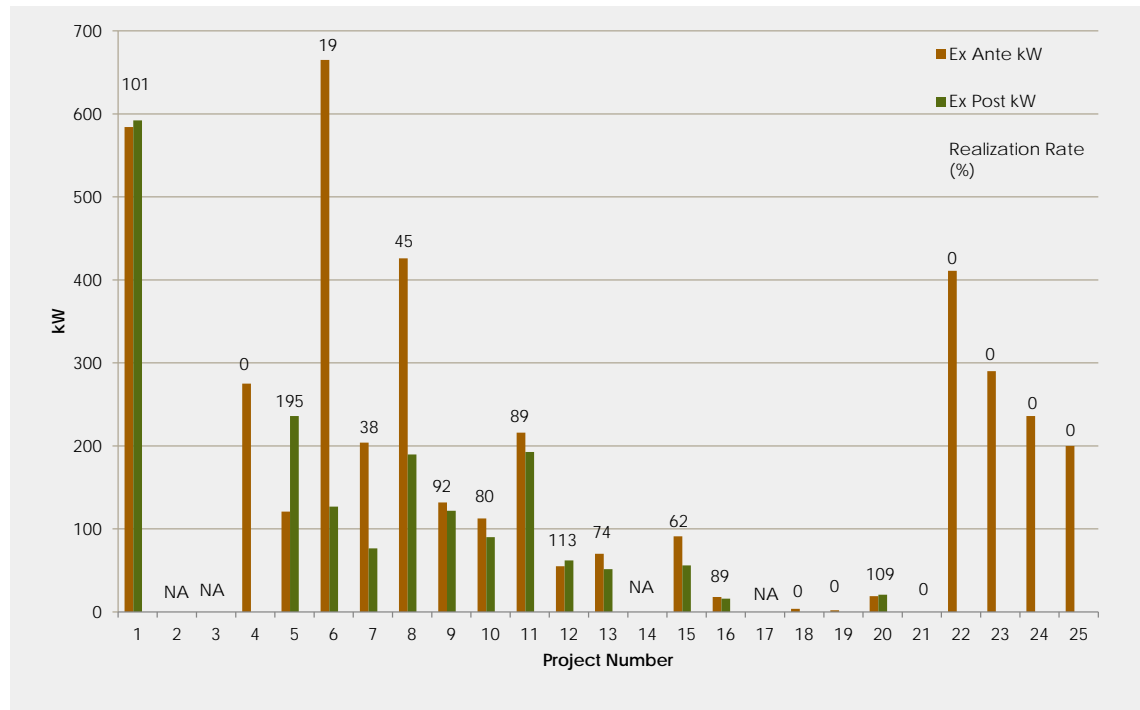
Navigant was unable to reach the precision goal of 15 percent for FY14-15 due primarily to the street lighting projects, which reported ex ante demand savings despite usage only occurring during off-peak time periods. Consequently, the actual precision with 85 percent confidence is 24.3 percent. These same street lighting projects are also a primary cause of the low calculated realization rate of demand savings. Figure 10-3 and Figure 10-4 show a summary of the impact sample with demand savings results. For site-specific explanations of any realization rates that vary from the ex ante savings by more than 25 percent, please see the 2015 and 2016 evaluation reports.

Figure 17. CPP FY11-12 and FY12-13 Impact Sample Demand Savings by Project



Source: 2015 evaluation report; Navigant analysis

Figure 18. CPP FY14-15 Impact Sample Demand Savings by Project



Source: 2016 Evaluation Report; Navigant analysis

10.2.2 Net Savings

Navigant conducted primary research into NTG effects and found a NTG ratio of 54 percent. Table 10-7 provides the program-level ex post estimates of gross and net energy savings.

Table 10-7. CPP Ex Post Gross and Net Energy and Demand Savings³⁵

Fiscal Years	Gross Annual Ex Post kWh Savings	Gross Annual Ex Post kW Savings	NTG Ratio	Net Annual Ex Post kWh Savings	Net Annual Ex Post kW Savings
FY11-12 and FY12-13	90,982,750	10,840	0.54	49,130,685	5,854
FY14-15	46,527,517	3,419	0.50	23,263,759	1,709
Total	137,510,267	14,259	0.53	72,394,444	7,563

Source: 2015 evaluation report; 2016 Evaluation Report; LADWP tracking data and Navigant analysis

³⁵ With the exception of LED streetlights, Navigant verified all measures using onsite data collection. For LED streetlights Navigant selected a statistical sample of the installation areas from within the selected projects and performed onsite verification of the number installed.

10.2.3 EUL and Lifecycle Savings

EUL is an estimate of the median number of years of installed measures under programs that remain operational. Table 10-8 identifies the lifecycle electric energy savings from the CPP. These values represent a weighted average across a measured lifecycle and may not represent actual measures installed.

Table 10-8. CPP Ex Post Lifecycle Savings

Fiscal Years	Gross Annual Ex Post kWh Savings	Net Annual Ex Post kWh Savings	Measure Life	Gross Lifecycle kWh Savings	Net Lifecycle kWh Savings
FY11-12 and FY12-13	90,982,750	49,130,685	11.8	1,073,596,450	579,742,083
FY14-15	46,527,517	23,263,759	11.3	525,760,946	262,880,473
Total	137,510,267	72,394,444		1,599,357,396	842,622,556

Source: LADWP tracking data and Navigant analysis

10.3 Process Results

This section presents a summary of process evaluation findings from the 2015 and 2016 evaluation reports for CPP. For the full process evaluations, including the NTG methodology, most participant survey results, program manager and trade ally interview findings, please see the 2015 and 2016 evaluation reports.

These are the high-level results from the FY11-12 and FY12-13 process evaluation of CPP:

- Overall, respondents were very satisfied with CPP.** Participant survey responses indicated that participants were very satisfied with all aspects of the program and their interactions with LADWP. Of those respondents who offered responses, average satisfaction scores averaged 8 or 9 out of 10 for every category. It is important to highlight again that most of these respondents were participants with the lowest savings in the program. Navigant therefore recommends that CPP staff reach out to larger participants in terms of savings in order to gauge their satisfaction.
- Based on survey findings, it appears that CPP is not reaching its full potential in terms of influencing its target audience,** which limits participation levels and program savings. CPP's marketing efforts currently focus on regular industry events and informal interactions with individuals in the industry. These events typically include industry functions and BOMA meetings. While staff engages regularly in these marketing efforts, the staff's interactions focus largely on customers who are already knowledgeable about efficient measures. Furthermore, CPP allows for recurring participation, and approximately 38 percent of survey respondents participated in this program more than once. Further research, such as the 2016 CPP evaluation, will help to determine whether CPP is reaching its target audience. However, by directing marketing efforts toward its current network and by allowing customers to participate multiple times, CPP may be focusing heavily on customers who are inclined toward energy efficiency while missing the opportunity to recruit new participants who are less knowledgeable in the field.

- CPP's focus on marketing the program to efficiency-savvy customers could help to explain the high levels of free ridership identified through the participant surveys.** Specifically, over three-quarters of the respondents reported some level of free ridership. This indicates that CPP is primarily reaching customers who have already planned to install high-efficiency measures. Furthermore, 69 percent of respondents stated they could have installed additional high-efficiency equipment in addition to the installations for which they received a CPP incentive. Those who did install additional measures indicated that the CPP program had little influence in their decision to do so, giving an average score of 4.17 out of 10.
- The program is not sufficiently tracking its contractors or exploring contractors as a communication channel.** Contractors and vendors serve as a key information channel for CPP, both in terms of marketing and throughout the program application process. Although contractors play a large role in customers' CPP experience, CPP staff does not track participating contractors. By keeping relationships with participating contractors informal, CPP is limiting its connection to additional potential participants and creating an informational barrier between itself and some of its current participants.
- The application processing is too dependent upon specific individuals, which can lead to processing delays.** For the 2011-2012 fiscal year, the program fell short of its target savings by 8,270,635 kWh. Program staff indicated that the program manager was unavailable for the last few months of that program year for personal reasons. Although other staff assumed the manager's responsibilities, they were unable to process payments for several large projects before the end of the fiscal year. When asked what LADWP could do to improve their services, participant survey respondents largely suggested the LADWP expedite the rebate process and increase communication with customers. If LADWP were to pursue these suggestions, it would presumably need additional or cross-trained staff. Therefore, Navigant recommends that LADWP cross-train additional key staff to support others' responsibilities, both to prepare for unforeseen events and to relieve the dependence on individual staff members for program success.
- Better program data management would enhance management effectiveness.** Based on findings from the review of tracking data and supported by findings from the program manager interview, Navigant found that CPP tracking data did not provide sufficient information to fully document program achievements. In addition to discrepancies between tracking data and E3 data, Navigant found that the current CPP tracking data does not offer detail on specific measures installed, nor does it specify the quantity of measures installed. This may limit the staff's ability to manage the program over time, as the savings per measure cannot be compared from year to year. Indeed, when Navigant asked respondents what LADWP could do to improve the program, overall, nearly 20 percent of respondents requested increased communication.

These are the high-level results from the FY14-15 evaluation of CPP:

- Satisfaction with the program by participants is high overall, 8.8 on a scale of 0-10.** The lack of timeliness for pre- and post-installation site visits concerns participants more than any other issue. LADWP is correct to ameliorate these delays by hiring additional engineering staff, allowing customers with time-sensitive projects to proceed without an incentive offer and consolidating one-off projects into whole building retrofits through EETAP.
- Satisfaction with the incentive level is high.** However, there is no appreciable increase in satisfaction between this year's evaluation and FY11-12 and FY12-13, despite the major increase in incentive levels. Given the large scale of CPP measures and the long planning cycles

associated with them, it may be too early to tell if the increase spurs action among customers otherwise unlikely to participate. Considering the sizable volume of feedback both by contractors and participants describing the processing backlog at LADWP, as well as the importance of the financial incentive to customer participation, the incentive increase may have maintained participation from customers inconvenienced by processing delays.

- **As described above, 50 percent of program savings is attributable to free riders.** An important priority for the program, therefore, is to achieve new savings unlikely to qualify as free ridership. There are three ways to achieve this. Participants with low levels of energy efficiency awareness are more likely to attribute high levels of influence to CPP; reaching these participants would reduce free ridership. Conducting whole building retrofits that extend savings into measure categories beyond what prompted the retrofit would incentivize savings unlikely to qualify as free ridership. Getting involved earlier when customers are undecided about the size and scale of a project will also generate more impact attributable to CPP. EETAP audits have the potential to achieve each of these and drive whole building retrofits to new customers who lack the sophistication to pursue energy efficiency.
- **However, EETAP's success is threatened by the dissatisfied experiences of its initial trade allies.** Feedback from these trade allies highlights a perception that LADWP wants too much modeling detail for the level provided by current incentives. They recommend EETAP management reduce stringency of audit reports and reduce the number of iterations. Guidelines that simplify the process are already under development by EETAP program managers. Additionally, program managers plan to expand in-depth technical modeling training in future program years to limit the modeling expenses of participating trade allies and utility reviewers.
- **LADWP is in the process of overhauling its tracking system to address the lack of contractor/vendors and participant firmographics tracking.** Presently, the absence of this information jeopardizes the ability of CPP to reach new participants. Participant and contractor surveys indicate the most common participants are real estate firms and large office spaces. These easy-to-reach customers are already well-informed of program incentives and frequently participate year-after-year. Firmographic and contractor/vendor detail in CPP tracking data will enable LADWP and third-party evaluators to establish the sub-markets served by CPP and therefore its ability to identify the harder-to-reach, underserved customers with less awareness of energy efficiency opportunities.

10.3.1 Benchmarking Custom Commercial Incentives

CPP offers incentives to non-residential customers for energy-saving measures not covered by existing prescriptive programs. Such measures include equipment controls, industrial processes, and other energy-saving strategies exceeding Title 24 or industry standards that are not included in other LADWP non-residential energy efficiency programs. Program offerings include incentives for equipment controls, CO monitoring systems, hotel guest room controls, variable speed drives, cutting-edge, high-efficiency lighting technologies, and other strategies.

CPP saves the equivalent of 0.29 percent of C&I sales, almost half of LADWP C&I savings. The other half comes from CLEO (0.31 percent of C&I sales). This makes CPP's contribution to its portfolio similar to CPAU's Custom Advantage program (0.23 percent of C&I sales), but less than SMUD's Customized Incentives program (0.80 percent of C&I sales) and more than SCL's Custom Incentives program (0.12 percent of C&I sales). CPAU and SMUD report the lowest cost per kilowatt-hour saved at \$0.10 and

\$0.09, respectively, but as Table 10-9 and the subsequent analysis indicate, there are few discernable differences between program designs or processes that account for this.

Table 10-9. Custom Commercial Comparison Group Attribute Table

Utility	Program Name	Target Market	Primary Implementer	Contractor Network*	Incentive levels
LADWP	Custom Performance	Commercial, Governmental, Industrial, Institutional	Utility Staff	Open	\$0.05 - \$0.25 /kWh depending on load type**
City of Palo Alto Utilities	Custom Advantage	Commercial, Industrial, Institutional	Utility Staff	Open	\$0.10 / kWh
Sacramento Municipal Utility District	Customized Incentives	Custom projects ineligible for other rebates	Utility Staff	Open (with third-party incentive)	\$0.10/kWh, \$200/kW
Austin Energy	Custom Technology	Custom projects ineligible for other rebates	Utility Staff	Open	Process Loads - \$200/kW, Non-Process Loads - \$350/kW
Seattle City Light	Custom Incentives	Custom projects ineligible for other rebates	Utility Staff	Open	Process Loads- \$0.01/yr/kWh, Non-Process Loads - \$0.02/yr/kWh***

Source: In-Depth Benchmarking Report

*See Table 2-7. Contractor Network Model

**Up to \$750/kW offered for thermal storage

***estimated annual kWh savings times estimated measure life. No incentives for demand (kW) savings

Findings Summary

Custom programs complement rigid prescriptive programs with broad and non-prescriptive assistance to customers. This broad responsibility belies a very specific focus among our comparison programs of cost-effective resource acquisition. Alternative objectives such as emerging technologies or serving hard-to-reach customers were not present, except where they happen to offer cost-effective resource acquisition. No variations in program design, process, or outreach were noted, except related to the presentation of rebate materials and webpages to channel customers to prescriptive rebates first.

Two barriers CPP sought to overcome in its 2014 evaluation were the limited number of trained installers and the lack of awareness in customers of energy efficiency measures. Each of these could be ameliorated by LADWP adopting incentives similar to SMUD's industrial efficiency incentive to motivate the contractor network to reach out to large potential customers and audit their sites. Like other utilities, LADWP identifies energy-saving opportunities through site audits with its own teams, but engaging the

contractor network in outreach could extend awareness to customers who would not otherwise take the initiative and increase the number of trained installers.

10.4 Recommendations and Action

This section documents the recommendations from Navigant's 2015 and 2016 CPP evaluations, including actions taken by LADWP to address them.

Table 10-10. CPP FY11-12 and FY12-13 Recommendations and Actions Taken

CPP FY11-12 and FY12-13 Recommendations	Action Taken
Resolve inconsistencies between the tracking database and the E3 database and increase transparency in reporting. The inconsistencies between these databases and the lack of information that would allow for these inconsistencies to be rectified makes it difficult to properly track programmatic savings. CPP staff should develop a data-driven management plan that includes explicit links between measure installations and resulting savings.	A new tracking system is being developed in house to address this issue
Provide measure-specific detail in the tracking database. This detail should include measure categories, individual measure types, and the quantity of measures installed. Although the CPP database includes measure descriptions for some project names, it does not contain a measure category. Including a measure category in line with the E3 calculator would minimize efforts and time in filling in the E3 calculator and provide additional information on measures that make up the most savings for the program. Furthermore, by tracking individual measure types and the quantity of installed measures, CPP staff would be able to better manage resources by focusing efforts on the highest-impact measures.	A new tracking system is being developed in house to address this issue
Develop and disseminate further marketing materials, including bill inserts for target markets such as C&I customers. This could increase participation among a broader audience and extend communication with current participants.	Under on-going consideration for marketing material.
Increase formal communication efforts with contractors, beginning with tracking current participating contractors and vendors. This would allow for extended communication with current LADWP customers and potentially increase CPP's audience.	Trade Ally program for CPP is being considered
Seek out and attend new industry events that staff members do not currently attend. Engaging in more diversified marketing efforts could attract new participants who are less likely to be free riders. Furthermore, CPP could direct these extended marketing efforts to large C&I customers, which is a CPP program goal.	Under consideration
Track participating vendors and contractors in order to better understand savings allocations, to expand its participant network, and to better manage the program's information channels.	A new tracking system is being developed in house to address this issue

CPP FY11-12 and FY12-13 Recommendations	Action Taken
<p>Formalize CPP's trade ally network, offering program-specific training and disseminating marketing materials through the trade allies. This will extend both CPP's formal and informal networks and will allow for an additional communication channel with participants. It may also positively affect CPP's marketing efforts, as increased communications with contractors and trade allies may encourage them to further market the program. With increased two-way communication, CPP staff may be able to better gauge customer satisfaction, better identify areas for improvement, and leverage contractor connections to market to target customers.</p>	Under consideration.
<p>Cross-train sufficient staff to cover application processing and related administrative details, and allow additional staff to approve final projects. Regular knowledge-sharing between staff could allow for an easier transition in the instance that one staff member is unable to carry out his or her duties. This will, in turn, reduce the likelihood that the program will miss targets due to changing staff conditions.</p>	This is currently being done on both program administrative staff and engineering staff as well. All operations aspects now have backup staff to address this issue
<p>Enforce the restrictions on application deadlines for all customers, regardless of size. By enforcing these requirements, staff can ensure that they will have sufficient time to process applications, which may alleviate bottlenecks throughout the administrative process.</p>	This is being considered.
<p>Keep contact information up-to-date and communicate more regularly with participants, especially those who are frequent participants. This will allow for increased communication with participants, which may in turn increase participant satisfaction, which is a CPP program goal.</p>	No update at this time.
<p>Review savings values from SPC CCT software. Although the SPC CCT software is a reasonable tool for calculating energy savings on custom projects in California, it is subject to errors based on both inputs and possible software bugs. Navigant recommends reviewing the acceptability of savings estimates against the likely power consumption of actual equipment over the operational hours.</p>	Tool is no longer used for custom calculations with the exception of a single measure (CO Sensors).
<p>Confirm customer-reported hours of operation against available data. The CPP uses customer-reported hours of operation to determine equipment runtimes. Navigant recommends that is cross-checked with EMS or other trend data that show actual runtimes, where available, especially for large projects.</p>	This is a new verification item being enforced by the engineering team

Sources: 2015 Evaluation Report, LADWP program managers

Table 10-11. CPP FY 14-15 Recommendations and Actions Taken

CPP FY14-15 Recommendations	Action Taken
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CPP FY14-15 Recommendations	Action Taken
<p>Increase available human resources for CPP and EETAP's engineering teams. Program savings are currently limited by LADWP human resources, not customer participation. Expanded timeframes for processing applications, conducting site visits, and issuing rebates were confirmed through interviews with participants, contractors, and program managers. This threatens participant and contractor satisfaction while limiting the number of projects that can be processed through the program.</p>	Both in-house resources in new hires and external supporting the technical review process
<p>Resolve inconsistencies between the tracking database and the E3 database and increase transparency in reporting. The inconsistencies between these databases and the lack of information that would allow for these inconsistencies to be rectified makes it difficult to properly track programmatic savings. Include a column in the tracking database to denote project rows that are individual phases of larger projects. More broadly, CPP staff should develop a data-driven management plan that includes explicit links between measure installations and resulting savings. Since the previous evaluation, LADWP has added measure categories to its tracking database, but these databases do not completely match those used in the E3.</p>	A new tracking system is being developed in house to address this issue.
<p>Issue guidelines, developed in concert with EETAP trade allies, to streamline audit report requirements. Such guidelines are already under development by EETAP management, and EETAP trade allies confirmed they are a badly needed fix for a process that may cause them more costs than benefits. A successful EETAP program can feed new customers into CPP and reduce the free ridership of old ones by intervening earlier and more fully into participant decision-making.</p>	Guidelines were developed and training sessions have been conducted to educate EETAP trade allies to the program requirements.
<p>Track the involvement of contractor/vendors in customer projects. The conditions that led to this recommendation in the FY11-12 and FY12-13 CPP evaluation—that contractors largely drive awareness, are integral to the application process, and are sometimes responsible for negative satisfaction outcomes—are still present. The benefits of tracking contractors—including increased information flow between potential participants and better outreach to the target audience through enhanced analysis—can still be realized.</p>	No update at this time.
<p>Enforce application deadlines. Free ridership is high and allowing customers to submit applications for incentives after their measures are installed reduces the measurable influence of the program on their decision-making. Additionally, it contributes to a larger workload for staff, which exacerbates delays.</p>	Under consideration

CPP FY14-15 Recommendations	Action Taken
<p>Confirm baselines against available data and typical conditions. Although eQUEST, the SPC CCT software, and specialized analysis are all reasonable tools for calculating energy savings on custom projects in California, they are subject to errors based both inputs. Navigant recommends reviewing the acceptability of savings estimates against the likely power consumption of actual equipment over the expected operational hours.</p>	<p>The engineering team is enforcing more stringent verification of baseline conditions and inspection documentation.</p>
<p>Confirm customer-reported hours of operation against available data. Many savings calculations, including those in the SPC CCT, use customer-reported hours of operation to determine equipment runtimes. Navigant recommends that is cross-checked with EMS or other trend data that shows actual runtimes where available, especially for large projects.</p>	<p>The engineering team is enforcing more stringent verification of baseline conditions and inspection documentation</p>
<p>Confirm annual normalization of weather-dependent savings measures. Some of the weather-dependent measures did not include normalization to a typical meteorological or average year. This resulted in wide variations between ex ante and ex post savings.</p>	<p>New technical requirements have been established to use standardized TMY3 weather data in all modeling efforts. Weather stations are determined based on proximity to Zipcodes and utilizes the CEC's CBECC mapping of weatherstation to zipcode allocation</p>

CPP FY14-15 Recommendations	Action Taken
<p>Support a deemed value for window film through the Custom Express Program. Project managers indicated this is being considered, and Navigant supports it. This will help reduce the modeling workload and increase the total number of applications processed in the year. Alternatively, explore the potential for eFilm, a software program, to reduce the complexity of modeling window film as suggested by a CPP contractor/vendor.</p>	<p>A new spreadsheet tool has been developed that incorporates dozens of measures including window film that rely on deemed savings estimates. This tool is planned to be used for small projects lower than 75000kWh and used as preliminary rough order of magnitude estimates for large projects requiring lengthier custom analysis.</p>
<p>Improve the uniformity of measure category tracking and expand it to quantify the number and capacity of measures. Measure categories are currently tracked in the program database but could be improved. With more detail on the quantity and capacity of measures available, LADWP can calculate average measure savings, and third-party evaluators can identify spillover measures during participant surveys. Calculating spillover savings may improve the program NTG ratio appreciably. Improved measure category tracking will be necessary, as EETAP drives whole building retrofits with multiple measure categories.</p>	<p>A new tracking system is being developed in house to address this issue. It includes a standardization of measure description and granular categorization. Preliminary estimates vs final approved calculated savings etc..</p>

CPP FY14-15 Recommendations	Action Taken
<p>Track customer firmographics. In both FY14-15 and the previous FY11-12 and FY12-13 evaluations, Navigant's participant survey found a concentration of real estate and property management firms among the participants. Large office space may also be overrepresented. Because firmographics are not tracked by CPP, Navigant cannot confirm whether they are disproportionately represented in survey respondents or if CPP is indeed missing opportunities to attract more participation by industrials and other large commercial customers.</p>	<p>Under consideration.</p>

Sources: 2016 Evaluation Report, LADWP program managers

11. COMMERCIAL LIGHTING INCENTIVE PROGRAM

This section presents two Navigant evaluations of the Commercial Lighting Incentive Program (CLIP) during FY2014-15, and its predecessor, the Commercial Lighting Efficiency Offering (CLEO) during FY11-12 and FY12-13. CLIP offers incentives to help make a wide variety of high-performance lamps and lighting fixtures cost-effective for businesses that still utilize standard fixtures. CLIP targets larger businesses while other LADWP programs (such as SBDI) target smaller businesses. CLIP is designed to be consistent with California's statewide lighting program, leveraging established contractor networks that provide comprehensive, energy efficient lighting solutions. This newly designed commercial lighting program launched October 1, 2014 and replaced the CLEO program.³⁶ LADWP plans to utilize CLIP to contribute to the mandate set forth in AB 2021 to achieve all cost-effective energy efficiency in California by 2020.³⁷

11.1 Program Achievements

According to the program database provided to Navigant, CLEO & CLIP achieved savings of 120,271,925 kWh from FY11-12 through FY14-15. The tracking data reviewed by Navigant also shows potential savings for unfinalized FY13-14 CPP lighting projects that appear to be transferred to CLIP. Tracking data shows 15 projects with potential savings over 250,000 kWh. From the tracking data, Navigant understands that there are currently no CPP lighting projects started in FY14-15 being transferred to CLIP. While the CLIP tracking data shows these CPP transfers in and unfinalized projects from FY13-14, the CLIP evaluation verified only projects in FY14-15.

Table 11-1. CLEO & CLIP Claimed Savings Summary for FY11-15*

Program Year	Number of Unfinalized Projects**	Potential Savings from Unfinalized Projects (kWh) [†]	Number of Finalized Projects ^{††}	Reported Savings (kWh)
CLEO FY11-12	N/A	N/A	746	49,930,029
CLEO FY12-13	N/A	N/A	1,009	37,659,062
CLEO FY 13-14	26	237,422	303	18,668,616
CLIP FY14-15	107	5,598,231	16	4,273,797
CPP transfers FY13-14	15	251,493	67	9,740,421
Total	148	6,087,146	2,141	120,271,925

Sources: LADWP 2014-2015 tracking database provide to Navigant and Navigant analysis

*These counts and totals differ from E3 as previously described.

**LADWP assigned status: Potential or Committed

[†]These unfinalized savings are LADWP's initial estimates for projects. Some project details are initially unknown and estimates are recorded as 0 kWh. Therefore, final savings will likely be greater.

^{††}LADWP assigned status: Closed.

³⁶ LADWP. *Energy Solutions Portfolio Business Plan, FY2014/15 – 2019/20*, pg. 130.

³⁷ LADWP. *Energy Solutions Portfolio Business Plan, FY2014/15 – 2019/20*, pg. 133.

11.2 Impact Results

The following subsections detail the impact evaluation findings. For detail on methodology, including onsite data collection and sampling, please see the 2014 and 2016 evaluation reports.

11.2.1 Gross Energy and Demand Savings

Navigant developed impact results for the 33 CLEO & CLIP sites included within the sample and extrapolated those findings to report the verified, ex post impact results for FY11-12, FY12-13, and FY14-15. The ex ante impacts shown in the following sections relate to LADWP's E3 impacts; thus, realization rates and ex post impacts are reflective of the utility's filings. The E3 calculators report impacts at high levels and do not provide project-level savings values. After determining that program tracking data and E3 data do not align, Navigant was not able to directly compare differences at the project level. However, Navigant applied the E3 to tracking data ratios shown previously in the 2015 evaluation report to each project's energy (kWh) and demand (kW) ex ante impacts (depending on the FY) in order to estimate the project-level E3 reported savings.

The CLEO & CLIP programs achieved energy savings of 99,395,945 kWh and gross coincident peak demand of 18,324 kW. Table 11-2 and Table 11-3 show the program impacts for the FY11-12, FY12-13, and FY14-15 populations where realization rates are relative to the impacts reported by LADWP within E3 calculators.

Table 11-2. CLEO & CLIP Gross Energy Impacts

Fiscal Year	Ex Ante Energy Savings (kWh)	Ex Post Energy Savings (kWh)	Energy Realization Rate	Relative Precision
FY11-12	50,087,174	55,093,571	1.10	12.5%
FY12-13	36,031,248	39,632,703	1.10	12.5%
FY14-15	4,273,797	4,669,671	1.09	3.8%
Total	90,392,219	99,395,945	1.10	

Sources: E3 Calculator and onsite results

Table 11-3. CLEO & CLIP Program Gross Demand Impacts

Fiscal Year	Ex Ante Coincident Demand Savings (kW)	Ex Post Coincident Demand Savings (kW)	Coincident Demand Realization Rate	Relative Precision
FY11-12	10,687	10,075	0.94	10.3%
FY12-13	8,066	7,604	0.94	10.3%
FY14-15	680	645	0.95	12.4%
Total	19,433	18,324	0.94	

Sources: E3 Calculator and onsite results

For site-specific and strata realization rates, please see the 2015 and 2016 evaluation reports. The main drivers for the FY11-12 and FY12-13 realization rates include the following:

- **HVAC interaction factors (IFs) increase energy savings.** The majority (63 percent) of verified fixtures are located within conditioned spaces served by HVAC equipment. The average energy HVAC IF for these fixtures is 1.13. HVAC IFs also increased peak demand savings, but in a magnitude less than CFs reduced savings.
- **Coincident factors (CFs) decrease peak demand savings.** Using the logged time-of-use lighting data collected, the evaluation team determined that peak demand CFs are generally less than the assumed value of 1.00, and instead average around 0.75.
- **Hours of use increase energy savings.** Navigant verified higher annual hours of use for several projects. For all verified measures, the associated ex ante hours average 4,089 hours, while the ex post averages 4,640 hours.
- **E3 to tracking data ratios increase savings.** Navigant found that E3 generally underreports savings. That is, energy and demand impacts in E3 are less than the impacts shown in tracking data (and subsequently less than Navigant's verified amounts). For both program years combined, E3 reports 94 percent of the demand and 98 percent of the energy reported within the program tracking data.

The main drivers for the FY14-15 realization rates include the following:

- **Verified hours of use increase energy savings.** For fixture-only retrofits, Navigant verified higher annual hours of use for several projects. Specifically, the associated ex ante annual hours averaged 6,532 hours, while the ex post averaged 6,959 hours.
- **Controls curtail post-retrofit energy consumption and increase savings.** For fixture and control combination retrofits, Navigant verified a larger reduction in hours of use between the pre- and post-retrofit cases. For most projects, Navigant verified that controls achieved operating hours well below assumed levels. The average reported control allowance was 0.31, and Navigant verified an average allowance of 0.41 (see control allowance equation in 2016 evaluation report).
- **Fixture wattages increase savings.** Navigant found that the 1,291 post-retrofit fixtures reported at 51W per fixture in one large sampled project were actually rated at 31W per fixture. The field team and QC analysts investigated this discrepancy and reviewed all available information to confirm this finding. Additionally, amp logger data readouts agreed with this finding and found maximum operations coinciding with 31W.
- **CFs decrease peak demand savings for fixture-only retrofits.** Using the logged time-of-use data collected, the evaluation team determined that peak demand CFs are generally less than the assumed value of 1.00, and instead average around 0.79. For CLEO, that average was 0.75.
 - **CFs increase peak demand savings for control retrofits.** Although to a lesser extent, Navigant found that controls were capable of driving down hours of use more so than the program reported. This, in turn, reduced peak time operations and CFs. Again, while CLIP uses a CF of 1.00 for all measurements, control post-retrofit CFs averaged 0.51. Ultimately, these gains were not significant, and Navigant reports a demand realization rate less than 100 percent.

- **Quantities decrease savings.** As stated previously, Navigant verified all fixture counts within the onsite sample. The ratio of verified and reported quantities creates an ISR of 90 percent. However, the resulting contribution to ex post impacts are less significant than the main drivers previously described that increased the energy realization rate.

11.2.2 Net Savings

Navigant conducted primary research into NTG effects and found an overall NTG ratio of 50 percent. The program-level NTG ratio as reported by the CLEO & CLIP programs from the E3 database is 70 percent for FY11-12, 85 percent for FY12-13, and 100 percent for FY14-15. Table 11-4 provides the program-level ex post estimates of gross and net energy savings.

Table 11-4. CLEO & CLIP Ex Post Gross and Net Energy and Demand Savings

Fiscal Year	Gross Ex Post Coincident Demand Savings (kW)	Gross Ex Post Energy Savings (kWh)	NTG Ratio	Net Ex Post Coincident Demand Savings (kW)	Net Ex Post Energy Savings (kWh)
FY11-12	10,075	55,093,571	0.50	5,038	27,546,786
FY12-13	7,604	39,632,703	0.50	3,802	19,816,352
FY14-15	645	4,669,671	0.55	355	2,568,319
Total	18,324	99,395,945	0.50	9,195	49,931,457

Sources: E3, onsite results, and process findings

11.2.3 EUL and Lifecycle Savings

Navigant assessed EUL and lifecycle savings. The necessary inputs for determining EUL include the estimated median number of years a rebated measure is installed and operable and the technical degradation over time due to time-related and use-related changes in savings for a measure. The DEER³⁸ database, a secondary source, and the E3 calculator offer estimates of EUL. Navigant calculated lifecycle savings by multiplying the EUL value for each measure by the estimate of first-year energy savings. Table 11-5 identifies the EULs for the measures installed through the CLEO & CLIP programs. Navigant notes that the E3 EULs generally align with DEER estimates. Further, Navigant determined that the EULs reported in FY11-12 and FY 12-13 are reasonable based on its engineering judgment and used them to estimate the ex post lifecycle savings for all fiscal years.

Table 11-6 shows the average measure life applied to the first-year savings to calculate lifecycle savings. The average measure lives reflect the energy-weighted average for each measure within each project. On a per-project basis, CLIP includes significantly more LEDs than CLEO. As a result, the average measure lives increased from CLEO to CLIP by nearly a third.

³⁸ DEER. *Technology and Measure Cost Data/Effective and Remaining Useful Life (EUL/RUL) Values*. http://www.deeresources.com/files/deer0911planning/downloads/EUL_Summary_10-1-08.xls.

Table 11-5. CLEO & CLIP Measure Expected Useful Life

Measure and Description	Measure Life: DEER	Measure Life: FY11-12 E3	Measure Life: FY12-13 E3
Linear Fluorescents	11	11	11
CFLs, Hardwired	12	12	12
CFLs, Screw-In	Varies	3	N/A
Induction Lamps	N/A	16	16
LED Lamps	N/A	N/A	16
Occupancy Sensors	8	8	8
LED Exit Signs	16	16	16

Sources: LADWP E3 calculator, DEER, and Navigant analysis

Table 11-6. CLEO & CLIP Ex Post Lifecycle Electric Savings

Fiscal Year	Gross Ex Post Energy Savings (kWh)	Net Ex Post Energy Savings (kWh)	Average Measure Life	Gross Lifecycle Ex Post Energy Savings (kWh)	Net Lifecycle Ex Post Energy Savings (kWh)
FY11-12	55,093,571	27,546,786	10.92	601,839,648	300,919,824
FY12-13	39,632,703	19,816,352	11.11	440,149,849	220,074,924
FY14-15	4,669,671	2,568,319	15.90	74,239,283	40,831,606
Total	99,395,945	49,931,457		1,116,228,780	561,826,354

Sources: E3, program tracking data, and onsite results

11.3 Process Results

This section presents a summary of process evaluation findings from the 2015 and 2016 evaluation reports for CLEO & CLIP. For the full process evaluations, including the NTG methodology, most participant survey results, program manager and trade ally interview findings, please see the 2015 and 2016 evaluation reports.

These are the high-level results from the FY11-12 and FY12-13 process evaluation of CLEO:

- **The CLEO tracking system currently does not include sufficient customer contact information for program evaluation.** The tracking system does not currently include any information about the project contacts, including contact name, site address, business name, and contractor contact information. This limits the ability of the program to track participation and hindered the program evaluation process. Contact information had to be manually extracted from the program files in order to conduct the participant survey.
- **The CLEO program is not currently advertised by LADWP.** LADWP does not currently advertise the CLEO program directly to customers, instead relying on contractors to market the program to potential participants. The program also does not currently have a strategy to market the program to contractors, and instead relies on the contractors to take the initiative and seek out information about rebate programs. The program has developed a trade ally program, a mutually beneficial arrangement that provides additional training to contractors. This should

increase the accuracy of program application, leading to fewer pre- and post-inspections and a decrease in processing times.

- **While participants are generally satisfied with the program, they are least satisfied with the energy and money they saved after participating in the program.** Because the program does not currently have a comprehensive customer marketing strategy, all the marketing is left to individual contractors, who may oversell the energy savings of the various measures installed under the program. If program participants are regularly disappointed with their energy savings, they may begin to spread negative word-of-mouth about the program, which could have an adverse effect on future participation levels.
- **There is overlap between the SBDI program and the CLEO program.** Because the CLEO program also services the small business customers that the SBDI program services, there may be some confusion among participants about the different programs. It is unlikely that this is having any overall effect on the portfolio savings as the programs are in the same portfolio, but efforts to define the targeted markets would decrease customer confusion and avoid contractor competition.
- **The overall free ridership rate is 50 percent.** A free ridership rate of 50 percent is not unexpected for a mature commercial program such as the CLEO program and has occurred in similar programs. A measure mix that included newer technologies with lower market share, such as LED lamps or high-output CFL, would likely decrease the prevalence of free ridership, since participants would be less likely to seek out these measures on their own. For additional information about advances in lighting technology, LADWP staff should consider attending professional events such as LightFair International or training events at the California Lighting Technology Center at University of California, Davis.
- **Free ridership is higher for the largest projects.** The free ridership rate was significantly higher for projects that were greater than 100,000 kWh savings. The largest projects may have been done in facilities with capital improvement budgets. Additional research would need to be done to determine if this is the case.

These are the high-level results from the FY14-15 evaluation of CLIP:

- **By changing the participant focus of the CLIP program, LADWP will be able to resolve the customer overlap between SBDI and CLEO.** The previous evaluation determined that SBDI and CLEO were competing for smaller projects such as T12 retrofits in small commercial facilities, potentially creating confusion among LADWP non-residential customers. By changing the design of CLIP from CLEO, CLIP should be able to focus on larger, lighting design-based projects, leaving SBDI to service customers with smaller projects. However, due to the small number of completed projects, it was not possible to determine if the average project size had increased under the CLIP program.
- **CLIP customers reported high levels of satisfaction with the lighting installed through the program.** As shown in the previous program evaluation, almost one in five CLEO customers reported being less than satisfied with the lighting installed through the program and the energy savings resulting from the program lighting. During the CLIP evaluation, all of the participants surveyed with completed projects reported being satisfied with the lighting installed through the program and the money and energy saved after participating in the program. The high standards that LADWP has set for LEDs included in the program may also be contributing to this high level of satisfaction among CLIP participants.

- **The lack of marketing for CLIP continues to be a barrier to increased participation.** LADWP does not currently advertise the CLIP program directly to customers, instead relying on contractors to market the program to potential participants. According to LADWP staff, they are currently developing a targeted marketing strategy that will be finalized and implemented once the program changes from CLEO to CLIP are complete. In increasing the amount of marketing of CLIP, the program will be better able to achieve its goal of reaching all eligible LADWP customers.
- **Participants and trade allies continue to be less satisfied with the length of time to complete projects,** creating an additional barrier to participation for both participants and trade allies. All of the trade allies reported lower satisfaction levels with the length of time to complete projects, and one of the participants specifically mentioned that they were unsatisfied with the length of time their participation took.
- **While the trade allies were satisfied with the new program applications, the participants who did not have a contractor complete their application reported being dissatisfied with the rebate process.** The certified trade allies who were interviewed expressed high levels of satisfaction with the improved spreadsheet-based application. However, all of these trade allies also reported that they were very familiar with the program and the application process. Participants who completed the rebated without the help of a contractor reported very low levels of satisfaction with the rebate application process.

11.4 Benchmarking Results

Table 11-7 details the programs most similar to CLEO within the comparison group. Navigant selected these programs because they fulfill a similar role in each utility's portfolio by offering lighting measures to a similar market segment. However, the comparison group offers lighting to commercial customers through multiple programs, some of which are most appropriately compared to the SBDI program because they target small customers or CPP because they are calculated. As a result, the comparison group for CLEO includes programs that provide prescriptive non-lighting and lighting incentives.

Table 11-7. Commercial Lighting Comparison Group Attribute Table

Utility	Program Name	Target Market	Primary Implementer	Contractor Network*	Free Onsite Assessment
LADWP	Commercial Lighting Efficiency Offer	All Non-Residential	Utility Staff	Semi-Open, Website Listed	--
City of Palo Alto Utilities	Custom Advantage*	All Non-Residential	Utility Staff	Open	--
Sacramento Municipal Utility District	Express Efficiency Incentives	Small to Medium Commercial	Utility Staff	Open	--
Austin Energy	Commercial Rebate	All Non-Residential	Utility Staff	Semi-Open, Website Listed	Yes
Seattle City Light	Smart Business	Small Commercial	Utility Staff	Semi-Open	Yes
Seattle City Light	Energy Smart Services	Medium to Large Commercial	Utility Staff	Semi-Open	Yes

*See Table 2-7. Contractor Network Model

**Also part of the custom commercial incentives section.

Source: In-Depth Benchmarking Report

Comparison programs deliver lighting to commercial customers in similar ways. As noted, distinctions can be made over the single-measure focus of CLEO, but overall implementation, utilization of contractor networks, and marketing approaches are similar to the comparison group. CPAU stands alone with its lack of a formal contractor network while SMUD demonstrates the potential to leverage one. LADWP has adapted to Title 24 as CPAU has, by moving CLEO's prescriptive lighting incentives to calculated per kilowatt-hour incentives, while SMUD remains apart continuing to offer prescriptive per-unit rebates. Although AE and SCL offer free assessments to lower barriers for small customers, the diminishing pool of customers who have not already been served by CLEO or SBDI suggests this would not be worthwhile. Given the segmentation overlap between those programs and increased reliance on calculated incentives, Navigant recommends CLEO narrow its target market from all non-residential customers to medium and large customers.

11.5 Recommendations and Action

This section documents the recommendations from Navigant's 2015 and 2016 CLEO and CLIP evaluations, including actions taken by LADWP to address them.

Table 11-8. CLEO FY11-12 and FY12-13 Recommendations and Actions Taken

CLEO FY11-12 and FY12-13 Recommendations	Action Taken
Increase the field staff for the CLEO program. This will allow the program to decrease the amount of time to schedule and perform pre- and post-inspections, which will decrease the project processing time significantly. By providing the necessary resources to improve the project processing time, the program will likely experience increased participation and savings.	One "lead" field inspector (USS-A) position added to unit.
Implement a systematic method of deciding which projects receive a field inspection. Other than a few broad size guidelines, the program currently does not have a consistent or systematic method of deciding which projects receive field inspections. By designing and implementing a documented, systematic method, the program can ensure that field inspections are assigned on a consistent, fair, and reasonable basis. Further, the inspection process should be documented and standardized so that results and project changes are also applied in a consistent manner. Documentation should occur within a comprehensive tracking database so that program managers or third-party evaluators can analyze activities in a manner to identify best practices and/or areas for improvements. For example, an analysis can determine if changes to the guidelines for assigning inspections are needed. Any development efforts should acknowledge the benefits of perceived inspection randomness from the contractors' perspective. Positive contractor influence, standardization, and documentation should be the goals of any redesign efforts.	No action taken.
Design promotional material for participating contractors to distribute to their customers. Since the program is going to rely on contractors to market the program to customers, the contractors should be provided with marketing materials that they can distribute to their customers. Providing contractors with adequate marketing materials will help ensure that the program is marketed in a consistent and accurate manner. All program participants will receive the same information about the program, which will ensure that program benefits, such as energy savings, will not be overstated or oversold. The participant marketing materials can contain general information about the program, payback calculators, program case studies, and information about other programs in the LADWP energy efficiency portfolio.	Program Fact Sheet, providing a brief summary of the lighting program, is available from the program webpage. Other contractor-specific literature is under consideration.

CLEO FY11-12 and FY12-13 Recommendations	Action Taken
<p>Clearly define the targeted customer to ensure minimized overlap with other LADWP programs. The CLEO program and the SBDI program currently target many of the same customers, which may lead to issues such as confusion among potential program participants and competition between the programs. By clearly defining the targeted market to create a clear demarcation between the programs, customer confusion can be reduced and the program contractors can better focus their marketing efforts.</p>	<p>CLEO/CLIP is contractor-driven program open to all LADWP customers. While conflicts with direct install programs may exist, the customers may determine which program best meets their individual needs. LADWP does not limit customer options.</p>
<p>Enhance and align program tracking data with impacts reported in E3 calculators. Inconsistent and partial tracking data limits the CLEO staff's ability to properly identify and report accurate savings. This hinders staff's ability to manage the program, and it could also indicate that CLEO savings are being overlooked. Navigant recommends that CLEO staff regularly cross-check and verify all savings values in their current tracking data against E3 filings. This will allow for better program management and a potential increase in program savings as reported in the E3 calculator. In addition, this will aid future accounting and verification activities and inform any strategy or program redesign decisions. This exercise can be facilitated by an electronic tracking system that comprehensively reports on each project. Further, the tracking system should be readily accessible by all LADWP CLEO team members and third-party evaluators. For example, the tracking system should capture:</p> <ul style="list-style-type: none"> • Customer contact information (name, address, telephone, account number, etc.) • Contractor contact information • Facility details (building type and HVAC equipment) • Start and end dates for projects • Approval, inspection statuses, and changes resulting from inspections • Measures descriptions (measure codes) and quantities • Impact estimates and all associated parameters (pre- and post-watts, pre- and post-hours, HVAC IFs, CFs) 	<p>The CLEO/CLIP project tracking system was improved to better track customer and contractor information and the status of projects.</p>
<p>Expand the program's savings algorithm to account for ISRs, CFs, and HVAC IFs. The program currently assumes values of 1.00 for these parameters.</p> <ul style="list-style-type: none"> • ISR: Navigant applied ISRs of 90 percent to any quantities that could not be counted (e.g., restricted access) and to delamping measures where no equipment was available to count. The 90 percent rate is based on Navigant's field findings and accounts for lamp burnouts and failures, quantity discrepancies, and other project changes that are not 	<p>See similar recommendation in Table 11-9 below.</p>

CLEO FY11-12 and FY12-13 Recommendations	Action Taken
<p>captured within project applications. The CLEO program should account for ISRs, particularly for non-inspected projects.</p> <ul style="list-style-type: none"> CFs: Navigant verified CFs of 0.75 on average through the metering study. The CLEO program should account for CFs other than one to represent the diverse mix of building types where CLEO projects occur. Further, capturing building types within program tracking data can facilitate the assignment of secondary source CFs, such as from DEER.^[1] HVAC IFs: Navigant also referenced DEER to estimate average HVAC IFs of 1.13 for energy, for example. Similar to CFs, LADWP should track building types so that DEER HVAC IFs can be assigned.^[2] Tracking data should also capture the presence of HVAC equipment so that HVAC IFs can be properly applied. Incorporating HVAC IFs will generally result in additional savings for the program. 	
<p>Keep electronic copies of application files. Navigant recommends that CLEO program managers keep electronic copies of all application files for easy reference. This should include invoices and all material used to justify savings calculations.</p>	<p>All lighting program documentation is now filed electronically, in addition to hardcopy files.</p>
<p>Examine baseline equipment, where available, against program assumptions to understand how CLEO measure codes represent actual retrofit conditions. For example, Navigant understands that the current CLIP program includes T12 retrofits. These measures and resulting savings are transferred from the Codes and Standards program and are in response to Title 24 updates. Future evaluations should attempt to verify not only the retrofitted fixture specifications, but also the baseline/in situ equipment. This will provide the program with another point of confirmation for its measure offerings. This could be accomplished with a pre-/post-study.</p>	<p>No action at this time.</p>

Sources: 2015 Evaluation Report, LADWP program managers

Table 11-9. CLIP FY14-15 Recommendations and Actions Taken

CLIP FY14-15 Recommendations	Action taken
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^[1] California Public Utilities Commission. *DEER 2011 Update. Coincident Factor*, pg. 26 of 70.

http://www.deeresources.com/files/DEER2011/download/2011_DEER_Documentation_Appendices.pdf.

^[2] California Public Utilities Commission. *DEER 2011 Update. HVAC Interactive Effects (HVAC IE)*.

<http://www.deeresources.com/index.php/deer2011-for-13-14>.

CLIP FY14-15 Recommendations	Action taken
<p>Increase the field staff for the CLIP program. This will allow the program to decrease the amount of time to schedule and perform pre- and post-inspections, which will decrease the project processing time significantly. By providing the necessary resources to improve the project processing time, the program will likely experience increased participation, participant satisfaction, and program savings. Navigant also made this recommendation during the CLEO evaluation. During the program manager interview, Navigant was informed that the field staff had increased, but this was offset by some field staff leaving.</p>	<p>See recommendation above. No additional action taken.</p>
<p>Increase CLIP staff for application processing. Along with increasing the field staff, increasing the number of LADWP staff members who are responsible for processing program applications will decrease the amount of time that each project takes to complete. By providing the necessary resources to improve the project processing time, the program will likely experience increased participation, participant satisfaction, and program savings.</p>	<p>The volume of applications received for CLIP has been lower than the number received through the CLEO program, so increased staffing has not been necessary. However, recent programmatic changes have resulted in a significant increase in workload, so staffing levels are under review.</p>
<p>Once the program design process is complete, finalize and implement targeted program marketing. The marketing strategy should include materials that CLIP trade allies can distribute to their customers.</p>	<p>Targeted marketing is under development.</p>
<p>Provide additional assistance to CLIP customers who are completing the program application by themselves. Results from both the trade ally interviews and customer surveys suggest that there is a steep learning curve to understanding the program applications, but once understood, the applications are easy to complete. This was evident in the high satisfaction with the application among the trade allies, but low satisfaction levels among the participants who completed the applications themselves. LADWP can do several things to improve participant satisfaction with the application process:</p> <ul style="list-style-type: none"> • Encourage and consider requiring contractors to complete the application on the behalf of their customers. • Provide trained LADWP staff to assist customers who are completing the application by themselves. • Provide training for lighting consultants who can then assist their clients with completing the application. 	<p>The majority of CLIP applications are submitted by lighting contractors on behalf of their customers. CLIP staff provides monthly training workshops available to contractors and customers on the program requirements and process. CLIP also staffs a program hotline to answer customer questions on the program.</p>
<p>Expand the program's savings algorithm to account for ISRs, CFs, and HVAC IFs. The program currently assumes values of 1.00 for these parameters. Navigant made a similar recommendation for CLEO and makes it here again for CLIP. Navigant understands that this specific update, which would add complexity to the savings estimation approach,</p>	<p>CLIP now captures information on conditioned/non-conditioned spaces and has incorporated HVAC interactive effects into the</p>

CLIP FY14-15 Recommendations	Action taken
<p>was not a priority for LADWP given the overall positive performance of the program. However, Navigant maintains the recommendation in consideration of the recent program changes and the anticipated ramp up in participation. That is, CLIP allows for more flexibility in equipment selections to meet a range of applications and lighting needs, and space and facility type diversity will increase with participation. Accounting for these parameters will promote accurate savings reporting.</p> <ul style="list-style-type: none"> • ISR: Navigant's field teams were able to verify all fixture installations for the sample. The verified quantities and the difference from the reported quantities implied an ISR of 90 percent. LADWP should consider including a similar ISR within the CLIP savings algorithm. As the program expands and inspections can only occur for a selection of projects, an ISR can supply a reasonable estimate for lamp burnouts and failures, quantity discrepancies, and other project changes that are not captured within project applications. • CFs: Navigant verified an average CF of 0.65 for the sampled CLIP projects. An average CF of 0.75 was also found previously for CLEO. CLIP should account for CFs other than 1.00 to represent the diverse mix of building types where projects are likely to occur as the program expands. Accurate CFs are also critical as control implementations become more commonplace where fixtures will experience intermittent control even during peak periods. LADWP should also consider changes in CF from the pre- to post-retrofit case as a result of controls. Reductions in CF can contribute significantly to peak demand goals. Secondary sources such as DEER^[3] provide useful estimates for CF. • HVAC IFs: Navigant also referenced DEER to estimate average HVAC IFs of 1.13 for energy, for example (e.g., HVAC savings resulting in 13 percent more energy savings). Navigant noted that CLIP captures building type/space function within project details. However, LADWP should consider expanding the application to capture the presence of HVAC equipment so that building type-specific HVAC IFs can be properly applied. Incorporating HVAC IFs from sources such as DEER^[4] will generally result in additional savings for the program. 	<p>savings calculations. Recommendations for ISR and CF are under consideration.</p>
<p>Create a comprehensive program tracking database. Navigant identified substantial improvements in program and project tracking with CLIP. However, Navigant recommends additional improvements and</p>	<p>A new database system is under development which will allow tracking of</p>

^[3] California Public Utilities Commission. *DEER 2011 Update. Coincident Factor*, pg. 26 of 70. Accessed December 13, 2015. http://www.deeresources.com/files/DEER2011/download/2011_DEER_Documentation_Appendices.pdf.

^[4] California Public Utilities Commission. *DEER 2011 Update. HVAC Interactive Effects (HVAC IE)*. Accessed December 13, 2015. <http://www.deeresources.com/index.php/deer-versions/deer2011-for-13-14>.

CLIP FY14-15 Recommendations	Action taken
<p>enhancements to data structures in anticipation of the significant program activities planned for CLIP. Navigant reviewed internal tracking spreadsheets that contained project-level details on each CLIP project. Navigant recommends that this spreadsheet be expanded to capture measure-level details for each project. Currently, LADWP program managers and third-party evaluators must refer to individual project files in order to identify all inputs and assumptions used to arrive at the reported savings for each measure and project. Further, each project file folder can include up to 15 or more documents or spreadsheets. This task was manageable for FY14-15 CLIP, where reported savings totaled less than 5,000,000 kWh and there were only 16 projects. However, conducting internal program assessments and/or third-party evaluations will become difficult and costly when the program expands and includes hundreds and potentially thousands of project files (e.g., CLEO FY12-13 included over 1,700 projects). Containing all critical measure-level parameters within a single spreadsheet or database will streamline program reviews and create transparency as the program grows. For example, the tracking system should include many of the parameters found with the detailed project files so that savings calculations can be replicated. Navigant notes that LADWP's CLIP tracking spreadsheet captures some of these fields currently:</p> <ul style="list-style-type: none"> • Customer contact information (name, address, telephone, account number, etc.) • Contractor contact information • Start and end dates for projects • Approval, inspection statuses, and changes resulting from inspections <p>However, Navigant recommends the inclusion of additional fields:</p> <ul style="list-style-type: none"> • Facility details (participant type, building type, and HVAC equipment) • Measures descriptions (pre- and post-retrofit) • Pre- and post-retrofit impact estimates and all associated parameters (quantities, fixture wattages, hours, HVAC IFs, CFs, control allowances) 	<p>building type, measure-level data (post-retrofit), and energy savings.</p>

CLIP FY14-15 Recommendations	Action taken
<p>Specify stairwell/bi-level lighting control allowances. Navigant found several instances of agreement between reported and verified control allowances. However, Navigant evaluated one stairwell project and found allowances over approximately 0.90, while LADWP reported 0.24. In cases where pre-retrofit installations are in operation for 8,760 hours per year, LADWP should consider specifying a control allowance for stairwells where savings can be significantly higher due to infrequent use. LADWP may consider additional requirements and/or guidance so that allowances are assigned to the appropriate lighting applications. For example, only emergency stairwells in buildings also served by elevators are eligible.</p>	<p>Allowances for lighting controls assume average situations. Without site-specific datalogging as in custom projects, or studies of stairwell occupancy rates, LADWP has a limited basis to set allowances by area type with an expectation of accurate savings claims.</p>
<p>Capture more information on control strategies. As controls become more prevalent and contribute more significantly to savings, LADWP should consider capturing more details on control strategies. Such details would benefit any future refinements of control allowances and third-party evaluations. LADWP may also consider creating specific control strategy requirements for the program. Control strategy details and/or requirements may include:</p> <ul style="list-style-type: none"> • Delay time before standby mode for occupancy sensors (e.g., 15 minutes or less) • Standby lighting levels for bi-level fixtures (in watts or a percent of full load) • Standby lighting levels for other fixtures that do not power down completely (in watts or a percent of full load) 	<p>No action taken. Capturing detailed control data would require additional staff time in collecting information and a database system capable of storing and reporting on the data. Suggested requirements are under consideration, but would be difficult to verify during site inspections.</p>
<p>Examine pre-retrofit equipment, where available, against program assumptions to understand how CLIP measure codes represent actual retrofit conditions. Navigant made a similar recommendation for the CLEO evaluation. However, this was not pursued due to resource and scheduling constraints. Future evaluations should attempt to verify not only the retrofitted fixture specifications, but also the pre-retrofit/in situ equipment. Pre-retrofit wattages for CLIP measures are sourced from an LADWP-defined listing. Pre-retrofit verifications will provide the program with another point of confirmation for its reported energy savings. This could be accomplished with a pre-/post-study. For example, Navigant would propose to conduct onsite M&V of a facility prior to a CLIP retrofit project. Pre-retrofit M&V activities would capture equipment specifications and hours of use characteristics similar to the activities performed for this evaluation. Following the retrofit activities, Navigant would then conduct additional onsite M&V activities to similarly characterize the post-retrofit installations and verify the energy impacts. Navigant cautions that any pre-/post-study effort would need to accommodate the typically longer schedules associated with larger projects. Therefore, as an alternative, LADWP may consider a baseline-only verification as a means to confirm the program baseline assumptions.</p>	<p>LADWP conducts both pre and post inspections of the majority of projects, verifying the existing and installed equipment. Standard values are used for existing fixtures in calculations, since verification of actual fixture wattages would be excessively time consuming to gather. Actual wattages, per manufacturer data, are used of installed fixtures.</p>

CLIP FY14-15 Recommendations	Action taken
<p>Examine changes in pre-retrofit operating conditions against post-retrofit operating conditions, where available, to understand how CLIP control allowances represent actual hours reductions. Similarly, this could be accomplished with a pre/post-study. Confirming the contributions of controls to CLIP program savings will become more important as controls become more prevalent.</p>	No action taken.
<p>Examine the influence of LADWP inspections on realization rates. Navigant's FY14-15 CLIP evaluation was unable to examine the influence of LADWP's inspection process since all 16 completed projects received inspections. For the CLEO evaluation, the Navigant team compared verification findings for inspected and non-inspected projects and found that non-inspected projects achieved realization rates less than 1.00 and inspection process exceeded 1.00. Those results were not statistically significant; however, Navigant determined that further investigation would be warranted. Therefore, as the CLIP program expands and inspections become selective, future evaluations should continue this comparative analysis to understand the influence of inspections on savings outcomes.</p>	Under consideration by management.

Sources: 2016 Evaluation Report, LADWP program managers

12. CHILLER EFFICIENCY PROGRAM

This section presents Navigant's process and impact evaluation of the Chiller Efficiency Program (CEP) during FY2011-12 and FY2012-13. The program offers incentives for high-efficiency air- and water-cooled chillers, with rebates ranging from \$8 to \$193 per ton and approaching 100 percent of the incremental cost. CEP is designed to assist large offices, hotels, hospitals/medical facilities, institutional facilities, or any business with a chiller-based air conditioning system. LADWP incorporated the program's measures into CPP in FY14-15.

12.1 Program Goals and Achievements

When combining FY11-12 and FY12-13 program savings, CEP ranked sixth out of the 20 programs for which LADWP claimed savings during these years. Table 12-1 presents the program achievements for FY11-12 and FY12-13, including the number of projects and measure savings. The following evaluation covers both of these program years.

Table 12-1. CEP Claimed Savings Summary for FY11-12 and FY12-13

Program Year	Number of Projects	Tracking System Tonnage	Tracking System kWh Savings	Tracking System kW Savings
FY11-12	31	18,874	4,756,633	211
FY12-13	27	12,138	4,705,777	197
Both	58*	31,012	9,462,410	408

**One of the 2012-2013 projects was listed as "PAID" according to the "Application Status" but "RFP/AWAITING CHECK" according to the "CC Status" and so was omitted from the evaluation plan. It is, however, included in E3 savings and so is included here for completeness.*

Note: Because the program tracking data show all project descriptions as "chiller retrofit," the table only shows totals for each year and does not denote which type of chillers were retrofitted. In addition, the number of projects refers to the number of unique "order numbers" in the tracking database, not the total number of new chillers, since some chillers were separated into multiple projects and some projects contained more than one chiller.

Source: Navigant analysis

12.2 Impact Results

The following subsections detail the impact evaluation findings. For detail on methodology, including onsite data collection and sampling, please see the 2014 and 2016 evaluation reports.

12.2.1 Gross Energy and Demand Savings

Navigant estimates that the program achieved a total of 9,429,798 kWh in gross electric energy savings over the evaluation period. This represents a realization rate of 0.97 relative to the ex ante program savings. However, Navigant was unable, due to the difficulties in securing site visits from program participants, to reach the precision goal of 15 percent. Rather, our precision with 85 percent confidence is 21.1 percent. Navigant stratified the program data by project size and calculated savings for each stratum. The total verified gross energy savings and realization rates are shown by stratum in Table 12-2.

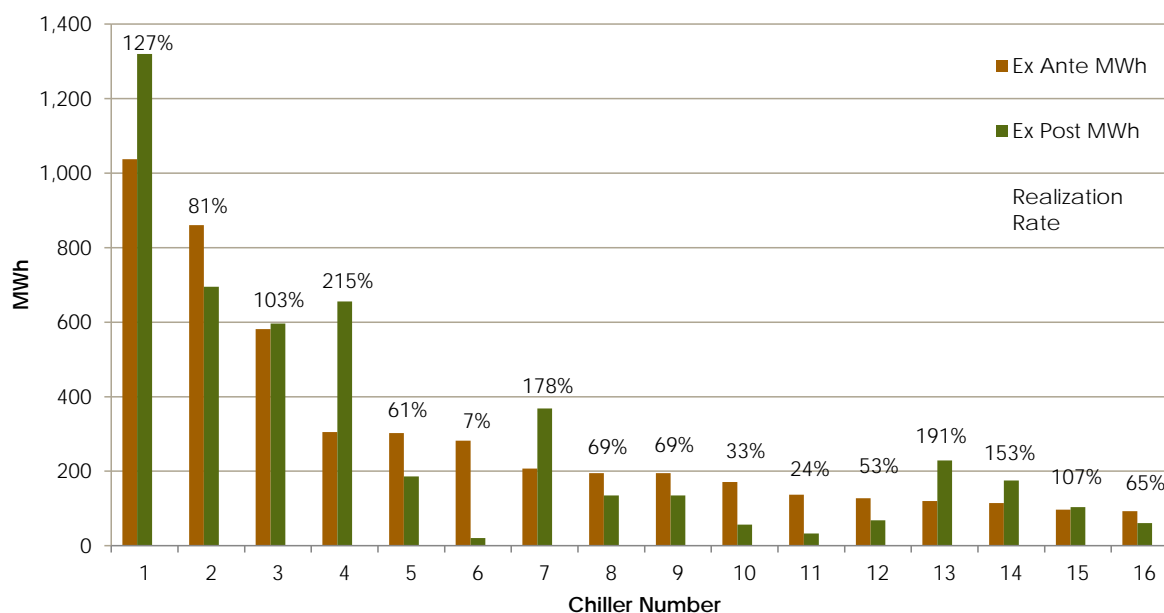
Table 12-2. CEP Gross Energy Impacts

Stratum	Ex Ante Gross Energy Savings (kWh)	Ex Post Gross Energy Savings (kWh)	Gross Energy Realization Rate	Energy Relative Precision at 85% Confidence
Large	4,386,195	4,906,033	1.12	22.9%
Medium	2,334,032	1,588,346	0.68	66.8%
Small	2,709,571	2,633,678	0.97	59.7%
Total	9,429,798	9,128,056	0.97	21.1%

Source: LADWP tracking data and Navigant analysis

The spread in realization rates shown in Figure 12-1 is due to the semi-deemed nature of the program savings—specifically, the use of 1,918 effective full load hours per chiller. However, the program-level realization rate of 0.97 is nearly 1.0, suggesting that, on average, the current ex ante assumptions provide a reasonable savings estimation.³⁹

Figure 19. Impact Sample Energy Savings



Source: LADWP tracking data and Navigant analysis

Realization rates varied greatly from site to site, largely due to differences in operating hours compared to the ex ante estimate of 1,918 effective full load hours per chiller. Some chillers had very high realization rates; for example, both chillers 1 and 7 were located at medical facilities with continuous operations. Chiller 4 had an exceptionally high realization rate because the facility ran its chillers continuously instead

³⁹ Overall baseloaded chillers at high-use facilities had higher usage rates than units which ran fewer hours. Consequently, the realization rates for baseload chillers tended to be high, while those for trim chillers or those at sites with low operational hours were low due to less than 1,918 annual hours of operation.

of running them in alteration, as intended. Alternatively, chiller 6 had an extremely low realization rate; Navigant logged this unit for a month, during which it was rarely used, due to low occupancy of the facility. According to facility operators, staff operations were normal during this time. Therefore, since Navigant was unable to obtain long-term occupancy details for this variable-use facility, Navigant applied these low hours during the monitoring period to a typical year.

According to CEP data, the program achieved a total of negative 366 kW in gross, ex ante electric demand savings. The tracking data reported negative demand savings values for several of the projects. These numbers did not always match the project files, nor did they appear to correspond to the deemed values in the E3 calculator, so the overall realization rate shown here should be taken more as an indication of problems with reporting than with deemed savings. Because of these issues, Navigant cannot report a program-level realization rate for demand savings. Rather, Navigant is using the sampled amount of 859 kW of demand to make a prorated estimate of program-level demand impact.

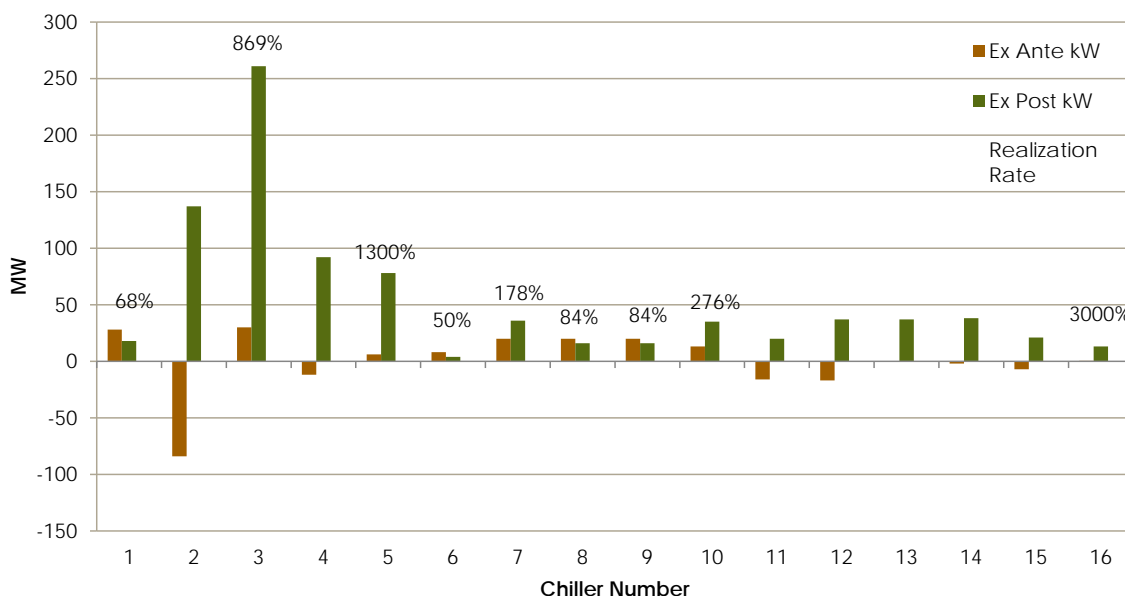
Table 12-3. CEP Gross Demand Impacts

Ex Ante Gross Demand Savings (kW)	Ex Post Gross Sampled Sites Energy Savings (kWh)	Ex Post Program Energy Savings (kWh)	Prorated Ex Post Program Demand Savings (kW)
408	4,906,033	9,040,498	1,570

Source: LADWP tracking data and Navigant analysis

Figure 12-2 provides the estimate of ex post program-level demand savings.

Figure 20. Impact Sample Demand Savings



Source: LADWP tracking data and Navigant analysis

12.2.2 Net Savings

Navigant conducted primary research into NTG effects and found an NTG ratio of 54 percent. The program-level NTG ratio as reported by the CEP from the E3 database was 85 percent. Table 12-4 provides the program-level ex post estimates of gross and net energy savings.

Table 12-4. CEP Ex Post Gross and Net Energy and Demand Savings

Measure	Gross Annual Ex Post kWh Savings	Gross Annual Ex Post kW Savings	NTG Ratio	Net Annual Ex Post kWh Savings	Net Annual Ex Post kW Savings
Chillers	9,040,498	1,570	0.54	4,881,869	848

Source: LADWP tracking data and Navigant analysis

12.2.3 EUL and Lifecycle Savings

EUL is an estimate of the median number of years that the measures installed under a program are still in place and operable. The DEER database and the E3 model offer estimates of EUL, which Navigant used to calculate lifecycle savings by multiplying this value by the estimate of first-year energy savings. Table 12-5 identifies the lifecycle electric savings of energy from the CEP.

Table 12-5. CEP Ex Post Lifecycle Electric Savings

Measure	Gross Annual Ex Post kWh Savings	Net Annual Ex Post kWh Savings	Measure Life	Gross Lifecycle kWh Savings	Net Lifecycle kWh Savings
Chillers	9,040,498	4,881,869	20	180,809,960	97,637,380

Source: LADWP tracking data and Navigant analysis

12.3 Process Results

This section presents a summary of process evaluation findings from the 2015 evaluation report for CEP. For the full process evaluation, including the NTG methodology, most participant survey results, and program manager interview findings, please see the 2015 evaluation report.

These are the high-level results from the process evaluation of CEP:

- 1. The technology included in the program has not kept up with changes in the chiller market.** As mentioned by the program manager, the CEP measure mix was designed around the technologies available several years ago. It is highly possible that many of the technologies in the program have become commonplace in the chiller market, which is demonstrated by the low number of non-free riders. Also, the chiller rebate may in some cases discourage customers from researching and installing newer, high-efficiency HVAC technology, since those measures were not included in the program. LADWP appears to be aware of this issue, and is currently in the process of absorbing the CEP into the CPP. This will allow for the program to keep up with changes in technology and issue rebates for measures not currently included in the program. Navigant commends LADWP staff for taking steps to ensure that its programs are encouraging the adoption of the highest-efficiency measures.

2. **The program is not taking full advantage of its participating contractor network.** The program tracking data does not currently contain information about the participating contractors, nor is there any kind of participating contractor database separate from the program database. While it appears that the program manager has made efforts to develop relationships with some of the participating contractors, there appears to be no systematic effort to track or reach out to contractors who have participated in the past. The participating contractors are essential to the program promotional efforts, and maintaining a robust network of contractors will help the program reach additional program participants.
3. **The CEP is currently relying on the program manager to complete all the pre- and post-inspections.** Although the CEP pre- and post-inspection were originally intended to be carried out by the LADWP field staff, due to the length of time of the inspection process, the program manager began completing all the inspections himself. While Navigant recognizes the efforts of the program manager to expedite the application process, the issue of field understaffing remains.

12.4 Recommendations and Action

This section documents the recommendations from Navigant's 2015 evaluation, including action taken by LADWP to address them.

Table 12-6. CEP FY11-12 and FY12-13 Recommendations and Actions Taken

CEP FY11-12 and FY12-13 Recommendations	Action Taken
E3 Calculator and database should reflect actual installations. Currently, the E3 Calculator and database show total energy savings nearly matching the project files. However, the three data sources have divergent values for demand savings and tons, which in some cases lead to negative values. Inconsistent tracking data limits the CEP staff's ability to properly identify accurate savings. This not only hinders staff's ability to manage the program, it could also indicate that CEP savings are being overlooked, which otherwise might have been claimed. Navigant highly recommends ensuring that the database demand savings and tons reflect the values in the project files, and that these are entered in the E3 in the same way. This will allow for better program management and a potential increase in program savings.	No update at this time.
LADWP should work to ensure that the field staff has adequate training, including chiller-specific training where appropriate. The CPP may require additional application processing and field staff to ensure that the program application processing time is not adversely affected by the inclusion of the CEP in the CPP.	No update at this time.

CEP FY11-12 and FY12-13 Recommendations	Action Taken
<p>LADWP staff should maintain a database of participating contractors. This will allow for both increased and targeted marketing to these contractors. Marketing the program to contractors is especially important since the contractors are one of the major drivers of participation. LADWP should consider distributing a monthly or bimonthly email newsletter to participating contractors. The newsletter could contain the answers to frequently asked questions, case studies of successful projects, and information about successfully marketing the LADWP program portfolio to customers.</p>	<p>No update at this time.</p>
<p>The LADWP CEP and CPP staff should continue to build relationships with participating contractors, and the program should consider continuing to provide a single point of contact for participating contractors. By providing contractors with a single point of contact for any questions they may have about program applications and submitted projects, the program will increase the ease of participation for contractors, which will encourage their continued participation in the program.</p>	<p>No update at this time.</p>
<p>The program should continue to increase its focus on early replacement of chillers. By encouraging customers to participate in the program before their chillers are broken, the program can increase overall participation while gaining additional early replacement energy savings. Additional early replacement will also allow customers to accommodate the rebate processing time, because their need for a chiller will not be as crucial as it would be if their chiller was non-functional.</p>	<p>No update at this time.</p>
<p>LADWP should increase cross-promotion of other LADWP programs to CEP/CPP participants. Currently, there are no known efforts to promote additional LADWP programs to current CEP participants. The LADWP marketing staff should create flyers that describe other LADWP programs that CEP/CPP participants may be interested in, and distribute these to participants. These flyers could be distributed to participating contractors to hand out to their CEP customers, and can also be included when rebate checks are issued to program participants. The LADWP marketing team should also consider sending targeted emails to CEP participants describing both the additional programs that they may be interested in participating in, and the benefits of taking additional energy-saving measures.</p>	<p>No update at this time.</p>

Sources: 2015 Evaluation Report, LADWP program managers

13. SAVINGS BY DESIGN PROGRAM

This section presents Navigant's process and impact evaluation of the Savings by Design Program (SBD) during the FY14-15. SBD is a statewide program offered by the LADWP as well as SMUD and California's four IOUs. It offers technical assistance and financial incentives to builders of new commercial construction or significant renovations. The approach, a single uniform program administered separately by utilities throughout the state, is designed to provide the commercial building market with a single, consistent set of offerings to encourage building with energy efficient equipment and systems.

To participate, a builder must submit an energy model for their proposed construction that either demonstrates an overall energy efficiency at least 10 percent better than code, or energy savings in a building subsystem such as interior lighting or service hot water. This first approach—whole building—is more popular than the systems approach. The program administrator reviews the building plan to verify the proposed savings and, if applicable, offers recommendations about ways to improve the design. For each percentage point above 10 percent, the program offers a larger incentive per kilowatt-hour saved, helping to defray the larger incremental costs for higher and higher efficiency materials and equipment. The program also offers an incentive directly to the design team to encourage the most ambitious and sophisticated designs as well as bonus incentives for peak demand reductions and including end-use monitoring equipment to measure and verify savings. The program administrator issues incentive payments after construction is complete.

In LADWP's territory, LADWP and SCG jointly administer the program, with SCG taking the lead and retaining the two firms hired to implement the program, Okapi Architecture and, previously, Waypoint Building Group. LADWP and SCG have collaborated to provide SBD since 2012. Prior to that, LADWP had discontinued its SBD program due to the economic recession and the associated downturn in construction. SCG also offers SBD jointly with Southern California Edison in its territory.

13.1 Program Goals and Achievements

According to the program database provided to Navigant, during FY14-15, the number of projects whose designs were accepted and reviewed by the program implementer (in owners' agreement) totaled 31. These projects represent expected savings of 11,287,215 kWh, 3,208 kW, and 299,696 therms. Since almost all of these projects are still under construction, they do not match the reported savings in the E3 database shown in Table 13-1.

Table 13-1. SBD Claimed Savings Summary for FY14-15

Fiscal Year	Number of Projects	kWh Savings	kW Savings
FY14-15	31	497,693	19

Sources: E3 database; LADWP & SCG tracking data

13.2 Impact Results

Since SBD is a statewide program, Navigant applied the realization rates from IOU evaluations to LADWP's ex ante savings to derive ex post savings. In addition, Navigant forecasted the future contribution of SBD as part of the Market Transformation report described in Section 2.2.

13.2.1 Gross Energy and Demand Savings

The FY14-15 E3 model reports ex ante savings of 497,693 kWh and 19 kW. Applying the statewide evaluation realization rates⁴⁰ produced the ex post figures in Table 13-2 and Table 13-3.

Table 13-2. SBD Gross Energy Impacts

Ex Ante Gross Energy Savings (kWh)	Ex Post Gross Energy Savings (kWh)	Statewide Energy Realization Rate
497,693	457,693	0.92

Sources: CPUC, Navigant Analysis

Table 13-3. SBD Gross Demand Impacts

Ex Ante Gross Energy Savings (kW)	Ex Post Gross Energy Savings (kW)	Statewide Energy Realization Rate
19	15	0.79

Sources: CPUC, Navigant Analysis

13.2.2 Net Savings

No net savings estimate was conducted for this program. Its contribution to market effects are considered in the Market Transformation report.

13.2.3 EUL and Lifecycle Savings

No EUL or lifecycle savings estimates were conducted for this program.

13.3 Process Results

This section presents a summary of process evaluation findings from the 2016 evaluation report for SBD. For the full process evaluations, including the tracking system review, most participant survey results, and program manager interview findings, please see the 2016 evaluation report.

These are the high-level results from the FY14-15 evaluation of SBD:

- **Participant feedback indicates satisfaction and repeat participation is high.**

⁴⁰ California Public Utilities Commission, Energy Division, [IALC4 NRNC Whole Building Impact Evaluation Report PY-2013](#). July 2015. P 7.

- **Program manager interviews suggest the existing format of tracking data and invoices LADWP receives is not ideal for their review.** They have to spend time and effort aligning program costs with program activities. These interviews also suggest general improvements to the format have been requested in the past, but the specifics have not yet been sufficiently articulated by LADWP.
- **Interviews with program managers and the program implementer indicate there have been multiple meetings and phone discussions on the protocol for transferring to LADWP rejected applicants,** but that the process has never been codified. Transferring projects requires careful communication with customers to ensure clear expectations. Failure to do so has the potential to leave customers frustrated and unsure if they will receive any incentives.
- **LADWP has set a high priority for developing its own new construction program to complement SBD by serving the customers rejected by it.** Such a program would help both customers with all-electric projects that SCG cannot serve and customers who are unable to achieve at least 10 percent improvement above code. SCG supports the creation of such a program because it will help their customers, too.

13.4 Recommendations and Action

This section documents the recommendations from Navigant's 2016 SBD evaluation, including actions taken by LADWP to address them.

Table 13-4. SBD FY14-15 Recommendations and Actions Taken

SBD FY14-15 Recommendations	Action Taken
SCG and LADWP meet annually to determine the program goals and coordinate their expectations for the coming year. This is an opportune time to discuss the specific challenges created by the current format of tracking data and invoices LADWP receives. Before next year's annual planning, LADWP staff should create a template for tracking data that meets their needs and deliver it to SCG and Okapi Architecture to discuss its viability. This will help LADWP supervise the program administration with its current level of dedicated human resources.	No update at this time.
SBD rejects potential participants when they fail to meet is criteria. SCG and LADWP would like to create a new construction program administered by LADWP for ineligible customers. To serve them, define the program protocol for transferring rejected projects to LADWP, including the determination criteria and the communication that follows the determination. Design the requisite communication materials and ensure customers are not lost during the handoff by asking Okapi Architecture to formalize its tracking data for transfers. The reliability of this handoff may be a key element of the new program's success as it will primarily serve customers rejected by SBD.	No update at this time.

SBD FY14-15 Recommendations	Action Taken
<p>To assess the firmographics of the sample, Navigant used general Internet research to learn about projects owners and their building types. Okapi Architecture should include firmographics in its tracking data for the building owner, the architect or consulting firm leading development, and the building type. Self-reported firmographic information from the program application is a more robust source of information and will help internal and third-party reviewers assess the program outreach.</p>	No update at this time.
<p>Okapi Architecture received high marks from participants, and LADWP and SCG should retain them as the program implementer. However, SBD currently relies on this strong contribution from Okapi Architecture to guide participants through the complex process. LADWP, SCG, and Okapi Architecture should develop guidance materials for participants that clearly define each step, from the earliest phases of engagement (before the project has applied to the program) through the rebate payout. Respondents requested step-by-step guidance materials and they would increase the program's resilience to unexpected changes in Okapi Architecture's performance.</p>	No update at this time.
<p>Participants described the fast pace of their projects inhibiting the opportunity for meaningful feedback from SBD review and technical review. The more significant the change recommended by Okapi Architecture, the less likely they have the budget to make it. Best practices research suggests LADWP and SCG should investigate the possibility of offering a zero-down financing option for gut-rehab projects where the debt obligation after incentive is lower than the energy savings, or offering financial assistance for energy modeling to include higher levels of efficiency in the early design.^[1]</p>	No update at this time.
<p>Quantify the magnitude of cross subsidy between LADWP and SCG for SBD and other joint programs across the portfolio. This will ensure equitable collaboration between the utilities.</p>	No update at this time.
<p>Interview potential participants who fail to meet SBD criteria. Their needs will inform the design of a new construction program at LADWP and assess how the transfer process from Okapi Architecture affects their satisfaction with SCG or LADWP.</p>	No update at this time.
<p>Interview other utilities and implementers to identify recommended practices LADWP and SCG could adopt, such as monitoring property purchases to engage potential participants before they even consider constructing a building, as one participant indicated PG&E does.</p>	No update at this time.

Sources: 2016 Evaluation Report, LADWP program managers

14. RETRO-COMMISSIONING EXPRESS PROGRAM

This section presents Navigant's process and impact evaluation of the Retro-Commissioning Express (RCx Express) program during the FY12-13, FY13-14, and FY14-15. RCx Express is offered in partnership with SCG and is designed to help businesses reduce electricity and gas usage. The program requires minimal system data and uses prescribed savings calculations using standardized tools to estimate energy savings. Measure-specific data is supplied by participating customers filling out hard copy forms, or by filling in the Building Optimization Analysis (BOA) Tool. All LADWP non-residential electric customers in good standing are eligible to participate in the RCx Express as long as the building qualifies for one or more of the program's HVAC airside, HVAC waterside, or lighting measures.

14.1 Program Goals and Achievements

Navigant reviewed the reported impacts against the program's projected impacts as reported in LADWP's Energy Efficiency Portfolio Business Plan.⁴¹

Table 14-1 summarizes reported savings versus savings goals. The E3 calculator of reported savings covers FY12-13 and FY14-15, which does not align with the Energy Efficiency Portfolio Business Plan. Reported savings for FY12-13 were 50,000 kWh and 0 MW and 1,100,000 kWh and 0 MW for FY14-15.

Interviews with the RCx Express program manager revealed that the program has been slow to enroll customers and numerous delays by customers initiating projects have contributed to the very low achieved savings versus planned savings.

Table 14-1. RCx Express Claimed Savings Summary for FY12-13, FY13-14, and FY14-15

Program Year	Number of Projects	Program Therm Goal	Program kWh Goal	Tracking System Therm Savings	Tracking System kWh Savings
FY12-13	2	0	8,200,000	806	53,814
FY13-14	1	0	4,500,000	8,710	72,475
FY14-15	6	0	4,500,000	121,331	1,289,286
Total	9	0	17,200,000	130,847	1,415,575

Sources: LADWP Tracking Database, LADWP EE Program Portfolio Overview FY 2012/13 & FY 2013/14, Energy Efficiency Portfolio Business Plan FYs 2013/14 – 2019/20

14.2 Impact Results

The following subsections detail the impact evaluation findings for RCx Express. For detail on methodology, including baseline estimation tracking data review, please see the 2016 evaluation report.

⁴¹ LADWP. Energy Efficiency Portfolio Business Plan, FYs 12-13 & 13-14, page 97.

14.2.1 Gross Energy and Therm Savings

Table 14-2 Table 14-3 present the electric energy and natural gas therm savings for RCx Express. Navigant's evaluation did not assess electric coincident peak demand savings.

Table 14-2. RCx Express Gross Energy Impacts

Sample Size	Ex Ante Energy Savings (kWh)	Ex Post Energy Savings (kWh)	Energy Realization Rate	Relative Precision
9	1,415,573	1,116,737	79%	N/A*

* There is no relative precision on the sampling error, as a census of projects was evaluated.

Source: Navigant Analysis, tracking database, and project files

Table 14-3. RCx Express Gross Therm Impacts

Sample Size	Ex Ante Natural Gas Savings (Therms)	Ex Post Natural Gas Savings (Therms)	Natural Gas Realization Rate	Relative Precision
9	130,847	141,939	108%	N/A*

* There is no relative precision on the sampling error, as a census of projects was evaluated.

Source: Navigant Analysis, tracking database, and project files

For detailed realization rates by year, please see the 2016 evaluation report. The main drivers for the FY12-15 realization rate include the following:

- Verified measure parameters: Decrease electricity energy savings and slightly increase gas savings.** The verified temperatures, temperature setpoints, static pressure setpoints, equipment schedules, and equipment statuses were different than what was modeled for projects with ex ante savings estimated by energy simulation models and different than parameters used in the BOA Tool. Conditions that add to these differences are air handler fan speed assumptions. If the verified fan speeds are slower on average than the energy simulation model or the BOA Tool, then the magnitude of the savings will be less.
- Measure not implemented: Decrease both electricity and gas energy savings.** Field technicians verified that several measures had the same conditions or setpoints at the time of the evaluation as they did prior to the RCx Express measure implementation. For example, technicians found duct static pressure setpoints of 1.5 inches of water before and after the RCx Express measure was implemented. Technicians also found hot water pumps and boilers not shutting off or with the same conditions before and after the RCx Express measures were implemented.

14.2.2 Net Savings

No net savings estimate was conducted for this program. Its contribution to market effects are considered in the Market Transformation report.

14.2.3 EUL and Lifecycle Savings

Navigant used secondary sources to assess EUL and determine lifecycle savings for RCx Express. A 2010 study conducted by SBW Consulting for the CPUC reports an estimated EUL across all RCx Express measures of 8 years.⁴² The study also reports that one of the California IOUs uses 3 years for control measures, 8 years for equipment repairs, and 12 years for new equipment installations. Since LADWP's RCx Express program is mostly control measures, Navigant analysts believe an appropriate EUL would be somewhere in between 3 and 8 years. Specifically, Navigant estimates that a EUL of 5 years is reasonable and conservative, and suggests adopting a 5-year EUL for the RCx Express to estimate the ex post lifecycle savings, as shown in Table 14-4.

Table 14-4. RCx Express Measure Expected Useful Life

Measure and Description	Measure Life (Years)
CPUC Study - RCx Controls	3
CPUC Study - RCx Equipment Repair	8
CPUC Study - RCx New Equipment	12
LADWP RCx Evaluation Results	5

Sources: CPUC Study and Navigant analysis

Navigant calculated lifecycle savings by multiplying the EUL value of 5 years by the estimate of first-year energy savings. Table 14-5 shows the ex post lifecycle electric savings of the RCx Express program.

Table 14-5. RCx Express Ex Post Lifecycle Savings

Program	Gross Ex Post Energy Savings (kWh)	Average Measure Life (Years)	Gross Lifecycle Ex Post Energy Savings (kWh)
RCx Express	1,116,737	5	5,583,685

Sources: Program tracking data and onsite data collection

14.3 Process Results

This section presents a summary of process evaluation findings from the 2016 evaluation report for RCx Express. For program manager interview findings, please see the 2016 evaluation report.

These are the high-level results from the FY12-15 process evaluation of RCx Express:

- A lack of promotion and competition with other LADWP programs has limited RCx Express participation.** The RCx program receives very little promotion from LADWP or from contractors. Customers who could potentially participate in RCx Express are instead participating in EETAP and CPP, mainly because these are contractor-driven programs, and contractors are promoting them to their customers.

⁴² SBW Consulting, Inc. 2010. "Final Report: 2006-2008 Retro-Commissioning Impact Evaluation." San Francisco, CA: California Public Utilities Commission.

- **The program services two specific demographics of LADWP C&I customers.** RCx Express is intended to remain part of the LADWP portfolio because it still services customers who do not qualify for other LADWP commercial programs. This includes participants whose RCx Express projects include natural gas reducing measures and those who are not using a contractor for their RCx Express projects.
- **LADWP should follow best practice when developing the tracking database spreadsheet.** Missing or incorrect data reduces LADWP's ability to quantify savings using the tracking spreadsheet. Outdated or incorrectly versioned tracking spreadsheets limit continuity of program management options for LADWP, making it difficult for new or different program managers to pick up the program as it grows or as a result of staff changes. An example of the best practices can be found in the National Energy Efficiency Best Practices Study.⁴³

14.4 Recommendations and Action

This section documents the recommendations from Navigant's 2016 RCx Express program evaluation, including any actions taken by LADWP to address them.

Table 14-6. RCx Express FY12-15 Recommendations and Actions Taken

RCx Express FY12-15 Recommendations	Action Taken
Retain current RCx Express services for customers that have smaller, straightforward projects. This program meets the needs of customers that do not meet the criteria for EETAP or CPP. Without this offering, these customers would have limited incentive to choose energy efficient options. However, the program in its current form should only accept projects with measures that are applicable to the BOA Tool.	Program has been rebranded RCx. Program is currently ongoing.
Collect pre- and post-trending data for each project. In addition to energy management control system screen prints, which are currently being captured in the pre- and post-inspection, trend data before and after the implementation of the RCx Express measures should be set up and collected. This will provide verifiable parameters that can be used to accurately estimate energy savings.	Under development.
Provide final applicable files in a "Final" folder. Create a "Final" folder for only the final project documents so that it is clear what the final measures implemented were and what the estimated savings are. This will speed up the implementation and evaluation of these projects. Without this, it is more difficult and time consuming for LADWP, the implementer, and the evaluator to process these projects.	LADWP will implement for future applications.
Abide by established best practices with regards to tracking in the RCx Express Excel project database. Navigant recommends that LADWP follow the following best practices:	No update at this time.

⁴³ www.eebestpractices.com

RCx Express FY12-15 Recommendations	Action Taken
<ul style="list-style-type: none"> • Implement a QC process to ensure data entered into the tracking spreadsheet is correct. • Ensure that the tracking database spreadsheets are kept up-to-date with all project progress tracked regularly. • Fill out all fields in the tracking spreadsheet, including indicating if a project has been closed or canceled. • Implement a version control system to ensure that the most up-to-date version of the tracking spreadsheet is in use by project managers. 	
<p>Create a more robust tracking spreadsheet to accommodate growth of the program. As the program grows in size, adding additional tabs to the existing tracking spreadsheet will allow it to scale as the program does. For detailed specifications, see the 2016 evaluation report.</p>	<p>Access relational database tool to track all programs currently in development. Should go live by the third quarter of FY16-17.</p>
<p>Conduct a benchmarking study on customer facilities to determine potential savings opportunities for RCx Express projects. Use US Environmental Protection Agency programs or DOE Commercial Buildings Energy Consumption Survey database to benchmark each facility.</p>	<p>No update at this time.</p>
<p>Continue to conduct impact evaluations of current RCx Express projects on an annual basis or as needed.</p>	
<p>Conduct a study to determine the benefits of creating a full RCx Express.</p>	<p>LADWP is considering moving RCx into the CPP in the future.</p>

Sources: 2016 Evaluation Report, LADWP program managers

15. REFRIGERATION PROGRAM

This section presents Navigant's process and impact evaluation of the Refrigeration Program during FY11-12 and FY12-13. The Refrigeration Program offers incentives to encourage retrofit measures and technologies to reduce energy consumption in businesses including supermarkets, liquor stores, convenience stores, and restaurants. Rebates are offered for refrigerator cases, ice machines, reach-in freezers/refrigerators, display cases, and walk-in coolers, as well as other refrigeration equipment. Since our evaluation these measures have been rolled into the Food Service Program.

15.1 Program Goals and Achievements

Navigant's 2015 Evaluation Report does not describe any goals for the Refrigeration Program.

15.2 Impact Results

The following subsections detail the impact evaluation findings. For detail on methodology, site-specific evaluation plans, and issues arising from discrepancies in CPP tracking data and E3 reported data, please see the 2015 and 2016 evaluation reports.

15.2.1 Gross Energy and Demand Savings

The Refrigeration Program achieved a total of 3,499,127 kWh and 181.54 kW in gross electric energy and demand savings, respectively, over the evaluation period. The final realization rates for the program are 92.7 percent for kWh and 43 percent for coincident peak kW.

There are two main drivers behind the realization rates of the Refrigeration Program. The first is the realization rate adjustment based on on-site results. The second, and most significant, is the misalignment of the program data and the reported E3 data.

On-site savings were calculated from the provided program data and site-level results described in the 2015 evaluation report. The on-site realization rate was multiplied by the program data ex ante savings to calculate the final ex post results. Due to the small difference found during the on-sites, the realization rate between the program data and the on-site ex post is 99.9 percent, with a relative precision of less than 1 percent with a confidence interval of 85 percent. This on-site realization rates was applied to both the energy and demand savings as it represented a very small change.

$$\text{Onsite Results Realization Rate} = \frac{\text{Verified Savings}}{\text{Program Data Savings}} = \frac{3,505,648 \text{ kWh}}{3,508,706 \text{ kWh}} = 99.9\%$$

Although the on-site data showed a fairly high realization rate, the E3 and program data did not align, as explained earlier. In order to calculate the final realization rate, the data factor (the program data compared to the reported data,) must be factored in. The data factor was calculated by dividing the E3 savings by the program data savings.

$$\text{Data factor} = \frac{\text{Program Data Savings}}{\text{E3 Claimed Savings}} = \frac{3,508,706 \text{ kWh}}{3,775,286 \text{ kWh}} = 92.9\%$$

The final realization rate of this program is the product of these two values. Therefore,

$$\text{Final RR} = \text{Data factor} \times \text{Onsite RR} = 92.9\% \times 99.7\% = 92.7\%$$

This realization rate of 0.93 represents the kWh results of both the site visits and the data factor of the two databases. Table 15-1 presents these energy impacts.

Table 15-1. Refrigeration Program Gross Energy Impacts

Fiscal Year	Ex Ante Gross Energy Savings (kWh)	Ex Post Gross Energy Savings (kWh)	Gross Energy Realization Rate	Energy Relative Precision at 85% Confidence
FY11-12, 12-13	3,782,527	3,499,127	0.93	<1.0%

Sources: 2015 Evaluation Report, LADWP program managers tracking data and Navigant analysis

The realization rate for the demand savings is calculated in a similar fashion. The program factor for the demand savings was very low, resulting in a final demand realization rate of 43 percent. This low realization rate is due to the way the program reported its savings within the E3. They did not report to the E3 the same measures that were installed according to the program data, they instead adjusted the measure install counts to align reported cost and kWh. This alignment did not result in measure counts matching well and resulted in this very low demand realization rate. Please see the 2015 Evaluation Report for tables illustrating the demand adjustments made based on the measure-level inaccuracies within E3. Table 15-2 presents these demand impacts.

Table 15-2. Refrigeration Program Gross Demand Impacts

Fiscal Year	Ex Ante Gross Demand Savings (kW)	Ex Post Gross Demand Savings (kW)	Gross Demand Realization Rate	Demand Relative Precision at 85% Confidence
FY11-12, 12-13	423	182	0.43	<1.0%

Sources: 2015 Evaluation Report, LADWP program managers tracking data and Navigant analysis

15.2.2 Net Savings

Navigant found an NTG ratio of 66.6 percent, lower than the program-level NTG ratio as reported by the Refrigeration Program from the E3, which was 85 percent. Table 15-3 provides the program-level ex post estimates of gross and net energy savings as well as gross and net ex post coincident peak demand. For measure level net savings results, please consult the 2015 Evaluation Report.

Table 15-3. Refrigeration Program Ex Post Gross and Net Energy and Demand Savings

Fiscal Year	Gross Annual Ex Post kWh Savings	Gross Annual kW Savings	NTG Ratio	Net Annual Ex Post kWh Savings	Net Annual Ex Post kW Savings
FY11-12, 12-13	3,499,127	182	0.67	2,330,419	121

Sources: 2015 Evaluation Report, LADWP program managers tracking data and Navigant analysis

15.2.3 EUL and Lifecycle Savings

EUL is an estimate of the median number of years that the measures installed under a program are still in place and operable. The DEER database and the E3 model offer estimates of EUL, which Navigant used to calculate life-cycle savings by multiplying this value by the estimate of first-year energy savings. Table 15-4 identifies the life-cycle electric savings of energy from the Refrigeration Program. Again, for measure level life and lifecycle savings, please consult the 2015 Evaluation Report.

Table 15-4. Refrigeration Program Ex Post Lifecycle Savings

Fiscal Year	Gross Annual Ex Post kWh Savings	Net Annual Ex Post kWh Savings	Measure Life	Gross Lifecycle kWh Savings	Net Lifecycle kWh Savings
FY11-12, 12-13	3,499,127	2,330,419	Varies	33,407,216	22,249,206

Sources: 2015 Evaluation Report, LADWP program managers tracking data and Navigant analysis

15.3 Process Results

This section presents a summary of process evaluation findings from the 2015 evaluation reports for the Refrigeration Program. For the full process evaluations, including the NTG methodology and participant survey results, please see the full report.

These are the high-level results from the process evaluation of the Refrigeration Program :

- **The Refrigeration Program is understaffed, which affects the participation rate and overall program savings.** As revealed in the program manager interview, the Refrigeration Program has neither the necessary field nor administrative staffing resources to effectively process program applications. Application processing often can take up to several months, which can lower program participation and savings, as many potential participants have neither the inclination nor the ability to wait for the program inspections and rebates.

- **Requiring pre-inspections for every refrigeration unit may be a barrier to expanded program participation.** Because the Refrigeration Program is competing for field staff resources with other, larger LADWP energy efficiency programs for field-staffing resources, most pre-inspections are not completed quickly enough for customers with non-working units to participate, leading to lower participation and savings achieved. Customers who have “burnt-out” equipment cannot currently participate due to the lag time associated with the pre-inspection requirement.
- **The information contained in the program tracking database is not consistent with the reported savings from the E3 models.** The program tracking data accounts for 93 percent of the reported kWh and 52 percent of the kW. The evaluation team also observed variations in the quantity of measures installed, the measure types available in the databases, and the savings associated with the included measures.
- **The Refrigeration Program does not currently maintain a database of participating contractors or include contractor contact information in their tracking database.** This lack of readily available contractor contact information limits their ability to perform targeted marketing to contractors who have participated in the program in the past. While using contractors as a means of marketing the program to customers is a viable marketing plan for a program like the Refrigeration Program, the program needs to maintain a robust contractor network for it to be successful.
- **The Refrigeration Program is currently primarily promoting the program to contractors through social media.** During the program manager interview, it was revealed that the Program staff does not currently market the Program to contractors outside of updates made on social media pages. While this may engage some contractors, many likely do not engage with social media on a frequent basis, and would therefore miss many announcements.
- **The program currently provides little material for participating contractors to market the program to their customers.** Only one of the participants interviewed stated that they recalled seeing any marketing materials from the program. While relying on contractors to promote the program is a viable strategy, the Program needs to provide them with adequate marketing materials that they can distribute to their customers. Additionally, two customers were unsatisfied with the energy savings from the rebated measures. Providing contractors with adequate marketing materials will help ensure that the energy savings benefits will not be oversold.
- **Program participants reported high levels of satisfaction with their experience with the program.** Overall, the program participants were satisfied with the experience in the Refrigeration Program, including the contractor and the measure installed. The program aspect that received the lowest level of satisfaction was the amount of energy saved after the installation of the technology.
- **There are opportunities for the Refrigeration Program to install LED lighting in previously participating businesses.** Nearly 70 percent of the Refrigeration Program participants surveyed do not currently have LED lighting in their refrigerated cases. These participants represent additional savings opportunities for the program. By updating the program to include LED lighting, and actively seeking out past participants who may be interested in upgrading their lighting to LEDs, the program can capture additional savings.

15.4 Recommendations and Action

This section documents the recommendations from Navigant’s 2015 evaluation, including actions taken by LADWP to address them.

Table 15-5. Refrigeration Program FY11-12 and FY12-13 Recommendations and Actions Taken

Refrigeration Program FY11-12 and FY12-13 Recommendations	Action Taken
<p>LADWP should increase both the administrative and field staff for the Refrigeration Program. This will allow the program to decrease the amount of time to schedule and perform pre- and post-inspections, approve projects, and issue measure rebates. By providing the necessary resources to improve the project processing time, the program will likely experience increased participation and savings.</p>	<p>The Commercial Refrigeration incentive program no longer exists, at least not in its past form.</p>
<p>The program should consider waiving the pre-inspection requirement for contractors who received additional training. The program should allow some participating contractors who are willing to receive additional program-specific training to complete projects without an LADWP field staff pre-inspection. This will allow the program to include participants with “burnt-out” units that need to be replaced quickly and would not typically be able to otherwise participate in the program, leading to increased program savings.</p>	<p>However, many of the refrigeration measures from the old program were incorporated into our Food Service program. The Food Service program is administered by the Southern California Gas Company through a partnership agreement. It is a statewide IOU prescriptive program paying incentives for commercial refrigeration and cooking equipment. Please see our webpage http://www.ladwp.com/foodservice for more information.</p>
<p>The Refrigeration Program should maintain a database of participating contractors or include contractor contact information in their current tracking database. By having contractor contact information readily available, the program will be able to perform targeted marketing to participating contractors. Using contractors as a means of marketing the program to customers is a viable marketing plan for a program like the Refrigeration Program. However, the program needs to maintain a robust contractor network for it to be successful.</p>	
<p>The Refrigeration Program should begin to promote the program to contractors through email newsletters. Using social media, such as Facebook and Twitter, to promote the program may engage some contractors. However, many contractors likely do not engage with social media on a frequent basis, and would therefore miss many announcements. The program should consider sending participating trade allies a periodic newsletter containing information about the program such as program updates, case studies, and tools to promote the program to customers.</p>	
<p>The program should design marketing material for participating contractors to distribute to their customers. If the program is going to rely on contractors to market the program to customers, the contractors need to be provided with marketing materials that they can distribute to their customers. Providing contractors with adequate marketing materials will help ensure that the program is marketed in a consistent and accurate manner. All program participants will receive the same information about the program, which will ensure that program benefits, such as energy savings, will not be oversold. The participant marketing materials can contain general information about the program, payback calculators, program case studies, and information about other program in the LADWP energy efficiency portfolio.</p>	

Refrigeration Program FY11-12 and FY12-13 Recommendations	Action Taken
<p>The Refrigeration Program should expand to include LED lighting for refrigerated cases and make an effort to market the additional measure to past participants. Through both the participant telephone surveys and the on-site surveys, Navigant was able to identify that the majority of program participants were using T8 fixtures for their refrigerated cases. By updating the program to include LED lighting and actively seeking out past participants who may be interested in upgrading their lighting to LEDs, the program can capture additional, readily available, savings.</p>	
<p>The Program should take steps to align the E3 and the program tracking database. The E3 database should be updated to match the program tracking database per unit savings and cost for each measure. The program should also review the tracking databases and take any additional steps to ensure database alignment. This will allow the program to report program results to the CEC with greater accuracy and consistency.</p>	
<p>The Refrigeration Program should consider removing strip-curtains and door gaskets from the measures currently rebated by the program. The literature review performed by Navigant identified these two measure savings as not reflecting the currently accepted savings. Gaskets have much lower savings and have been removed by other California programs. If these measures are not removed from the program, their attributed savings should be reduced to reflect the accepted values of other California utilities.</p>	
<p>The Refrigeration Program staff should continue to research changes that can be made to the program design to create a program that focuses on the “food service” market sector. The program could include various measures that are currently rebated through several different LADWP programs, and would potentially allow participants to apply for rebates for all of these measures using one application. The program would focus on being a “one-stop shop” for all of the energy efficiency measures that a grocery store or restaurant would want to install.</p>	

Sources: 2015 Evaluation Report, LADWP program managers

16. CODES, STANDARDS, AND ORDINANCES PROGRAM

This section details process and impact evaluations of LADWP's Codes, Standards, & Ordinances (CSO) program documented in Navigant's 2016 evaluation for FY14-15. Navigant curtailed a previous round of evaluation in 2014 until LADWP could switch the calculated baseline for programs like Custom Performance and CLIP from CSO baselines to existing (as-found) baselines in accordance with the CSO methodology for calculating savings. LADWP made this switch on October 1, 2014. LADWP now pays incentives for measures that bring a technology or building up to code, as well as for the savings those measures provide above code.

CSO conducts advocacy activities to improve building, appliance, and water use efficiency regulations. These activities include monitoring and active participation in code and standard development, legislative review, sponsorship of local ordinances, and participation in policy efforts with other city departments, state agencies, and utilities.

The program launched during FY12-13 and does not have dedicated FTE staff. One program manager has responsibility for involvement in the California Codes and Standards (C&S) statewide team but shares his duties with other Efficiency Solutions Group personnel as needed. Due to the cyclical nature of C&S development, the program manager's time commitment varies from a small amount to most of his time. As an advocacy program with several audiences, multiple LADWP personnel contribute to program activities. CSO is not a program that customers participate in; rather, it is a collection of LADWP advocacy efforts. Its savings are an adjusted prorated portion of the savings generated by the C&S statewide team.

16.1 Program Goals and Achievements

In its business plan, LADWP projected energy and demand savings of 80,100,000 kWh and 0 kW in FY14-15.⁴⁴ Table 16-1 Shows what LADWP submitted to the E3 database for FY14-15 savings.

Table 16-1. CSO Claimed Savings Summary for FY14-15

Program Year	Number of Projects	kWh Savings	kW Savings
FY14-15	N/A	121,781,298	13,630

Sources: E3 database; LADWP & SCG tracking data

CSO does not track the program's achievements in code, standard, and ordinance advocacy.

16.2 Impact Results

The following subsections detail the impact evaluation findings for the CSO program. For detail on methodology, including the statewide codes and standards allocation and ELRAM framework, please see the 2016 evaluation report.

⁴⁴ Los Angeles Department of Water & Power Efficiency Solutions Portfolio Business Plan FYs 2014/15-2019/20

16.2.1 Gross Energy and Demand Savings

The framework of E3 is to estimate gross savings and then, utilizing a NTG factor, estimate net savings. The prorated C&S energy savings based on the SCE claim includes the CPUC-approved attribution factor, which LADWP considers equivalent to a NTG factor. LADWP used the CPUC's Integrated Standards Savings Model (ISSM) to estimate the attribution factor for Title 20 and Title 24 state C&S (LADWP did not adjust attribution estimates for federal standards). The utility attribution to Title 20 and Title 24 C&S range from 53 percent to 75 percent, and for the "Reach Codes" it is 100 percent. The federal appliance standards have much lower attribution of only 6.25 percent. The weighted utility attribution (without considering the federal appliance standards) is 69.2 percent. Navigant reviewed the LADWP calculations and found that the weighted attribution factor was calculated correctly.

Table 16-2 shows the summary of the steps for estimating gross energy and demand savings from the C&S portion of CSO. It also includes the estimated impacts from the LADWP ordinances. The LADWP ordinance portion of the CSO gross savings is about 3 percent, and the assumptions used to estimate it were not reviewed.

Table 16-2. CSO Ex Post FY14-15 Gross Savings before ELRAM Based Adjustments

Ex Post Gross C&S Energy Savings (kWh)	Ex Post Gross C&S Demand Savings (kW)	Weighted Attribution Factor	Ex Post Net C&S Energy Savings (kWh)	Ex Post Net C&S Demand Savings (kW)	LADWP Ordinance Savings (kWh)	LADWP Ordinance Savings (kW)	Ex Post Net CSO Energy Savings (kWh)	Ex Post Net CSO Demand Savings (kW)
166,711,607	30,209	69.2%	116,748,432	20,905	1,319,760	0	118,068,192	20,905

Source: Navigant Analysis

Table 16-3 shows the summary of ex post gross CSO savings after the ELRAM based adjustments.

Table 16-3. CSO Ex Post FY14-15 Gross Savings after ELRAM Based Adjustments

ELRAM Based Energy Adjustment (kWh)	ELRAM Based Demand Adjustment (kW)	Gross Ex Post Energy Savings (kWh)	Gross Ex Post Demand Savings (kW)
13,593,619	3,526	170,031,367	30,209

Source: Navigant Analysis

Finally, Table 16-4 summarizes the realization rates for the CSO program. For energy, the realization rate is 1.40 and for demand 2.22.

Table 16-4. CSO Realization Rates

Ex Ante Gross Energy Savings (kWh) from E3	Ex Ante Gross Demand Savings (kW) from E3	Ex Post Gross CSO Energy Savings (kWh)	Ex Post Gross CSO Demand Savings (kW)	Energy Realization Rate	Demand Realization Rate
121,781,298	13,630	170,031,367	30,209	1.40	2.22

Source: Navigant Analysis

The primary reason why the realization rates are high is the difference between the pro-rating methods employed by Navigant compared to LADWP. The LADWP method prorated statewide totals, while the Navigant method prorated SCE sector-level goals. There is a significant difference in energy demand impact between the residential and non-residential sectors for which the LADWP method does not adjust.

16.2.2 Net Savings

The C&S portion of the CSO gross savings do not take into account the CPUC-approved attribution factors. The net impact from CSO should include this attribution factor for the C&S portion of the savings. The savings from the LADWP plumbing ordinance does not need adjustment as the City of Los Angeles is solely responsible for its affects. Table 16-5 identifies the net ex post impacts from the CSO program to be 118,068,192 kWh and 20,905 kW.

Table 16-5. CSO Ex Post FY14-15 NET Savings

Ex Post Gross C&S Energy Savings (kWh)	Ex Post Gross C&S Demand Savings (kW)	Weighted Attribution Factor	Ex Post Net C&S Energy Savings (kWh)	Ex Post Net C&S Demand Savings (kW)	LADWP Ordinance Savings (kWh)	LADWP Ordinance Savings (kW)	Ex Post Net CSO Energy Savings (kWh)	Ex Post Net CSO Demand Savings (kW)
166,711,607	30,209	69.2%	116,748,432	20,905	1,319,760	0	118,068,192	20,905

Source: Navigant Analysis

16.2.3 EUL and Lifecycle Savings

The E3 model utilizes a 20-year measure life for CSO savings. Given that CSO encompasses a large variety of measures with varying lengths and several are very long-term lifetime measures, the estimate of 20 years appears reasonable.

Table 16-6. CSO Ex Post Net FY14-15 Lifecycle Savings

Ex Post Net Annual Energy Savings (kWh)	Measure Life (Years)	Net Lifecycle Savings (kWh)
118,068,192	20	2,361,363,835

Source: Navigant Analysis

Table 16-7 shows the summary gross CSO savings after the ELRAM based adjustments for the fiscal years FY12-13 through FY22-23. The estimates are adjusted by the 69.16 percent attribution factor for C&S, the removal of C&S savings included in the energy efficiency programs, and the addition of LADWP ordinances. In order to project embedded energy savings from incentive programs, the ELRAM based

adjustment value for FY14-15 was prorated over energy efficient Incentive Program potential savings per the 2014 LADWP Potential Study (first column of the table below).

Table 16-7. CSO Gross Savings after ELRAM Based Adjustments Including Ordinance Savings

Fiscal Year	Total Gross Statewide C&S (Title 24, Title 20, Fed Standards less Incentive Program Embedded C&S)		EE Programs Potential without C&S		LADP Incentive Programs Embedded C&S savings		Adjusted Statewide C&S (Title 24, Title 20, Fed Standards less Incentive Program Embedded C&S)		LADWP Plumbing Ordinance Gross Savings		LADWP CSO Program Gross Savings	
Year	kWh	kW	kWh	kW	kWh	kW	kWh	kW	kWh	kW	kWh	kW
2012-13	193,309,524	29,958	95,087,912	24,000	6,952,824	1,485	186,356,699	28,473	1,319,760	0	197,676,459	28,473
2013-14	169,957,021	27,844	162,028,352	52,000	11,847,506	3,217	158,109,514	24,627	1,319,760	0	159,429,274	24,627
2014-15	182,305,226	30,735	185,908,462	57,000	13,593,619	3,526	168,711,607	30,209	1,319,760	0	170,031,367	30,209
2015-16	247,660,189	57,559	308,458,352	89,000	22,554,462	5,506	225,105,727	52,054	1,319,760	0	226,425,487	52,054
2016-17	202,749,656	42,444	393,927,363	110,000	28,803,952	6,805	173,945,704	35,639	1,319,760	0	175,266,464	35,639
2017-18	164,062,626	41,826	445,438,242	119,000	32,570,426	7,361	131,492,200	34,465	1,319,760	0	132,811,960	34,465
2018-19	131,601,175	41,971	443,063,516	118,000	32,396,786	7,299	129,204,389	34,671	1,319,760	0	130,524,149	34,670
2019-20	153,487,516	41,136	402,094,945	106,000	29,401,166	6,557	124,086,350	34,579	1,319,760	0	125,406,110	34,579
2020-21	131,573,017	38,359	183,692,308	50,000	13,431,574	3,093	118,141,443	35,266	0	0	118,141,443	35,266
2021-22	118,958,090	36,484	112,604,396	31,000	8,233,629	1,918	110,724,461	34,566	0	0	110,724,461	34,566
2022-23	102,541,780	34,354	76,461,538	24,000	5,590,865	1,485	96,950,915	32,869	0	0	96,950,915	32,869

Source: Navigant Analysis

16.3 Process Results

This section presents a summary of process evaluation findings from the 2016 evaluation report for the CSO program. For program manager interview findings, please see the 2016 evaluation report.

CSO was created in FY12-13 to bring together almost a decade of local ordinance support and emerging technology research, as well as to centralize the legislative and rulemaking influence of LADWP in one program. These efforts center on a common outcome—they each bring new energy and water efficient technologies into the market and remove others through new codes, standards, and ordinances. However, not every activity in the program makes a direct contribution. Specifically, conducting studies of emerging technology—either through the California Technical Forum, other water agencies, or the upcoming facilities test lab—contributes to the knowledge of LADWP engineers, but may not upskill the specific staff people participating in developing new codes and standards. Unless LADWP staff specifically disseminate the results of studies to groups developing codes, standards, and ordinances, this activity does not belong as part of the program design. Studies of emerging technology help commercialize emerging technologies, though. If the program business plan explicitly defined market transformation as both the improvement of new technologies and the obsolescence of old ones through code, it would logically incorporate these activities.

The lack of human resources currently limits the tracking of any activities under the CSO umbrella. Though individual activities generate a paper trail, CSO's many groups and proceedings distribute it across multiple LADWP staff and external contacts. Integrating that paper trail into a central place for program tracking and evaluation may be challenging because LADWP has performed many of these activities for years. However, tracking the program activities in a central location can help build robust processes, document the program's achievements, and provide an entry point for evaluation and improvement. Specifically:

- **Attribute the activities performed by LADWP staff to specific codes, standards, or ordinances** to claim them as LADWP achievements.
- **Track the frequency and contact point at each organization.** This will establish how LADWP reaches audiences like the DOE, ENERGY STAR, Water Sense, and industry groups cited in the business plan with its appliance standards advocacy.
- **Catalog the roles and responsibilities of current personnel and define the activities they undertake.** CSO works with a variety of external organizations, and formally defining the process for responding to rules associated with each may be difficult because at least four LADWP departments—Efficiency Solutions, WCP, Environmental Affairs, and Public Affairs—may wish to provide input. Clearly defined CSO-specific processes will ensure LADWP departments collaborate effectively and increase organizational resiliency.

In addition, creating this program tracking has several administrative benefits:

- Weekly summaries provide a reflective opportunity for LADWP personnel
- A central repository helps capture the disparate efforts of many LADWP personnel, creating opportunities for innovation, strategic thinking, and sharing best practices
- Documenting the contribution of individual personnel is helpful for employee reviews
- Documenting program processes create training tools for new or additional employees
- Identifying the steps in a program's processes is required for a lean process review
- For public organizations, tracking creates transparency
- During years when the city council is reviewing a rate case, documentation can defend the job positions and spending associated with the program

The effectiveness of Title 24 trainings for city inspectors and the resultant improvement to code enforcement cannot be quantified unless CSO program managers track the training inputs (educational materials, spending) and outputs (code enforcement indicators). Further, the business plan and the program manager interview do not indicate Title 24 training is an ongoing activity. It may be more appropriate to list it as an accomplishment in the business plan rather than in parallel with ongoing program activities.

16.4 Recommendations and Action

This section documents the recommendations from Navigant's 2016 CSO evaluations, including any actions taken by LADWP to address them.

Table 16-8. CSO FY14-15 Recommendations and Actions Taken

CSO FY14-15 Recommendations	Action Taken
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CSO FY14-15 Recommendations	Action Taken
<p>CSO's saving claims become more justified when it can attribute its activities to specific codes, standards, or ordinances. In order to demonstrate the frequency, CSO program management should begin documenting weekly the program activities they participate in. At minimum, they should track the following details of program activities:</p> <ul style="list-style-type: none"> • Activity name • One-sentence description of the activity • Names of proceedings, documents, or studies contributed to by aforementioned activity • Specific personnel involved, including LADWP staff and their contact at external group 	
<p>After a trial period to determine the appropriate data fields to include with these, the CSO program manager can request the broader Efficiency Solutions and WCP Group staff provide weekly updates to incorporate into the central tracking. Over time, this will catalog the accomplishments and contributions of LADWP staff to broader local, regional, and statewide efforts. It will also provide a table of contents for internal and third-party reviewers to make requests for specific files associated with activities to identify opportunities to enhance the program's advocacy. See the 2016 evaluation report for an example table.</p>	<p>LADWP is planning to create new positions to help expand CSO's involvement in the statewide proceedings but has not taken action to implement a tracking system for its activities.</p>
<p>The activities of the WCP Group are outside the purview of CSO program management. Also, some activities, like "review and comment on legislation and rules" or "support building benchmarking ordinance," have multiple informal steps. In both cases, documentation can better link program objectives and third-party evaluators can better understand activities. CSO program management should develop process maps for the "review and comment to statewide legislation and local ordinances" activity and develop process maps for WCP Group activities.</p>	
<p>Making it an expressed objective of the program to establish the costs and benefits of emerging technologies would tie three activities directly to the program logic, namely "conducting technical studies of emerging tech," "sharing these studies through the Metropolitan Water District," and "participation in the California Technical Forum." This objective could fit within a broader program goal of commercializing new measures to transform the market. Navigant recommends CSO program managers incorporate market transformation into the near-term program logic to justify these activities, or consider grouping them with like activities in the Emerging Technologies Program.</p>	

CSO FY14-15 Recommendations	Action Taken
<p>The logic model does not consistently define whether an objective or activity contributes to either codes, standards, ordinances, or some combination of the three. To help CSO program management attribute CSO activities to specific codes, standards, and ordinances and identify synergy or overlap between activities in different personnel groups, the logic model should define its objectives strictly by either codes, or standards, or ordinances. It should also define which of these three each activity contributes to. If CSO continues to include objectives related to emerging technology in its logic, attributing those studies to its three advocacy channels will be necessary.</p>	
<p>Interview LADWP staff in the WCP Group, Public Affairs, and Environmental Affairs to map their role in CSO activities and identify opportunities to make their coordination with CSO program management more robust.</p>	
<p>Interview personnel at the stakeholder groups like the California C&S statewide team, the California BSC, or the Alliance for Water Efficiency. This will help document CSO's contribution and identify opportunities to collaborate more effectively.</p>	
<p><i>Sources: 2016 Evaluation Report, LADWP program managers</i></p>	

17. FACILITIES PROGRAM

This section presents Navigant's process and impact evaluation of the LADWP Facilities Program (Facilities) for FY09-15. Facilities is an internal direct install program, not available to LADWP customers, focused on energy efficiency improvement of lighting and HVAC equipment throughout LADWP's facilities. The intention of the Facilities program is to improve energy efficiency in all suitable LADWP facilities, reduce energy consumption, and reduce procurements costs (costs that would have been passed to the customers prior to the program).

The Facilities program was introduced as a result of the requirements in the Green LA Action Plan. The Action Plan was released in 2007 with a goal of reducing greenhouse gases by 35 percent below 1990 levels by 2030. The Action Plan lays out steps to be taken by Los Angeles city departments and agencies and processes for businesses and residents of Los Angeles to reduce emissions. Within this plan, LADWP is committed to producing 35 percent of its electricity from renewable sources by 2020 and tripling its investment in energy conservation from 2007 levels.

17.1 Program Goals and Achievements

The program started on July 1, 2009 and has operated continuously to the present. LADWP did not have program goals for FY09-10 to FY12-13, but Table 17-1 provides this information for recent FYs.

Table 17-1. Projected Program Budget and Impact FY12-13, FY13-14, and FY14-15

Program Years	Projected Budget	Projected Savings (kW)	Projected Savings (kWh)
FY12-13	\$2,706,000	300	1,900,000
FY13-14	\$2,865,000	400	2,000,000
FY14-15	\$3,300,000	400	2,000,000
Total	\$8,871,000	1,100	5,900,000

Source: LADWP Energy Efficiency Portfolio Business Plan FYs 2012/13 & 2013/14

17.2 Impact Results

The following subsections detail the impact evaluation findings. For detail on methodology, including the measure-level analysis and tracking data review, please see the 2016 evaluation report.

17.2.1 Gross Energy and Demand Savings

Table 17-2 and Table 17-3 provide the Facilities program ex ante and achieved gross coincident peak demand and energy savings.

Table 17-2. Facilities Strata-Level Gross Energy Impacts

Strata	Sample Size	Ex Ante Energy Savings (kWh)	Ex Post Energy Savings (kWh)	Energy Realization Rate	Relative Precision
Large	7	1,326,225	1,542,649	1.16	37.2%
Small	13	1,237,496	1,714,342	1.39	26.7%
HVAC	2	490,225	617,088	1.26	0.0%
Total	22	3,053,946	3,874,079	1.27	17.7%

Sources: Program tracking data and onsite data collection

Table 17-3. Facilities Strata-Level Gross Demand Impacts

Strata	Sample Size	Ex Ante Coincident Demand Savings (kW)	Ex Post Coincident Demand Savings (kW)	Demand Realization Rate	Relative Precision
Large	7	313	155	0.50	43.2%
Small	13	260	166	0.64	29.2%
HVAC	2	164	131	0.80	0.0%
Total	22	737	451	0.61	17.0%

Sources: Program tracking data and onsite data collection

The drivers for the Facilities program realization rates include the following:

- **Verified retrofit fixture wattages increase energy and demand savings.** The average lighting measure delta wattage was increased based on verified ex post fixture rated input wattages being less than the ex ante efficient wattages. The average claimed retrofit fixture wattage was 82W, whereas the average retrofit installed fixture wattage was 79W.
- **IFs increase energy and demand savings.** While accounting for IFs drives energy and demand savings up, the impact is slight because the majority of facilities were unconditioned warehouses.
- **Verified hours of use increase energy savings for lighting control measures.** Navigant verified lower average annual hours of use across the sample for verified non-sensor measures. The non-sensor measures ex ante annual hours average was 4,427 compared to the verified ex post average of 2,356 hours. However, sensor measures achieve low hours of use to drive energy savings up; these sensor measures have the larger impact on program savings.
- **CFs decrease peak demand savings.** Using the time-of-use lighting data collected onsite, the evaluation team determined that CFs are roughly half of the ex ante value of 1.00, with a sample wide average around 0.43.

17.2.2 Net Savings

No net savings estimate was conducted for this program. Its contribution to market effects are considered in the Market Transformation report.

17.2.3 EUL and Lifecycle Savings

Navigant assessed EUL and lifecycle savings. The necessary inputs for determining EUL include the estimated median number of years a rebated measure is installed and operable and the technical degradation over time due to time-related and use-related changes in savings for a measure. The DEER⁴⁵ database, a secondary source, offers estimates of EUL for both lighting and HVAC measures. Navigant determined that the DEER EULs are reasonable based on its engineering judgment and suggests adopting them for the Facilities program to estimate the ex post lifecycle savings. Navigant calculated lifecycle savings by multiplying the EUL value for each measure by the estimate of first-year energy savings.

Table 17-4 identifies the EUL values for the measures installed through the Facilities program.

⁴⁵ DEER. Technology and Measure Cost Data/Effective and Remaining Useful Life Values.

http://www.deeresources.com/files/DEER2013codeUpdate/download/DEER2014-EUL-table-update_2014-02-05.xlsx

Table 17-5 shows the average measure life applied to the first-year savings to calculate lifecycle savings. The average measure lives reflect the energy-weighted average for each measure within each project.

Table 17-4. Facilities Measure Expected Useful Life

Measure and Description	Measure Life: DEER
VRF ⁴⁶	15.00
TES	20.00
Linear Fluorescents	14.89
CFLs, Screw-In	3.27
Induction Lamps	14.83
LED Lamps	16.00
Occupancy Sensors	8.00
LED Exit Signs	16.00

Sources: DEER and Navigant analysis

⁴⁶ Daikin Website: <http://www.daikinac.com/content/the-daikin-difference/product-advantages/reliability/>
Accessed August 2015.

Table 17-5. Facilities Ex Post Lifecycle Savings

Strata	Gross Ex Post Energy Savings (kWh)	Average Measure Life	Gross Lifecycle Ex Post Energy Savings (kWh)
Large	1,542,649	14.81	22,850,645
Small	1,714,342	13.18	22,602,435
HVAC	617,088	17.50	10,799,040

Sources: Program tracking data and onsite data collection

17.3 Process Results

This section presents a summary of process evaluation findings from the 2016 evaluation report for the Facilities program. For the full process evaluations, including secondary research, most participant survey results, and program manager interview findings, please see the 2016 evaluation report.

These are the high-level results from the process evaluation of the Facilities program:

- **The program managers should develop a logic model** (based on the elements detailed in this report) to provide a touchpoint for staff and management regarding the resources and ultimate intent of the Facilities program.
- **LADWP should develop digital copies of project documentation rather than paper reports**, which would assist in the management of the program and would assist in the production of higher quality program data.
- **PM interviews revealed that project reporting is not formalized and that project status reports are undertaken ad-hoc or on demand.** Program managers are made aware when a project has been completed, sometimes through a phone call. Program managers commented that the reporting was sufficient for their purposes and that a more automated and regular reporting process would be something they would like to have access to. A formalized/more regular reporting system would assist in the management of the program.
- **The Facilities program offers a more limited set of measures** than do comparable programs sponsored by other organizations.
- **The program managers expressed concern that there was low general awareness of the program across the facility manager population.** Due to the way the facilities have been prioritized, facility managers with high priority facilities are more likely to be aware of the Facilities program than facility managers with low priority facilities.
- **The program managers do not describe participation as being formal.** Participation is driven by the prioritization list, which in turn is driven by savings potential—there is no standard criteria for prioritization. The prioritization of facilities had previously sought out the low-hanging fruit; now that the majority of these facilities have been addressed, other facility types are being targeted where payback periods are less favorable and savings potential is lower.

- **The low-hanging fruit for obtaining savings for lighting have been achieved (warehouses), and focus is being turned to other facilities such as offices.** These require more expensive/sophisticated equipment; these projects result in over 30 percent savings, but previous projects were 50 to 60 percent. Although goals are expected to be met, savings may appear lower in comparison over future years of the program.
- **Facility managers report high satisfaction with the program and measures received.** Results of the surveys showed the highest levels of satisfaction being with the installer of the measure and the measure itself.
- **Program managers explained that facility managers do not have access to the utility bill for their facility** and so would not be aware of their energy usage.

17.4 Recommendations and Action

This section documents the recommendations from Navigant's FY09-15 Facilities program evaluations, including actions taken by LADWP to address them.

Table 17-6. Facilities FY09-15 Recommendations and Actions Taken

Facilities FY09-15 Recommendations	Action Taken
Program Goals: Program goals were established after the program was initiated for FY11-12. Goals should be reviewed on a yearly basis and adjusted as the program evolves.	No update at this time.
Program Documentation: Additional documentation providing more detail on the program would not only have helped produce a more detailed and potentially meaningful evaluation, but it is the foundation for better management and makes it easier to quantify program achievements. Navigant recommends that all project documents be comprehensive (or comprehensive when combined) and monitored or tracked. Project documentation should include the adoption of the program logic model. Navigant also recommends that project files be organized to include final drafts and digital copies for easier reference. This should include invoices and all material used to justify savings calculations. Finally, the tracking system should be consistently maintained to be current, complete, and accurate. The tracking system should include detailed contact information, measure-level parameter and savings data, baseline data, installation and reporting dates, and measure-level costs and incentives. A robust tracking system and a comprehensive set of program documents would assist in the management of the program as well as the internal reporting and the quantification of the program's achievements. Future changes to the program design and any future evaluations will be assisted by transparent, accurate, and consistent data.	LADWP has not developed a new tracking system.
Program Tracking: Program managers suggested that they would benefit from regular and automated reporting. Navigant recommends that the project reporting process for this program be developed to be formal and standardized to meet management's needs and more robust program documentation.	Due to a lack of time, LADWP is unable to standardize on reporting process.

Facilities FY09-15 Recommendations	Action Taken
<p>Training: The facility manager survey asked how important respondents considered energy efficiency in the management decisions for the facility. All respondents gave a score of six or above, indicating that energy efficiency was an important factor. Using this high level of interest in energy efficiency presents an opportunity for training and further development of energy efficiency. This could be addressed through workshops and further engagement/outreach. Training does not seem formalized or geared to this program, but rather more opportunistic/ad hoc. Therefore, a more formalized training schedule with courses focused on energy efficiency awareness may be beneficial.</p>	<p>LADWO's Green Team performs this outreach.</p>
<p>Marketing/Communications: During the facility manager survey, when asked about how easy it was to access information about the program, where scores were six or below, a follow-up question was asked to explain why accessing information was difficult. The most common response was that facility managers did not know where to look for the information. Communication activities are currently limited to E3 Lighting Bulletin and the original 2009 memo. A more formal regular communication from the Energy Efficient Engineering team may support the program's objectives. Navigant recommends that frequent communications through bulletins, memos, and linking with Green Team workshops may advertise the program more effectively.</p>	<p>No update at this time.</p>
<p>Management: Future participation is unpredictable and challenging to manage. The direction of participation in the program is becoming more opportunistic, which is not reflected in the program documents. Navigant recommends that program staff establish criteria to prioritize LADWP facilities for recruitment into the program and increase marketing to raise awareness of the program and energy efficiency in general.</p>	<p>LADWP now determines priority by highest energy users.</p>
<p>Measures: Based on similar programs sponsored by other organizations, LADWP should begin to offer additional measures such as water heating improvements and ISO 50000 energy management systems.</p>	
<p>HVAC Program Documentation: In addition to the program documentation recommendation from the process evaluation effort, Navigant recommends that LADWP track the source of ex ante savings estimates for HVAC measures. For Site 1, for example, it was unclear what the source of ex ante savings values were, and the energy savings entered in the tracking data were higher than the total verified baseline annual energy consumption of the facility.</p>	<p>N/A</p>
<p>HVAC Simulation Model Inputs: Navigant recommends that simulation model inputs should be tracked separately so that it is easier to verify during the impact evaluation site visits. Navigant was not able to obtain the modeling inputs that were used for the ex ante calculations using the Energy Pro model due to licensing issues. Some details of the systems (which were useful in building the eQUEST model) were provided, but in general there is specific data needed for the model that was missing (e.g., the building geometry, construction, occupancy, substation energy use and size, etc.) in order to have more confidence in the model.</p>	

Facilities FY09-15 Recommendations	Action Taken
<p>Lighting Program Documentation: Again, in addition to the program documentation recommendations of the process and HVAC impact evaluation efforts, Navigant has specific suggestions for information that the tracking system should contain. See the 2016 evaluation report for details.</p>	<p>Most information is already tracked and tabulated. Documentation and formatting can be improved when time is allowed.</p>
<p>Lighting Update Savings Algorithms: Navigant suggests expanding the program's deemed savings algorithms to include CFs and IFs. The program currently assumes values of 1.00 for these parameters.</p>	
<p>CFs: The Facilities program should account for CFs other than 1.00 to represent the building and area types that make up the majority of projects. Navigant verified samplewide average CFs of 0.43 through the metering study. Capturing building types within program tracking data can facilitate the assignment of secondary source CFs, such as from DEER.^[1]</p>	<p>No update at this time.</p>
<p>HVAC IFs: Navigant also referenced DEER to estimate HVAC IFs. Similar to CFs, LADWP should track building types so that DEER HVAC IFs can be assigned. Tracking data should also capture the presence of HVAC equipment so that HVAC IFs can be properly applied.</p>	
<p>Lighting Update Deemed Parameter Sources: In addition to updating the savings algorithms, Navigant also suggests updating the sources for deemed hours and EULs to DEER.</p>	
<p>Hours: For non-control measures, Navigant found that retrofit hours on average were 57 percent of reported hours. Navigant suggests that LADWP apply this correction factor to deemed hours for non-control lighting measures going forward.</p>	<p>Not implemented.</p>
<p>EUL: Navigant suggests that LADWP should reference DEER to update measure life used to determine the EUL. Measure categories should be tracked in the program tracking system to facilitate the measure life updates.</p>	

Facilities FY09-15 Recommendations	Action Taken
<p>Lighting E3 Calculator: Navigant recommends developing a transparent process for determining E3 calculator reported savings from the tracking system reported savings. Navigant could not develop a data factor compared to the E3 data because no map from tracking data savings to the E3 calculator existed. Inconsistent and partial tracking data limits Facilities program managers' ability to properly identify and report accurate savings. This hinders staff's ability to manage the program, and it could also indicate that Facilities savings are being overlooked. Navigant recommends that Facilities program managers regularly cross-check and verify all savings values in their current tracking data against E3 filings. This will allow for better program management and a potential increase in program savings as reported in the E3 calculator. In addition, this will aid future accounting and verification activities and inform any strategy or program redesign decisions. This exercise can be facilitated by an electronic tracking system that comprehensively reports on each project.</p>	<p>No update at this time.</p>
<p>Energy Management: Energy management and savings monitoring was a suggestion raised in interviews with facility managers and is something that could be considered by LADWP in the future to increase program satisfaction and quantify program savings.</p>	<p>LADWP's Green Team is working with Facilities for meter tracking.</p>
<p>Benchmarking: Similar program evaluations can serve as a benchmark for the evaluation of the Facilities program. LADWP could consider benchmarking the Facilities program against similar programs across the country.</p>	
<p>Similar Program Recommendations: Recommendations from the evaluation of similar internal programs run by utilities such as Exelon's Energy Reduction Challenge or a federal program such as the DOE's Federal Energy Management Program could provide insight into program improvements (e.g., a similar program evaluation suggested providing energy monitoring to document achieved savings for facility managers and the program tracking and reporting system).</p>	<p>No update at this time.</p>
<p>Larger samples. Using the coefficients of variations derived from this initial study, a larger yet still efficient sample should be pulled to supplement this study's data and results with greater confidence and precision.</p>	

Sources: 2016 Evaluation Report, LADWP program managers