ALAMEDA MUNICIPAL POWER
A Department of the City of Alameda

AGENDA ITEM NO.: 4.G.1
MEETING DATE: 12/12/2022
ADMINISTRATIVE REPORT NO.: 2023-47
ACTION: BY MOTION

To: Honorable Public Utilities Board

Submitted by: /S/
Chris Ferrara
AGM – Customer & Energy Resources

From: Jennifer Shen
Utility Energy Analyst

Approved by: /S/
Nicolas Procos
General Manager

Subject: By Motion, Accept the Evaluation, Measurement, and Verification of Alameda Municipal Power's Efficiency Programs for Fiscal Years 2020 and 2021

RECOMMENDATION

By motion, accept the evaluation, measurement, and verification of Alameda Municipal Power's energy efficiency programs for fiscal years 2020 and 2021.

BACKGROUND

California Assembly Bill (AB) 2021 (September 2006) requires that all publicly-owned utilities, in consultation with the California Energy Commission (CEC), develop an estimate of all potentially achievable, cost-effective energy efficiency (EE) savings and establish annual targets for EE savings and demand reductions over 10 years. It also requires an independent evaluation that measures and verifies the EE savings and reductions in demand achieved by utility programs.

The legislative requirement for a bi-annual evaluation, measurement, and verification (EM&V) study also provides staff with a valuable opportunity to learn from an independent third party how well the utility's programs performed and how they can be improved. Additionally, the findings are used in Alameda Municipal Power's (AMP) load forecast.

AMP has completed an EM&V of EE programs every other year since 2010. This year's study focuses on the utility's residential direct-install EE program and the commercial self-install rebate program.

ADM Associates was selected to manage the measurement and verification through a Request for Qualification process managed by the Northern California Power Agency (NCPA) in 2018. Three vendors were qualified through this process, including ADM Associates. AMP selected ADM Associates based on the company's qualifications and positive feedback from other publicly-owned utilities.

DISCUSSION

The EM&V study focused on Energy Plus, a non-residential direct-install program administered by Ecology Action, and the Energy Assistance Program Plus (EAP+), a low-income direct-install program administered by Synergy Companies. The study measured how well AMP's reported savings were aligned to the savings verified through survey and on-site verification in fiscal year (FY) 2020 to FY 2021.

Energy Plus offers direct-install lighting, refrigeration, and heating, ventilation, and air conditioning (HVAC) programs that allow small businesses to overcome barriers such as lack of capital, time, and experience necessary to analyze and implement EE improvements. In FY 2020 to FY 2021, a total of 20 projects at 19 locations were completed, producing 1,461,136 kilowatt-hours (kWh) in estimated energy savings. The Energy Plus program was closed in December 2021.

The EAP+ program supports income-qualified residents living in single and multi-family homes. Participating customers receive energy audits of their home, EE education and recommendations, plus upgrades including light-emitting diodes (LEDs), appliances, and weatherization measures, at no cost to the participant. In FY 2020 to FY 2021, there were 274 participating homes producing 226,101 kWh's in expected savings. The EAP+ program is currently open to all qualified customers.

ADM Associates employed what is known as a realization rate to measure the current observed or evaluated energy savings and compared them to the originally reported savings estimates. A high realization rate means that the EE savings were delivered as expected based on the original estimates. The overall realization rates were 99.8 percent for the Energy Plus program and 70.9 percent for the EAP+ program.

Energy Plus

Results for the Energy Plus program were positive. The evaluation showed a realization rate of 99.6 percent for FY 2020 and 100 percent for FY 2021, as shown in Table 1. Additionally, ADM Associates surveyed customer satisfaction, which showed that respondents were very satisfied with the program. Some respondents also noted they participated in other AMP commercial programs such as Electric Vehicle (EV) Charger Rebates program and Self-Install Lighting Retrofit Rebates program. Some feedback from respondents included requests for additional outreach and assistance for businesses interested in moving away from natural gas.

Table 1. Energy Plus Verified Program Savings and Realization

Program Year	Expected kilowatt-hour (kWh) Savings	Verified kWh Savings	kWh Realization Rate
Fiscal Year 2020	925,976	922,653	99.6%
Fiscal Year 2021	535,160	535,160	100.0%
Totals:	**1,461,136**	**1,457,812**	**99.8%**

EAP+

The realization rate for the EAP+ program was 68.3 percent for FY 2020 and 72.1 percent for FY 2021, as shown in Table 2. While Synergy Companies calculated most of the program measure savings accurately, some measures calculations used outdated specifications which resulted in inaccurate measure savings. Upon discovery of these errors, ADM Associates developed accurate measure savings for the LED lamps and fixtures, linear fluorescent fixtures, refrigerator recycling, and window caulking. Synergy companies is compensated based on materials installed, not energy savings. ADM Associates also surveyed customer satisfaction, which showed that respondents were satisfied or very satisfied with the program. Almost all respondents noted that AMP was a reliable or very reliable source of information regarding energy savings for their homes. Some respondents provided suggestions for additional topics to include in future energy consultation.

Table 2. EAP+ Verified Program Savings and Realization

Totals	# of Projects	Expected kilowatt-hour (kWh)	Verified kWh	kWh Realization
Fiscal Year 2020	90	69,412	47,432	68.3%
Fiscal Year 2021	184	156,689	112,960	72.1%
Totals:	**274**	**226,101**	**160,392**	**70.9%**

Detailed results and full descriptions of the test methodology are available in the attached report, Exhibit A.

NEXT STEPS

Staff will work with Synergy Companies to implement appropriate changes to improve the realization rate for the EAP+ program and staff will review recommendations provided by ADM Associates and adopt these recommendations where applicable.

FINANCIAL IMPACT

There is no financial impact.

LINK TO KEY RESULT AREAS AND GOALS

Sustainability, Strategy 2, Tactic 2: Promote energy efficiency and building electrification

EXHIBIT

A. FY2020 AND FY2021 Energy Plus and EAP+ Evaluation Report

FY2020 AND FY2021 ENERGY PLUS AND EAP PLUS EVALUATION REPORT

SUBMITTED TO:
ALAMEDA MUNICPAL POWER

SUBMITTED BY:
ADM ASSOCIATES, INC.

SUBMITTED DATE:
NOVEMBER 3, 2022

ADM Associates, Inc
3239 Ramos Circle
Sacramento, CA 95827
916-363-8383

ACKNOWLEDGEMENTS

ADM Associates, Inc. (ADM) would like to acknowledge the talented individuals who contributed to this report. AMP staff who ran these programs, selected ADM for the evaluation effort, attended meetings, and responded to follow-up questions, data requests and document requests. We also wish to thank Synergy, one of the implementers, for the time they took to participate in an interview. Additionally, we would like to thank the evaluation staff who supported the creation of this report.

ADM Staff

Heather Polonsky | Senior Evaluation Researcher

Zephaniah Davis | Senior Manager

Adam Thomas, PMP | Principal

CONTENTS

1 EXECUTIVE SUMMARY

This report covers the impact and process evaluations of Alameda Municipal Power's ("AMP") FY20 and FY21 Energy Plus and Energy Assistance Program Plus (EAP Plus) programs, as conducted by ADM Associates ("ADM" or "the Evaluators").

1.1 Summary of Programs

Below is a brief description of each program:

- The **Energy Plus** Program, which started in January 2016, was a nonresidential direct-install lighting, refrigeration, and HVAC program. This allowed small businesses to overcome barriers such as lack of capital, time, and experience necessary to analyze and implement energy efficiency improvements.
- The **Energy Assistance Program Plus (EAP Plus)**, which was launched in October 2019 and is currently in operation, is a direct-install program targeting income-qualified residents living in single and multi-family homes. Participating customers receive energy audits of their home, energy efficiency (EE) education and recommendations, plus upgrades including LEDs, appliances and weatherization measures, at no cost to the participant.

1.2 Evaluation Objectives

Two primary objectives of the program evaluations:

1) To provide independent validation of impact savings estimations; and

2) To provide recommendations for program improvement and future programs based on findings from process evaluations.

Additionally, AMP provided specific topics for each program that they wished for ADM to research and to provide recommendations accordingly:

- For Energy Plus, AMP is currently looking for recommendations for either an appropriate successor program and/or energy efficiency options that they can provide to their small commercial customers.
- For EAP Plus, AMP is interested in learning about current program outcomes.

1.3 Impact Findings

Below, Table 1 presents the claimed and verified savings from the Energy Plus program, and Table 2 presents the claimed and verified savings from the EAP Plus program.

Table 1: Summary of Energy Plus Claimed and Verified Savings

Totals	Expected kWh	Verified kWh	kWh Realization Rate
FY20	925,976	922,653	99.6%
FY21	535,160	535,160	100.0%
Totals:	**1,461,136**	**1,457,812**	**99.8%**

The overall Energy Plus verified savings is 1,457,812 kWh, 99.8% of expected savings.

Table 2: Summary of EAP Plus Claimed and Verified Savings

Totals	Expected kWh	Verified kWh	kWh Realization Rate
FY20	69,412	47,432	68.3%
FY21	156,689	112,960	72.1%
Totals:	**226,101**	**160,392**	**70.9%**

The overall Energy Plus verified savings is 160,392 kWh, 70.9% expected savings.

1.4 Conclusions and Recommendations

1.4.1 ENERGY PLUS

1.4.1.1 Conclusions

Conclusion 1 – The overall Energy Plus verified savings is 1,457,812 kWh, 99.8% of expected savings.

Conclusion 2 – Customers are satisfied with the services provided. In general, customers were satisfied with services provided by Energy Plus. Survey respondents indicated that AMP and Ecology Action staff were easy to get a hold of and that staff were very upfront about what the program entailed and what was being offered, and therefore there were no surprises nor unmet expectations.

Conclusion 3 – Survey respondents value energy efficiency and Energy Plus program helps them reach their energy goals. Survey respondents noted that they wanted to participate in the program to save money on their energy bill, as well as to save energy and protect the environment. Many of the survey respondents were already practicing energy saving behaviors prior to their enrollment in Energy Plus and the incentives from Energy Plus helped moved them closer to their energy goals.

1.4.1.2 Recommendations

Recommendation 1: Require implementation contractors to submit live calculators when performing custom or semi-custom calculations. All lighting projects completed used custom lighting hours of operation instead of deemed hours from TRM tables. Semi-custom and custom project savings calculations should include verifiable inputs, such as schedules of lighting operation in spaces where custom values are used.

Recommendation 2: Apply HVAC interactive factors by facility/building type, not room type. Six lighting sites' ex ante calculations had HVAC interactive factors that were specific to the room type, rather than the facility or space-type. HVAC interactive factors are developed using simulation models of specific building types and do not vary room-by-room like custom lighting hours may; they are applicable to a building as a whole. Building type-specific interactive factors were used in the calculation of verified savings for conditioned spaces, resulting in variation in measure-level realization and lower realization overall.

Recommendation 3 –Identify areas where commercial measure offerings can align with PG&E's. Some survey respondents noted that the measures offered by AMP did not always align with PG&E. Moving

forward, AMP may benefit from offering similar services as PG&E, provided that PG&E's program offerings are cost-effective for AMP and align with local businesses' programmatic needs.

1.4.1.2.1 Successor Programs

The Energy Plus program has closed and AMP has asked that the Evaluators for recommendations for a replacement program. Below we provide and discuss possible successors.

Refrigeration-based small business program. Three of the 19 projects Energy Plus projects were refrigeration projects, while the remining projects were lighting. AMP already has a self-install and custom lighting program options but does not offer refrigeration options outside of the custom program, may be too complicated for smaller businesses to consider. Turn-key refrigeration programs are common, particularly among municipal utilities. Typical measures are easy to install and have readily available UES, making for a prescriptive program that is easy to implement. Examples include:

- EC motors in walk-in fans
- Strip curtains
- LED refrigerated case lighting
- Refrigerated vending machine controls
- Anti-sweat heater (ASH) controllers
- Zero-energy doors
- Auto door closers
- Reach-in case doors
- Night covers

The program should be targeted at supermarkets, convenience stores, breweries and restaurants.

Dwelling Improvements Targeting Landlords. While the facilities may include residential dwellings, many are multifamily complexes with shared spaces and shared equipment. During the EAP Plus program evaluation it was found that landlords were a barrier to participation, preventing otherwise willing household from participating. Through conversations with landlords, Synergy has learned that landlords' hesitancy stems from a fear that the technicians will damage their property, as well as a misunderstanding that tenants will take the upgraded equipment with them when they move. By providing a program tailored specifically to landlords AMP and Synergy can gain the trust of the landlord. Further, measures offerings through the program are not typically as easy for residents to remove upon moving out: ENERGY STAR dishwashers, clothes washers and dryers, window ACs are less likely to be removed by tenants than LEDs. Further, these items not only produce more energy savings, but also allow the landlord to advertise 'energy efficiency' rental dwellings and improve the overall value of the dwelling.

Suggested measure offerings include:

- ENERGY STAR appliances:
    - Dishwashers
    - Clothes washers

    - Dryers
    - Window ACs
- Efficiency common area and parking lot lighting
- Solar walkway lighting, which has the added benefit of increasing resident safety
- AC tune-ups
- Pool pumps

This option removes burden of EAP Plus participation from tenants, allows landlords to work with implementors to upgrade properties realizing savings through an alternative channel.

1.4.2 EAP PLUS

1.4.2.1 Conclusions

Conclusion 1 – The overall EAP Plus verified savings is 160,392 kWh, 70.9% expected savings.

Conclusion 2 – UES for several measures did not align with the CMUA TRM 2017 or the CA eTRM. Lighting measures, which constitute 80% of program savings, did not align with CMUA TRM or CA eTRM UES. Calculations using actual wattages provided by the program implementors and deemed CMUA inputs (such as lighting hours of operation) showed that expected savings were overestimated. Refrigerator recycling used an outdated savings source whose UES was twice that of the most up-to-date source.

Conclusion 3 – Customers satisfaction with EAP Plus is high. Not only did all respondents express satisfaction with the program, but the majority of respondents also indicated that the decision to participate the program was easy. Additionally, most participants were likely to recommend the program to a friend.

Conclusion 4 – EAP and EAP Plus struggle to enroll all eligible customers: To-date, fewer than 10% of the total eligible customers are enrolled in EAP, with even fewer enrolled in EAP Plus. A variety of reasons can explain why enrollment rates are so much lower than eligibility rates. This gap in uptake may stem from a variety of factors, including application burden, lack of awareness, landlord agreeableness, other logistical issues, stigma, and income volatility.

1.4.2.1.1 Education Outcomes

Ninety percent of respondents noted that the energy report was helpful and included recommendations relevant to their home, and that the energy consultant was courteous, and the recommendations were easy to understand (Figure 10)

Twenty percent of respondents stated they remember receiving education materials, while 8% said they did not, and the reminding 72% could not remember. Of those who remembered, they stated that they received ‘booklets/brochures.’

The majority of respondents (80%, n=20) indicated that prior to participating in EAP Plus they were either somewhat or very familiar with energy saving behaviors like washing clothes with cold water, turning off the lights when not in use, and adjusting heating system settings. All respondents noted they turn off lights or unplug equipment when not in use, and about half noted they wash their clothes with cold water (Figure 8). Below, Table 3 shows reported energy savings behaviors before and after program participation.

Table 3: Energy Savings Behaviors Before and After Program Participation

Behavior	Before Participating	After Participating
Install energy efficient equipment with an incentive through the Energy Plus program	2	0
Install energy efficient equipment without an incentive from the Energy Plus program	1	1
Use programmable thermostats to better control ambient temperature	2	3
Turn off lights when not in use	23	22
Use motion sensing lights that turn off when no one is in the room	0	1
Wash clothes with cold water	12	12
Remove lint from dryer filter	5	5
Install energy efficient light bulbs (e.g. LEDS, CFLs)	9	10
Install power strips	2	5
Other:	6	8

Forty five percent of participants reported completing all efficiency improvements recommended to them after the assessment. An additional 18% stated they completed some of the improvements. 36% did not know.

1.4.2.2 Recommendations

Recommendation 1 – Require implementation contractors to provide sources or supporting documents for each UES proposed. Most measures did not state a source or the source was vague. In many cases, the UES did not correspond with the measure and measure configuration specified.

Recommendation 2 – Consider revising UES used for lighting and other measures. The Evaluators conducted a review of all UES used in the EAP Plus program. Specific suggested values and rationale for updates are discussed in section Appendix B: Review of EAP Plus UES.

Recommendation 3 – Collect email addresses: When enrolling participants into EAP and EAP Plus, AMP staff should collect customers' email addresses. Not only do emails provide an additional contact source for surveys and feedback forms, but more importantly, they provide AMP an additional marketing and communications outlet for promoting the program and increasing engagement.

Recommendation 4 – Diversify marketing strategies: Currently, EAP Plus fails to enroll all eligible participants. AMP should look to implementing more diverse and innovative marketing strategies in order to cast a wider net of applicants. Potential strategies include partnering with local community leaders, door-door canvassing, and more personalized push notifications (via phone, text, or email).

Recommendation 5 – Reduce application burden via categorical eligibility: Application burden, both on the side of the applicant and the administrator, is often one of the primary barriers to accessing social services and assistance. Although there are many ways in which AMP can reduce application burden, the Evaluators most strongly recommend the utility establishes categorical eligibility partnerships with other social service agencies, as well as allows for continuous enrollment. These strategies minimize the paperwork an applicant needs to submit, reduces the stigma associate with reporting income multiple times, as well as accounts for income volatility. A categorical eligibility partnership seems particularly relevant between AMP's EAP Plus

and PG&E's Energy Savings Assistance Program. Synergy manages both of these programs, and thus categorical eligibility, as well as automatic enrollment if feasible, would minimize the paperwork required for gas and electric customers to receive all the equipment upgrades their home needs (most notably weatherization measures for combo homes). This sort of partnership could also reduce stigma by reducing the number of times a customer needs to provide income information. Further, participation in PG&E CARE/FERA bill assistance programs for natural gas service can be used for this purpose as well.

Recommendation 6 – Increase landlord buy-in and engagement: AMP may be able to increase enrollment in EAP Plus through improved landlord engagement. Strategies to improve landlord engagement include providing discounted or free energy efficient upgrades to property owners who have a certain number of tenant participants, as well as through increase education regarding the marketability of energy efficient rental units. Landlords may be more amenable to tenant enrollment in EAP Plus if there is a direct benefit to them.

Recommendation 7 – Expand income eligibility criteria: Although the gap analysis demonstrates there is substantial room for increased engagement without expanding income eligibility criteria, AMP may consider expanding income eligibility criteria for its programs as a means of making the program more accessible to its service users. If AMP decides to expand its eligibility criteria, evaluators recommend using the Department of Housing and Urban Development's definition of "low income" (≤80% average median income for the county), as this is an accepted definition by other social service agencies.

Recommendation 8 – Phase out screw-in LEDs and LED fixtures: LED savings is premised on the assumption that baseline equipment is an incandescent or halogen lamp with adjusted baseline wattages compliant with EISA 2007 Regulations. The first of two advances of lighting standards from EISA 2007 Regulations were phased in from January 2012 to January 2014 and dictated higher efficiency for General Service Lamps (GSLs). Phase II took effect on July 25, 2022, stipulating that all GSLs sold in the United States (US) must achieve a minimum efficacy of 45 lumens/watt[1]. The ruling also significantly expands the definition of GSLs, extending the covered lumen range, base types, and shapes, while reducing the types of bulbs exempted[2].

The 45 lumen/watt efficacy requirement inherently disallows incandescent and halogen lamps, but the EISA backstop does not directly specify a technological standard to satisfy the efficacy requirement. LEDs are well beyond 45 lumens/W (very often operating at greater than 60 lumens/watt), and alternative technologies all fall below the new EISA backstop, effectively meaning that general service lamps which operate at 45 lumens/watts for common lighting categories are not available for purchase.

This precludes savings from LEDs in most program delivery channels however, the EAP Plus program relies on direct install of these items. Savings can still be realized through early replacement direct install program channels, where existing incandescent, halogen, CFL and other inefficient technologies can be directly identified. For this reason, direct install activities can continue after June 30, 2023 but no later than June 30, 2024: Incandescent and halogen lamps have roughly a one-year effective useful life, so any incandescent

[1] Federal Registrar document, page 27440: https://www.govinfo.gov/content/pkg/FR-2022-05-09/pdf/2022-09477.pdf
[2] Ibid.

lamp operating on June 30, 2023 will likely have burned out by June 30, 2024, with the only replacement option then being an LED.

Also, all projects that occur after June 30, 2023, should require that the program administrator "bag and tag" the old lamps, to be stored until a quarterly verification inspection is conducted by utility staff.

Please note that this recommendation is specific to screw-in LEDs and fixtures currently distributed by the program. The new regulations do not affect LED tubes used to replace fluorescent lamps – these lamps should remain in the program offerings for the foreseeable future.

1.5 Remaining Report Organization

The remainder of this report is organized as follows:

Energy Plus

Energy Assistance Program Plus

Appendix A: Methodology

Appendix B: Review of EAP Plus UES

Appendix C: Commercial Site Reports

Appendix D: Survey Instruments

2 ENERGY PLUS

2.1 Program Description

The Energy Plus Program, which started in January 2016, was a turn-key program for small businesses. Implemented by Ecology Action, the program offered direct install direct install lighting, refrigeration, and HVAC measures. This allowed small businesses to overcome barriers such as lack of capital, time, and experience necessary to analyze and implement energy efficiency improvements. Launched in January of 2016, the Program was based on the success of the previous similar Commercial Lighting Direct Install. The program remained open until February 28, 2021.

Eligible commercial measure types include:

- Lighting retrofits,
- Controls,
- HVAC equipment and system improvements and
- Food Service and Refrigeration.

During the time period from July 1, 2019, through June 30, 2021, or "FY20" and "FY21" by year, a total of 20 projects at 19 locations were completed, producing 1,461,136 kWh in estimated energy saving. Below, Table 4 summarizes program participation, expected savings, verified savings and program realization rates.

Table 4: Summary of Program Participation and Savings

Totals	Number of Projects	Expected kWh	Verified kWh	kWh Realization Rate
FY20	17	925,976	922,653	99.6%
FY21	3	535,160	535,160	100.0%
Totals:	**20**	**1,461,136**	**1,457,812**	**99.8%**

Projects included retrofitting high efficiency LED lighting in restaurants, retail service, religious gathering facilities, LED street light retrofits and refrigerated display case doors and evaporator motors on case doors in supermarkets.

2.2 Impact Evaluation

The objective of the impact evaluation is to validate ex ante savings estimates developed by AMP. AMP required that validation meet ±10% precision at the 90% confidence level for both program years, though since a total of 20 projects were completed during both years the Evaluators completed validation of savings for all projects.

While the CMUA TRM provides 'unit energy savings' (UES) for the majority of measures rebated during the FY20 and FY21 program years, implementors opted to perform semi-custom or custom calculations for most measures. All approaches were found to conform to CMUA TRM guidelines or were otherwise appropriate for determining expected savings. The Evaluators used the same methodology to develop verified savings using 'Partial Retrofit Isolation approach (IPMVP Option A)' framework: For custom or otherwise non-deemed measures, the Evaluators carefully reviewed the analyses and calculations that were used to develop

savings values for the measures that are rebated through the program. We evaluated the analysis for each measure according to the degree to which the savings calculations are supported and defensible and documentation is adequate. To facilitate our review of savings calculations, we used a checklist to record whether (1) the methodology used for the calculation was appropriate, (2) assumptions used were reasonable and appropriate, and (3) savings calculations were done correctly.

The evaluation was conducted using guidelines and prescriptive inputs from the 2017 CMUA TRM. Parameters and sources for evaluation of the Energy Plus Program are presented in Table 5 below.

Table 5: Data Sources for Gross Impact Parameters-SCS Program

Parameter	Source
Project Details	Program Tracking Data
Energy Efficient Equipment Specifications	Manufacturer's Literature
Lighting Hours of Operation	Custom hours calculated using actual lighting operation schedules
HVAC Interactive Factors	Simulations of archetypical buildings using local weather data from the CMUA TRM
Lighting Peak Coincident Factor	Simulations of archetypical buildings using local weather data from the CMUA TRM

2.2.1 PROGRAM GROSS SAVINGS ESTIMATES

Data provided by AMP showed that during FY20 and FY21, there were 20 projects locations producing 1,461,136 kWh in expected savings. Table 6 summarizes the total participation in both program years.

Table 6: Summary of Program Participation and Savings

Totals	Number of Projects	kWh
2019	16	792,120
2020	4	669,016
Totals:	**20**	**1,461,136**

2.2.1.1 Site-Level Realization

Table 7 presents realization at the site level.

Table 7: Expected and Verified Savings by Project

Project ID	Project and Facility Type	Expected kWh Savings	Verified kWh Savings	Realization Rate	Non-100% Explanation
1	Lighting – Office (Exterior)	1,559	1,559	100.0%	
2	Lighting – Office (Exterior)	4,143	4,143	100.0%	
3	Lighting – Grocery	5,898	4,705	79.8%	HVAC interactive factors varied by room
4	Lighting – Religious Gathering	6,935	6,756	97.4%	HVAC interactive factors varied by room

Project ID	Project and Facility Type	Expected kWh Savings	Verified kWh Savings	Realization Rate	Non-100% Explanation
5	Lighting – Office (Exterior)	7,974	7,973	100.0%	
6	Lighting – Office (Exterior)	8,262	8,261	100.0%	
7	Lighting – Religious Gathering	10,499	9,759	93.0%	HVAC interactive factors varied by room
8	Lighting – Office (Exterior)	16,729	16,729	100.0%	
9	Street Lighting	17,996	17,996	100.0%	
10	Lighting – Office (Exterior)	39,079	39,079	100.0%	
11	Lighting – Fast Food Restaurant	40,399	40,263	99.7%	HVAC interactive factors varied by room, ex ante calculations did not apply interactive factors to some conditioned spaces.
12	ECM - Grocery	43,249	43,310	100.1%	Ex ante calculations used averaged UES
13	Lighting - Retail	44,981	45,218	100.5%	HVAC interactive factors varied by room
14	Lighting – Fast Food Restaurant	54,935	55,300	100.7%	HVAC interactive factors varied by room, ex ante calculations did not apply interactive factors to some conditioned spaces.
15	Lighting - Warehouse	92,181	92,181	100.0%	
16	Street Lighting	114,948	114,948	100.0%	
17	Refrigerated Case Doors - Grocery	133,856	133,881	100.0%	
18	Lighting - Office	218,072	218,072	100.0%	
19	ECM, ASH controllers, Strip Curtains - Grocery	271,411	269,648	99.4%	Ex ante calculations used averaged UES
20	Street Lighting	328,031	328,031	100.0%	
Totals:		**1,461,136**	**1,457,812**	**99.8%**	

2.2.1.2 Discussion of Non-100% Realization

- Six lighting sites' ex ante calculations involved HVAC interactive factors that were specific to the room type, rather than the facility or space type. HVAC interactive factors are developed using simulation models of specific building types and do not vary room-by-room like custom lighting hours may; they are applicable to a building as a whole. Building type-specific interactive factors were used in the calculation of verified savings for conditioned spaces, resulting in variation in measure-level realization and lower realization overall.
- Two lighting sites' ex ante calculations did not include HVAC interactive factors for conditioned spaces. Verified savings calculations included these factors.

- Two ECM sites' ex ante calculations used averaged UES from the CMUA TRM. The values were averaged across building vintage. Verified savings calculations used UES specific to the building vintage.

2.2.2 OVERALL VERIFIED SAVINGS

Using the realization rates presented in Table 8 the Evaluators summed all sites' verified savings to develop program-level gross savings estimates.

Table 8: Verified Program Savings and Realization

Program Year	Expected kWh Savings	Verified kWh Savings	kWh Realization Rate
FY20	925,976	922,653	99.6%
FY21	535,160	535,160	100.0%
Totals:	**1,461,136**	**1,457,812**	**99.8%**

The overall Energy Plus verified savings is 1,457,812 kWh, 99.8% of expected savings.

2.3 Process Evaluation

The process evaluation included an interview AMP's Energy Plus Program Manager and customer surveys. Evaluators reached out to AMP's third-party implementer, Ecology Action, multiple times for an interview, but were unable to connect with the program manager.

The findings of the following sections summarize the results of those interviews and surveys. Interview results are included in the "Program Design and Operations" section, while survey results are included in "Energy Plus Customer Survey Results".

2.3.1 PROGRAM DESIGN AND OPERATIONS

Developed in 2016, the purpose of the Energy Plus program was to increase engagement in AMP's commercial offerings. Being a relatively small city of about 77,000 residents, Alameda does not have a plethora of commercial businesses and entities. The Energy Plus program sought to help businesses meet energy efficiency goals by helping them to move towards using more efficient equipment and eventually full electrification.

All AMP commercial customers are eligible for the program. Once a customer enrolls in the program, all the paperwork and next steps were managed by program staff. Ecology Action, the implementer of the program, would set up customers with an energy evaluation, recommend upgrades based on the evaluation, and then install the recommended upgrades. Many Energy Plus participants were repeat customers who used program incentives to upgrade different measures year after year; for example if a business upgraded its lighting in 2017, it could reapply to upgrade its refrigeration in 2018. According to AMP program staff, program participants ranged from big box chain stores to small businesses and startup companies.

Though the program exceeded its kWh savings goals, AMP closed Energy Plus at the end of 2021. Program staff cited high overhead costs and business saturation as the primary reasons for sunsetting the program. AMP staff would like to introduce a new and somewhat similar energy efficiency program in the future, with modifications based on the findings of this evaluation and consultation with their third-party implementer.

During the suspension, commercial customers interested in assistance can still receive equipment upgrades through AMP's in-house rebate program.

2.3.2 ENERGY PLUS CUSTOMER SURVEY RESULTS

Program participants were contacted via phone to complete the survey. AMP provided evaluators a list of 20 projects with project manager contact information. Participants were contacted up to five times via phone or email. Some participants were responsible for multiple projects and thus there were 13 unique contacts.

Evaluators were able to complete surveys with four participants, for a 30.8% response rate among unique contacts. None of the contacts surveyed represented multiple projects, therefore four of the 20 projects are represented by these results. Table 9 provides a more detailed breakdown of the recruitment efforts.

Table 9: Recruitment Status for EAP Plus Survey

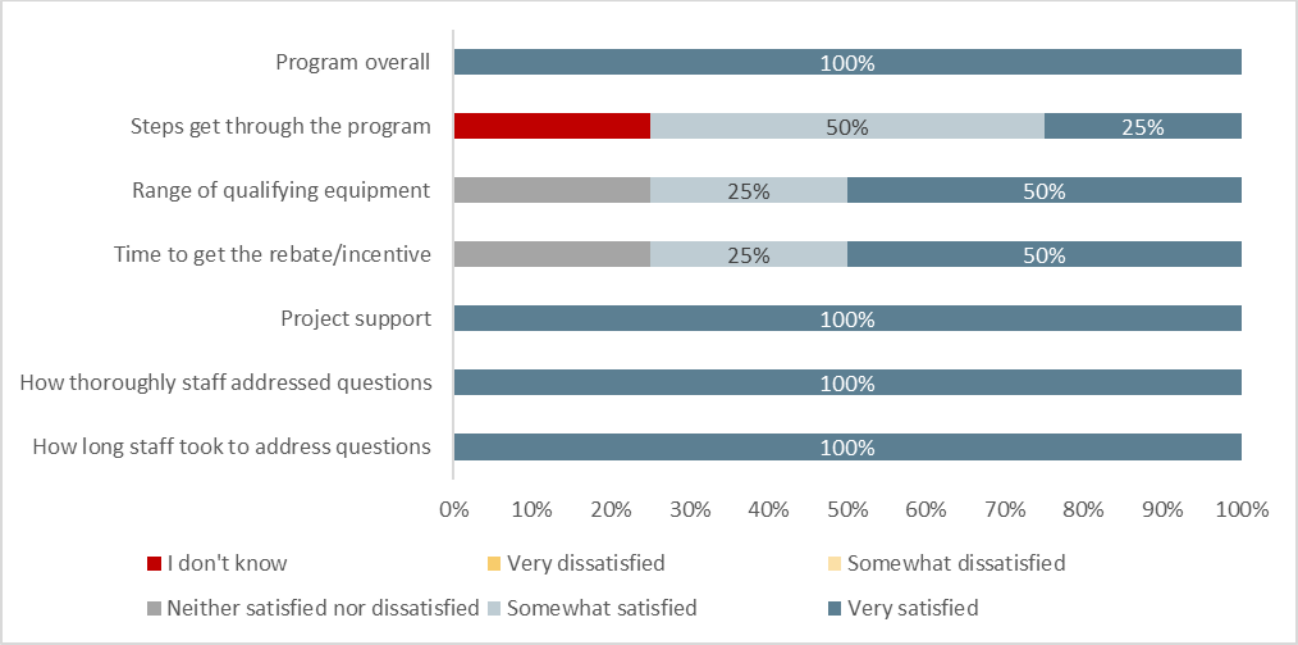
Recruitment Status	n
Complete	4
Don't remember enough to participate	2
Bad contact information	2
No response	5
Total:	**13**

2.3.2.1 Program Satisfaction

All four respondents were satisfied with the Energy Plus program and its components (Figure 1). All respondents indicated they were very satisfied with the Energy Plus program overall and no respondents expressed satisfaction with the steps to get through the program, the range of qualifying equipment, the time to get the incentive, project support, how thoroughly staff addressed their questions, and how long it took staff to address questions. Participating in Energy Plus had no impact on respondents' satisfaction with Alameda Municipal Power as their electrical service provider.

When asked what they liked most about the program, respondents emphasized the financial incentive and the fact that the service helped them meet their energy and money saving goals.

Figure 1: Program Satisfaction (n=4)



All respondents noted that the application process was easy and clear and that the incentive received matched what they were expecting to receive, indicating that program staff were very upfront about incentive amounts right from the start.

When asked how AMP could improve its commercial offerings moving forward, respondents provided feedback regarding services and measures offered. Respondents talked about AMP aligning their offerings with those offered by PG&E, noting that PG&E seems to provide more measures. One respondent requested more outreach and assistance for businesses interested in moving away from natural gas and towards full electrification. Lastly, one respondent mentioned that a previous AMP employee had been a great ambassador for everything AMP was doing; AMP seems to be missing that community outreach component as of late, and the respondent noted that this sort of community presence would be helpful to have again.

"There used to be a great rep who was an ambassador for everything AMP was doing. We had a personal connection with someone who really cared, and it made a huge difference in the relationship. The current people are nice, but they don't reach out unless I reach out first. We need someone who is proactive."

"We do a lot of other stuff that we don't get rebates for because of the lead time. We didn't apply for [some] upgrades because it would have taken too long"

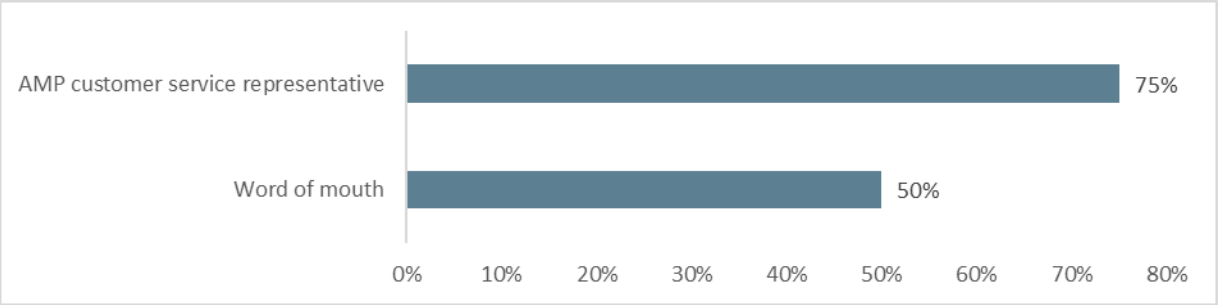
"I wish there were incentives for other things. PGE and AMP don't always line up"

"…interested in going towards electric, moving away from gas"

2.3.2.2 Program Participation

All the respondents noted that the decision to participate in the program was an easy one. Respondents either learned about the Energy Plus program through an AMP customer service representative (75%, n=3) or word of mouth (50%, n=2) (Figure 2).

Figure 2: Program Awareness (n=4)



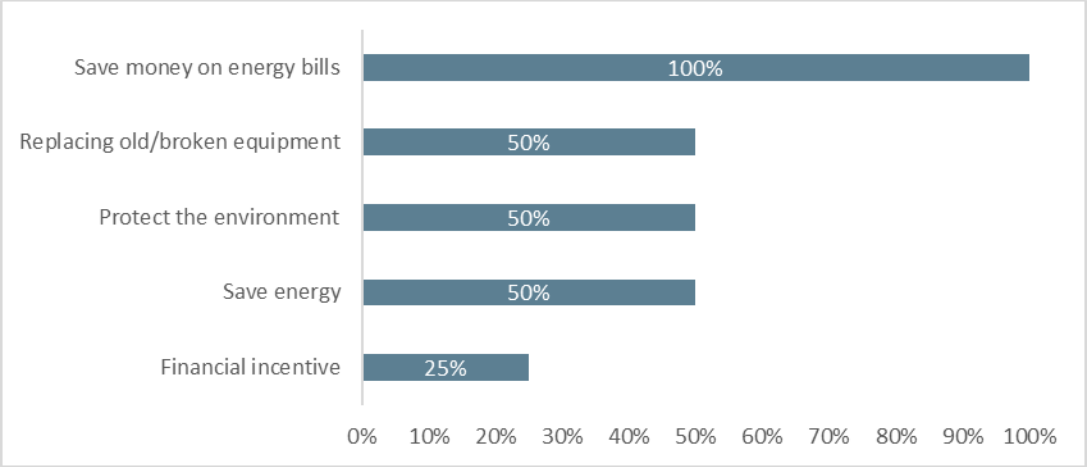
Respondents indicated that they currently take a variety of actions to conserve energy including installing energy efficient equipment and lighting, using programmable thermostats, and using motion sensor lighting (Table 10).

Table 10: Energy Saving Behavior (n=4)

Behavior	n
Install energy efficient lighting	4
Install energy efficient equipment with an incentive through the Energy Plus program	3
Install energy efficient equipment without an incentive from the Energy Plus program	3
Use programmable or smart thermostats to better control ambient temperature	2
Use motion sensing lights that turn off when no one is in the room	3
Install power strips	3

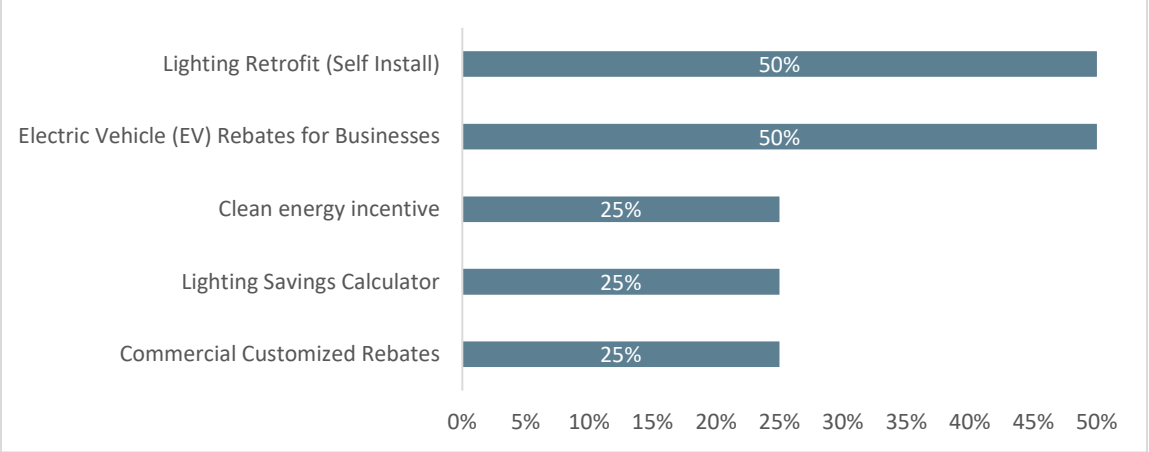
All respondents were interested in participating in the program to save money on energy bills. Respondents were also interested in the program to save energy, protect the environment, replace old equipment, and the financial incentive (Figure 3).

Figure 3: Motivation for Participation (n=4)



Some respondents noted they participate in other commercial programs offered by Alameda Municipal Program. Figure 4 outlines which programs respondents participate in.

Figure 4: Other AMP Program Participation (n=4)



2.3.2.3 Measures Received

All four respondents received upgraded lighting as part of their participation in the Energy Plus program; one respondent also indicated they may have received a refrigerator. Two respondents noted they received technical services, such as a facility assessment or assistance identifying the needed equipment, while the remaining two respondents noted no such service was provided. All respondents indicated that the equipment received through Energy Plus is still installed and operating.

2.3.2.4 Firmographics

All four respondents were the primary contacts for the Energy Plus program at their facilities. Respondents represented a variety of business types including grocery store, religious worship, industrial/manufacturing, and the government. Three of the respondents noted their business owns its facility, while the other respondent noted they rent.

2.4 Conclusions

Conclusion 1 – The overall Energy Plus verified savings is 1,457,812 kWh, 99.8% and 97.8% of their respective expected savings.

Conclusion 2 – Customers are satisfied with the services provided. In general, customers were satisfied with services provided by Energy Plus. Survey respondents indicated that AMP and Ecology Action staff were easy to get a hold of and that staff were very upfront about what the program entailed and what was being offered, and therefore there were no surprises nor unmet expectations.

Conclusion 3 – Survey respondents value energy efficiency and Energy Plus program helps them reach their energy goals. Survey respondents noted that they wanted to participate in the program to save money on their energy bill, as well as to save energy and protect the environment. Many of the survey respondents were already practicing energy saving behaviors prior to their enrollment in Energy Plus and the incentives from Energy Plus helped moved them closer to their energy goals.

2.5 Recommendations

Recommendation 1: Require implementation contractors to submit live calculators when performing custom or semi-custom calculations. All lighting projects completed used custom lighting hours of operation instead of deemed hours from TRM tables. Semi-custom and custom project savings calculations should include verifiable inputs, such as schedules of lighting operation in spaces where custom values are used.

Recommendation 2: Apply HVAC interactive factors by facility/building type, not room type. Six lighting sites' ex ante calculations had HVAC interactive factors that were specific to the room type, rather than the facility or space-type. HVAC interactive factors are developed using simulation models of specific building types and do not vary room-by-room like custom lighting hours may; they are applicable to a building as a whole. Building type-specific interactive factors were used in the calculation of verified savings for conditioned spaces, resulting in variation in measure-level realization and lower realization overall.

Recommendation 3 –Identify areas where commercial measure offerings can align with PG&E's. Some survey respondents noted that the measures offered by AMP did not always align with PG&E. Moving forward, AMP may benefit from offering similar services as PG&E, provided that PG&E's program offerings are cost-effective for AMP and align with local businesses' programmatic needs.

2.5.1 SUCCESSOR PROGRAMS

The Energy Plus program has closed and AMP has asked that the Evaluators for recommendations for a replacement program. Below we provide and discuss possible successors.

Refrigeration-based small business program. Three of the 19 projects Energy Plus projects were refrigeration projects, while the remining projects were lighting. AMP already has a self-install and custom lighting program options but does not offer refrigeration options outside of the custom program, may be too complicated for smaller businesses to consider. Turn-key refrigeration programs are common, particularly among municipal utilities. Typical measures are easy to install and have readily available UES, making for a prescriptive program that is easy to implement. Examples include:

- EC motors in walk-in fans

- Strip curtains
- LED refrigerated case lighting
- Refrigerated vending machine controls
- Anti-sweat heater (ASH) controllers
- Zero-energy doors
- Auto door closers
- Reach-in case doors
- Night covers

The program should be targeted at supermarkets, convenience stores, breweries and restaurants.

Dwelling improvements targeting landlords. While the facilities may include residential dwellings, many are multifamily complexes with shared spaces and shared equipment. During the EAP Plus program evaluation it was found that landlords were a barrier to participation, preventing otherwise willing household from participating. Through conversations with landlords, Synergy has learned that landlords' hesitancy stems from a fear that the technicians will damage their property, as well as a misunderstanding that tenants will take the upgraded equipment with them when they move. By providing a program tailored specifically to landlords AMP and Synergy can gain the trust of the landlord. Further, measures offerings through the program are not typically as easy for residents to remove upon moving out: ENERGY STAR dishwashers, clothes washers and dryers, window ACs are less likely to be removed by tenants than LEDs. Further, these items not only produce more energy savings, but also allow the landlord to advertise 'energy efficiency' rental dwellings and improve the overall value of the dwelling.

Suggested measure offerings include:

- ENERGY STAR appliances:
    - Dishwashers
    - Clothes washers
    - Dryers
    - Window ACs
- Efficiency common area and parking lot lighting
- Solar walkway lighting, which has the added benefit of increasing resident safety
- AC tune-ups
- Pool pumps

This option removes burden of EAP Plus participation from tenants, allows landlords to work with implementors to upgrade properties realizing savings through an alternative channel.

3 ENERGY ASSISTANCE PROGRAM PLUS

3.1 Program Description

The Energy Assistance Program (EAP) Plus Program, which was launched in October 2019 and is currently in operation, is a direct-install program targeting income-qualified residents living in single and multi-family homes. To participate, the home must already be enrolled in AMP's Energy Assistance Program (EAP) Program. Participants receive energy audits of their home, energy efficiency (EE) education and recommendations, plus upgrades including LEDs, appliances, and weatherization measures, at no cost to the participant. The focus is to remove barriers for low-income customers to participate in energy-efficiency upgrades. Measures and upgrades include:

Core energy efficiency measures:

- Energy Education
- LED lamps and fixtures
- Advanced power strips
- Refrigerant replacement
- LED tubes to replace fluorescent lights

Additional measures available to homes with electric heating and electric water heating:

- Programmable Thermostats
- Thermostatic shower valves
- Faucet aerators
- Low flow showerheads
- Hot water heater blankets

Optional measure for all households:

- Lint Cleaning from Dryer and the Vent
- Refrigerator Brush, Cleaning & Education
- Clothing Washer Temperature Adjustment
- Weatherization –
    - Attic Access Weatherstripping
    - Door Weatherstripping
    - Door Sweeps and Thresholds
    - Window Caulking
    - Outlet Cover Plates and Gaskets
    - Other (Wall, Floor or Ceiling Repair)
- Refrigerator and freezer replacement

Data provided by AMP showed that during FY20 and FY21, there were 274 participating homes producing 226,101 kWh in expected savings. Table 11 summarizes the number of measures distributed during each program year, and Table 2 summarizes program participation, expected savings, verified savings and program realization rates.

Table 11: Summary of Measures

Measure	Unit	Total-FY20	Total-FY21	Total
Energy Efficiency Measures				
Energy Education	Household	47	139	**186**
LED Screw-Ins	Lamp	749	1,373	**2,122**
LED Fixtures	Fixture	291	768	**1,059**
Bathroom Light Switch	Fixture	0	0	**0**
Tier 2 Advanced Power Strips	Fixture	12	94	**106**
Ref. Replacement - 15CF	Fixture	6	5	**11**
Ref. Replacement - 18CF	Fixture	8	14	**22**
Refrigerator Recycling	Fixture	14	19	**33**
Premium Chest Freezer	Fixture	0	0	**0**
4 Foot T8/T12 to LED 1-bulb with Ballast	Bulb	27	108	**135**
Plug-in LED Night Light	Fixture	0	0	**0**
Additional Measures for all Electric Homes				
Programmable Thermostats	Fixture	0	0	**0**
Thermostatic Shower Start	Fixture	0	0	**0**
Faucet Aerators	Fixture	2	1	**3**
Low Flow Showerheads	Fixture	4	0	**4**
Low Flow Showerheads with thermovalve	Fixture	1	0	**1**
Hot Water Heater Blanket	System	0	0	**0**
Pipe Wrap	Linear Ft.	0	0	**0**
Common Area & Exterior Lighting Measures				
Exterior Lighting LED Fixture	Fixture	0	0	**0**
Exterior Lighting LED Retrofit Kit	Fixture	0	0	**0**
Common Area LED Fixture	Fixture	0	0	**0**
Optional Measures for All Households				
Lint Cleaning from Dryer and the Vent	System	24	85	**109**
Ref. Brush, Cleaning & Education	System	1	0	**1**
Clothing Washer Temperature Adjustment	System	0	0	**0**
Weatherization - Attic Access Weatherstripping	Fixture	0	0	**0**
Weatherization - Door Weatherstripping	Fixture	50	12	**62**
Weatherization - Door Sweeps and Thresholds	Fixture	3	0	**3**
Weatherization - Window Caulking	Home	1	2	**3**
Weatherization - Outlet Cover Plates and Gaskets	Home	25	8	**33**
Weatherization - Other (Wall, Floor or Ceiling Repair)	Home	2	2	**4**
Weatherization - Other (Plumbing Penetrations)	Fixture	18	5	**23**
Totals:		**1,285**	**2,635**	**3,920**

Table 12: Summary of Program Participation and Savings

Totals	# of Projects	Expected kWh	Verified kWh	kWh Realization
FY20	90	69,412	47,432	68.3%
FY21	184	156,689	112,960	72.1%
Totals:	**274**	**226,101**	**160,392**	**70.9%**

3.2 Impact Evaluation

The Evaluators reviewed program tracking data, invoices, narratives, and internal reports from AMP. The validation effort was based on the CMUA TRM and CA eTRM UES values. Additionally, expected and verified savings for optional weatherization measures were sourced from the City of Palo Alto[3]. Further, during participant surveys the Evaluators addressed installation persistence. The results of this portion of the survey were not statistically significant but are detailed below in Figure 12. Verified UES values for measures installed are presented in Table 13 below.

Table 13: Unit Energy Savings (UES)

Measure	Unit	kWh/unit
LED Screw-Ins	Per Lamp	29
LED Fixtures	Per Fixture	57
Tier 2 Advanced Power Strips	Per Fixture	212
Refrigerator replacement - 15CF	Per Fixture	40
Refrigerator replacement - 18CF	Per Fixture	50
Refrigerator Recycling	Per Fixture	308
4 Foot T8/T12 to LED 1-bulb WITH Ballast (high usage)	Per Bulb	17
Faucet Aerators	Per Fixture	48
Low Flow Showerheads	Per Fixture	64
Low Flow Showerheads with thermovalve	Per Fixture	215
Weatherization - Door Weatherstripping	Per Fixture	3
Weatherization - Door Sweeps and Thresholds	Per Fixture	3
Weatherization - Window Caulking	Per Home	2
Weatherization - Outlet Cover Plates and Gaskets	Per Home	2
Weatherization - Other (Plumbing Penetrations)	Per Fixture	2

3.2.1 VERIFIED SAVINGS ESTIMATES

Table 14 shows expected and verified savings by measure.

[3] https://www.cmua.org/Files/Reports/EMV/Palo%20Alto_FY2013_SelectPrograms.pdf

Table 14: Summary of Program Participation and Savings (FY20 and FY21 Combined)

Measure	Expected kWh	Verified kWh	kWh Realization
Energy Efficiency Measures			
LED Screw-Ins	101,856	62,427	61.3%
LED Fixtures	67,776	60,670	89.5%
Tier 2 Advanced Power Strips	22,472	22,472	100.0%
Ref. Replacement - 15CF	440	440	100.0%
Ref. Replacement - 18CF	1,100	1,100	100.0%
Refrigerator Recycling	20,328	10,164	50.0%
4 Foot T8/T12 to LED 1-bulb WITH Ballast (high usage)	11,205	2,230	19.9%
Additional Measures for all Electric Homes			
Faucet Aerators	144	145	100.6%
Low Flow Showerheads	256	258	100.6%
Low Flow Showerheads with thermovalve	215	226	105.1%
Optional Measures for All Households			
Weatherization - Door Weatherstripping	143	143	100.0%
Weatherization - Door Sweeps and Thresholds	9	9	100.0%
Weatherization - Window Caulking	57	9	15.8%
Weatherization - Outlet Cover Plates and Gaskets	66	66	100.0%
Weatherization - Other (Plumbing Penetrations)	35	35	100.0%
Totals:	**226,101**	**160,392**	**70.9%**

3.2.2 DISCUSSION OF NON-100% REALIZATION

LED Screw-ins – Expected UES could not be located in the CMUA TRM or CA eTRM. The Evaluators reviewed equipment specifications provided by the implementor and determined that no TRM or eTRM line items would appropriately represent this measure.[4] Verified savings were calculated using the average wattage reduction (57W, based on equipment specs) and deemed hours and interactive factors from the CMUA TRM. The resulting verified kWh value represents actual equipment installed and are in line with the level of savings this measure typically produces.

LED Fixtures – Expected UES could not be located in the CMUA TRM or CA eTRM. The Evaluators reviewed equipment specifications provided by the implementor and determined that no TRM or eTRM line items would appropriately represent this measure.[5] Verified savings were calculated using the average wattage

[4] Specifically, given wattage ranges were poorly aligned.
[5] Specifically, given wattage ranges were poorly aligned.

reduction (111W, based on equipment specs) and deemed hours and interactive factors from the CMUA TRM. The resulting verified kWh value represents actual equipment installed and are in line with the level of savings this measure typically produces.

Refrigerator Recycling – Expected savings were sourced from the 2014 version of the CMUA TRM, which specified a UES of 616 kWh. Typically, savings values do not change significantly between iterations of such documents. However, in the case of appliances ENERGY STAR regulations regularly force efficiency levels higher. The result is that there is a diminishing difference between existing (baseline) appliances and new ENERGY STAR models. The 2017 CMUA compares new ENERGY STAR refrigerators against more efficient baseline models than the 2014 version, resulting in more up-to-date, but less substantial savings estimates.

4 Foot T8/T12 to LED 1-bulb WITH Ballast (high usage) – Expected UES could not be located in the CMUA TRM or CA eTRM. Evaluators reviewed equipment specifications provided by the implementor and determined that no TRM or eTRM line items would appropriately represent this measure.[6] Additionally, the CA eTRM provides estimated savings for T8-to-LED conversions but not for T12-to-LED. The Implementors provided the Evaluators with the specified wattage for the efficient equipment (12W). The CMUA TRM400 (nonres lighting) estimates a 1L 4' T12 lamp at 44W, which was used as the baseline wattage. Other factors, such as hours of use and interaction factors, were sourced from the CMUA TRM 204 (residential lighting) to calculate the resulting verified savings for this measure.

Low Flow Showerheads with thermovalve - Expected savings estimates were based on DEER climate zone 4, not climate zone 3, where AMP territory is located. Different groundwater temperatures result in slightly different savings values.

Weatherization: Window Caulking – Savings were derived from a Synergy database that was not available. However, referencing TRM document 203_Reduced_Building_Leakage, we see that no value of whole-home reduced leakage produces more than 16 kWh in savings, lower than the claim of 19 kWh for window caulking alone. Apportioning whole-home savings from a 15% overall reduction in a single story dwelling for each measure individually in a similar way to ex ante estimates yields 1.9 kWh in savings, more in line with other estimates. It is likely that “19” is a typo of “1.9.”

Other measures with kWh realization <1% different from expectations – Given the small magnitude of savings per measure, these differences can be attributed to rounding differences in expected and verified savings calculations and are of little to no consequence.

A further review and discussion of UES can be found in Appendix B: Review of EAP Plus UES.

3.2.3 OVERALL VERIFIED SAVINGS

Table 5 summarizes the total expected and verified savings in both program years.

[6] Specifically, this measure is more common in commercial settings, for which there are savings entries, though are premised on a different set of assumptions.

Table 15: Verified Program Savings and Realization

Program Year	Expected kWh Savings	Verified kWh Savings	kWh Realization Rate
FY20	69,412	47,432	68.3%
FY21	156,689	112,960	72.1%
Totals:	**226,101**	**160,392**	**70.9%**

The overall EAP Plus verified savings is 160,392 kWh, 70.9% of expected savings.

3.3 Process Evaluation

The findings of the following sections summarize the results of those interviews and surveys. Interview results are included in the "Program Design and Operations" section, while survey results are included in "EAP Plus Customer Survey Results".

3.3.1 PROGRAM DESIGN AND OPERATIONS

The Energy Assistance Program Plus (EAP Plus) started in 2019 as a means of providing lower income residents of Alameda additional energy assistance benefits. While the Energy Assistance Program (EAP) is a bill assistance program that provides enrollees a 25% discount on their energy bill, EAP Plus offers residents free home energy evaluations, as well as the recommended measure upgrades, free of charge.

All EAP participants are eligible for enrollment in EAP Plus. Table 16 outlines income eligibility criteria for EAP and EAP Plus. If residents meet income threshold they can apply for EAP; once enrolled in EAP, residents connect with Synergy – AMP's third-party implementer – to enroll in EAP Plus and are then scheduled for in-home energy evaluation. Before enrolling in EAP Plus, renters must get a signed waiver from their landlord indicating approval for any upgrades recommended by the home energy report.

Table 16: Income Eligibility Thresholds for EAP and EAP Plus

Household Size	Monthly Income	Annual Income
1	$3,996	$47,950
2	$4,567	$54,800
3	$5,138	$61,650
4	$5,708	$68,500
5	$6,167	$74,000
6	$6,625	$79,500
7	$7,079	$84,950
8	$7,538	$90,450

Customers learn about EAP Plus either through AMP or Synergy. AMP provides Synergy a list of all EAP participants and then Synergy reaches out to those customers via mailers, emails, or phone calls. According to Synergy staff, about half of EAP customers are interested in or enrolled in EAP Plus. The remaining customers cite lack of landlord approval, time constraints, or skepticism of the program as they primary barriers to enrolling in EAP Plus. When customers express a lack of landlord approval, Synergy employees will

reach out directly to the landlords to explain the program. Through these conversations, Synergy has learned that landlords' hesitancy stems from a fear that the technicians will damage their property, as well as a misunderstanding that tenants will take the upgraded equipment with them when they move. Although some landlords change their mind and agree to provide approval following further conversations with Synergy, some landlords still decline.

The home energy audit is conducted by a Synergy employee. The employee goes through a customer's home, tests appliances, and asks a range of questions regarding the equipment and energy usage. Following the audit, the Synergy employee provides customers an explanation on how they can improve their energy usage, as well as recommendations for upgrades. Customers can then agree to the upgrades, and then a Synergy technician installs all the upgrades for free. All of the installations are conducted by Synergy employees, and thus there is no trade ally network.

EAP Plus offers a wide range of measures to participants, including LEDs, smart power strips, light fixtures, night lights, weatherization measures for all-electric homes (i.e., door sweeps, door gaskets, window gaskets), and refrigerator replacement (only available for customers who have had their refrigerator more than 20 years). Each unit or home can participate in the program once every 2-3 years, regardless of whether or not the residence has changed occupancy in that time. Program staff acknowledge that this rule creates a barrier to participation, as there can be high turnover in rental units. Additionally, homes or apartment units that receive both electric and gas services must enroll in two separate programs to be eligible for weatherization measures. Specifically, homes that have some gas appliances are not eligible for weatherization upgrades through AMP, and instead must receive those services through PG&E. Although Synergy manages both AMP's and PG&E's programs and can connect customers to the PG&E program, this additional step creates more paperwork and another income verification process that some customers find troubling.

According to program staff, program enrollment has declined since 2019. Staff believe the program has hit a saturation point and is interested in exploring expanded eligibility criteria as well as marketing techniques. Because EAP Plus is a public benefit program, program goals are based on participation rates, rather than energy savings. The program has ample funding available through REC funds and staff are motivated to helps as many residents as possible.

3.3.2 EAP PLUS CUSTOMER SURVEY RESULTS

Program participants were contacted via phone to complete the survey. AMP provided evaluators a list of 264 participants to contact. Participants were contacted 4-5 times via phone. No other contact information was provided.

Evaluators were able to complete surveys for 25 participants, for a 9.4% response rate. Table 17 provides a more detailed breakdown of the recruitment efforts.

Table 17: Recruitment Status for EAP Plus Survey

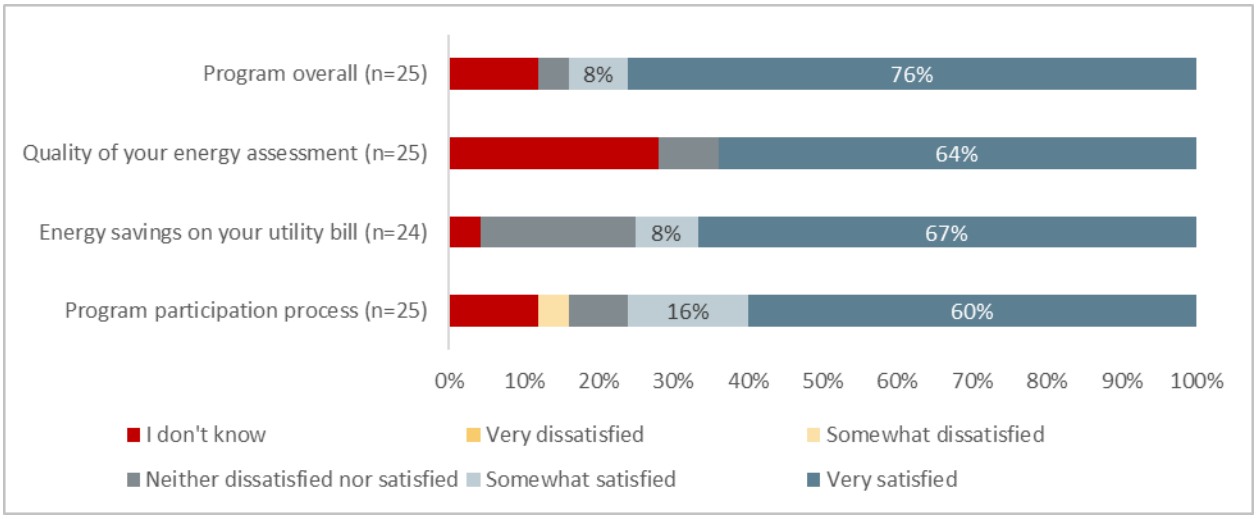
Recruitment Status	n
Complete	25
Partial complete	7
Left message	50
No answer	65

Refusal	45
Bad number/Technical difficulties	36
Language barrier	27
Screened out	9
Total	**264**

3.3.2.1 Program Satisfaction

All but one respondent indicated they were either very satisfied or satisfied with the EAP Plus program overall; the remaining respondent noted being satisfied nor dissatisfied (Figure 5). Moreover, respondents expressed high satisfaction the quality of their energy assessment, their energy savings, and the program participation process (Figure 5). About three-quarters (76%, n=19) of participants indicated they were somewhat or very likely to recommend the program to a friend, relative, or colleague.

Figure 5: Program Satisfaction



Almost all respondents noted that Alameda Municipal Power was a very reliable or reliable source of information regarding energy savings for their homes (84%, n=21). About three-quarters of respondents (76%, n=19) indicated that participating in EAP Plus increased their satisfaction with Alameda Municipal Power.

Despite this overall satisfaction, some respondents indicated that they wished AMP provided additional services (Table 18).

Table 18: Requested Services (n=5)

Service	n
Window sealing or window replacement	3
Washers/dryers	1
Water heaters	1
Rate discounts	1

3.3.2.2 Program Awareness

A little less than half of respondents learned about the program through a mailing or bill insert sent by AMP (48%, n=12) (Figure 6). Respondents were mostly interested in participating in the program to save money on energy bills (60%, n=15) and save energy (32%, n=8) (Figure 7).

Figure 6: Program Awareness (n=25)

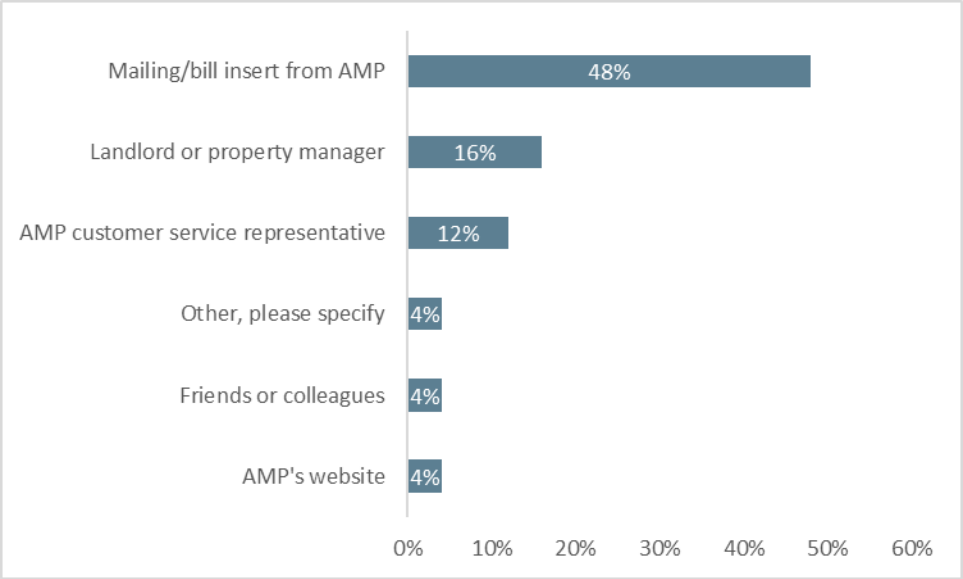
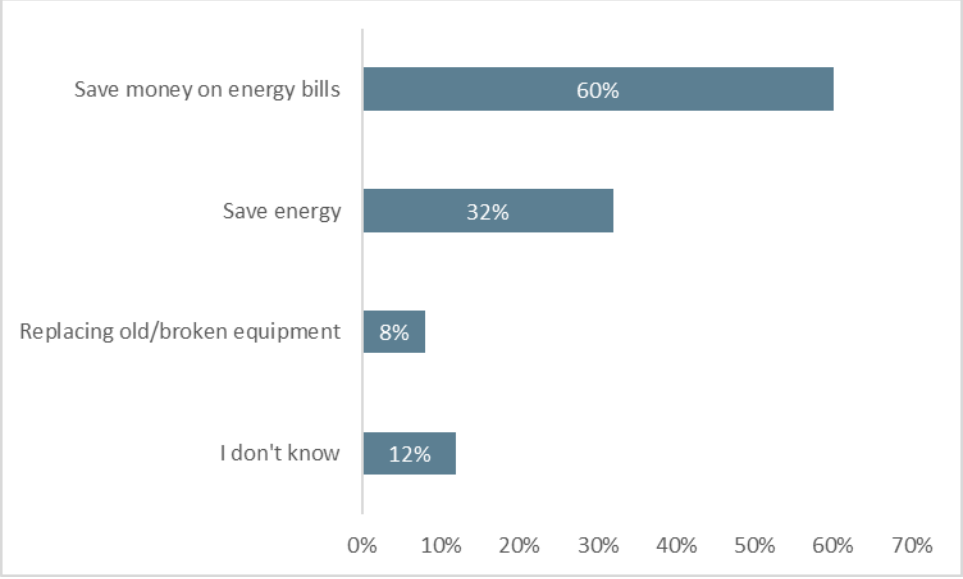
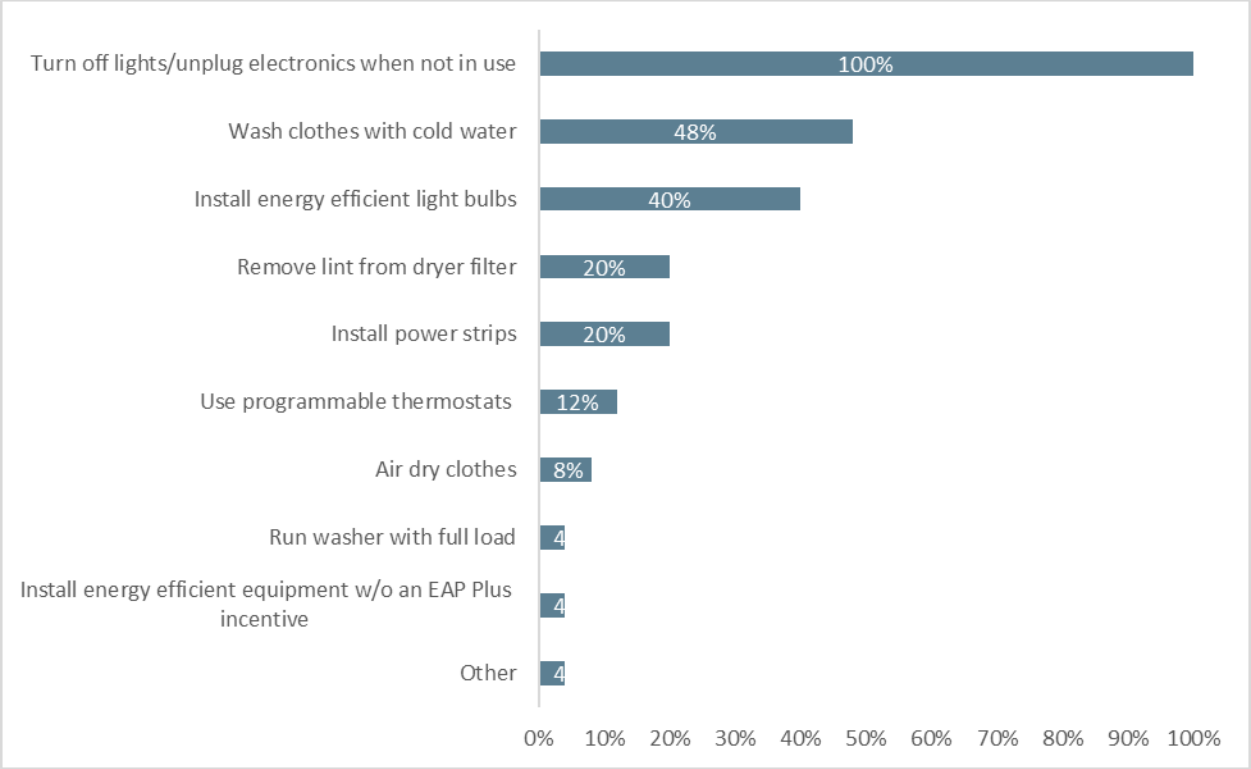


Figure 7: Motivation for Participation (n=25)



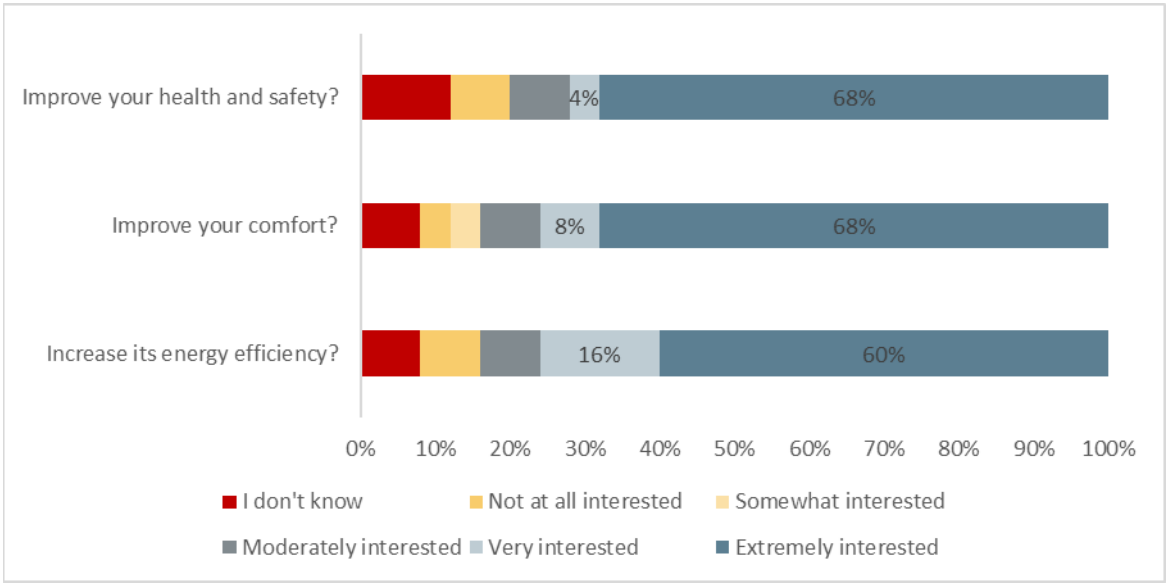
The majority of respondents (80%, n=20) indicated that prior to participating in EAP Plus they were either somewhat or very familiar with energy saving behaviors like washing clothes with cold water, turning off the lights when not in use, and adjusting heating system settings. All respondents noted they turn off lights or unplug equipment when not in use, and about half noted they wash their clothes with cold water (Figure 8)

Figure 8: Energy Saving Behaviors (n=25)



Three-quarters of respondents also indicated that prior to participating in EAP Plus they were very or extremely interested in increasing their home's energy efficiency (76%, n=19), improving their comfort (76%, n=19), and improving their health and safety (72%, n=18) (Figure 9). Forty percent (n=10) had previously installed energy efficient equipment in their homes.

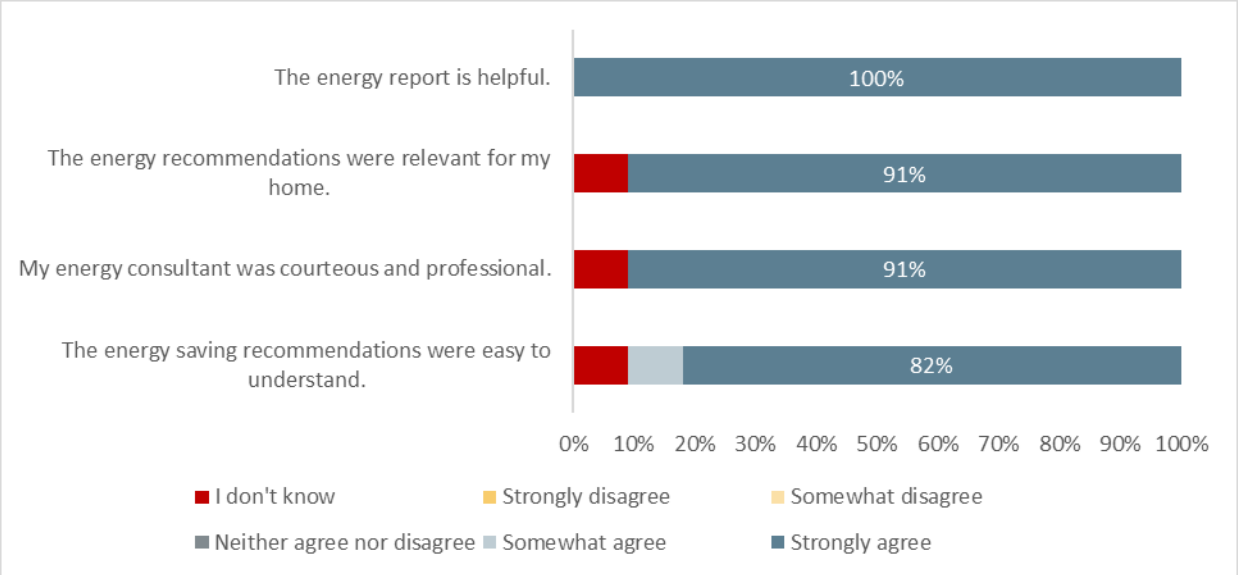
Figure 9: Interest in Energy Efficiency (n=25)



3.3.2.3 Home Energy Assessment

Just under half of respondents remember receiving a home energy assessment through EAP Plus (46%, n=12). Among those respondents, all indicated the process of scheduling the assessment was either somewhat or very easy. Additionally, almost respondents noted that the energy report was helpful and included relevant recommendations, and that the energy consultant was courteous, and the recommendations were easy to understand (Figure 10).

Figure 10: Energy Assessment (n=11)



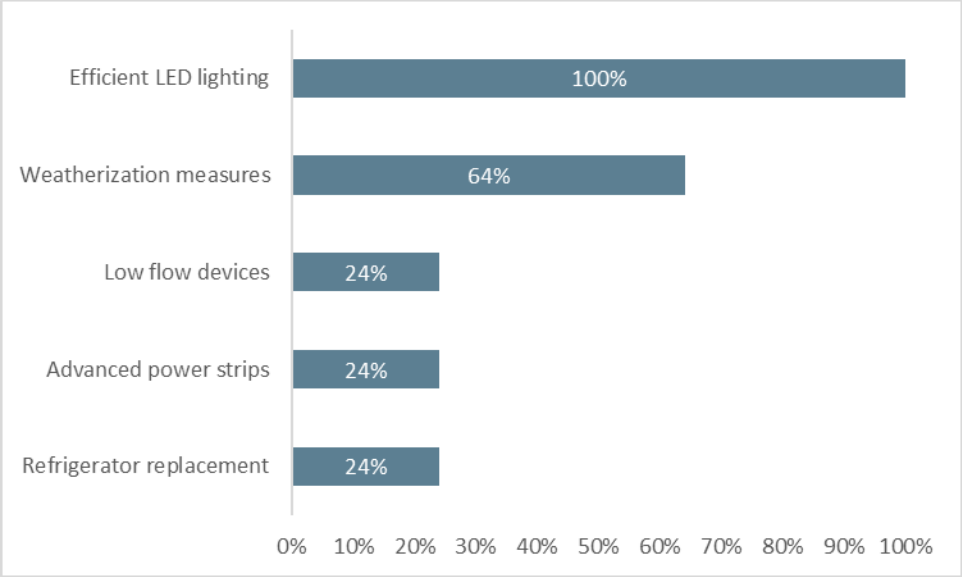
Some respondents provided suggestions for additional topics to include in future energy consultation. These suggestions included an explanation regarding the portion of utility bill that goes to Alameda community, as well as more information about why other utilities offer other measures, like window weatherization, that AMP does not.

3.3.2.4 Program Participation

More than three-quarters of respondents indicated participating in EAP Plus was an easy decision (77%, n=20). Many respondents do not remember if they received any educational materials as part of their participation in the program (72%, n=18).

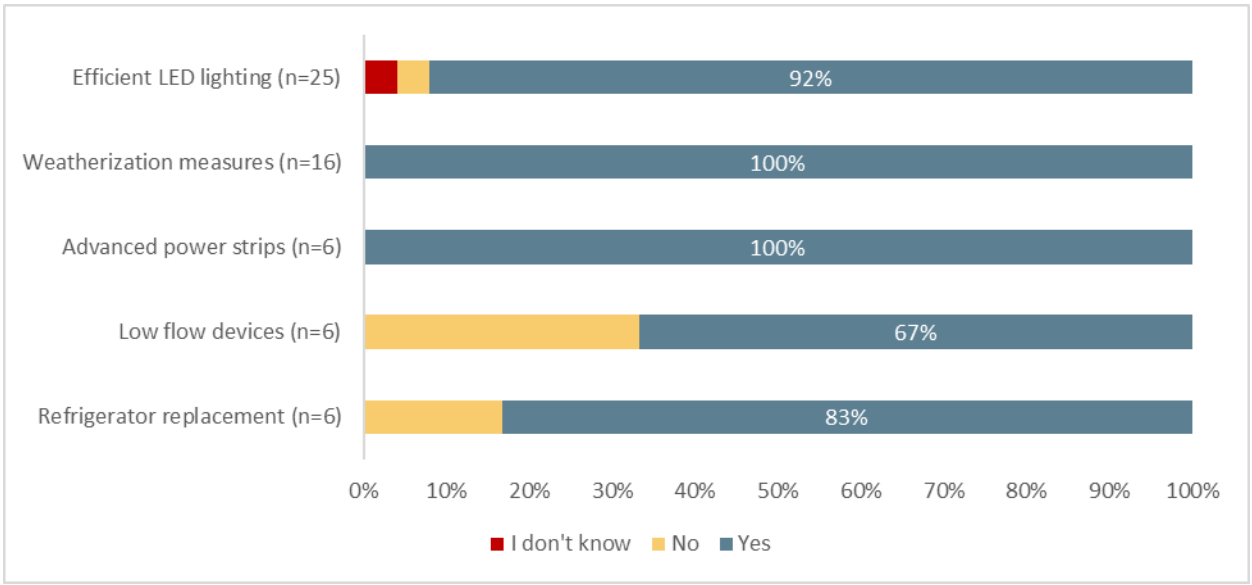
All respondents received LED lighting upgrades, while about two-thirds received weatherization measures, one-quarter received low flow devices, one-quarter received advanced power strips, and one quarter received a refrigerator replacement (Figure 11).

Figure 11: Measures Received (n=25)



In general, respondents' equipment is still installed and functioning (Figure 12). Reasons equipment is not currently installed include no longer working (refrigerator=1; LED lighting=1) or not liking the way it looked (low flow device=2).

Figure 12: Equipment Status



3.3.2.5 Demographics

About half of respondents own and occupy their home (52%, n=13), while 44% (n=11) rent. Among renters, 91% indicated that their landlord knew about EAP Plus when they approached them to get approval, and all the landlords approached were ultimately amenable to the program.

Just over two-thirds of respondents use natural gas to fuel their home (68%, n=17) and the majority of respondents do not have central air conditioning (88%, n=22).

About half of respondents live alone (46%, n=11), while 17% live with one other person (n=4), one-quarter live with two other people (n=6), and 13% live with three or more people (n=3). Half of respondents are 65 years older or older (n=12), one-third were 45-64 years old (n=8), and the remaining were 25-44 years old (n=3).

3.4 Conclusions

Conclusion 1 – The overall EAP Plus verified savings is 160,392 kWh and 12.96 kW70.9% and 1.4% of their respective expected savings.

Conclusion 2 – UES for several measures did not align with the CMUA TRM 2017 or the CA eTRM. Refrigerator recycling used an outdated savings source whose UES was twice that of the most up-to-date source. Lighting measures, which constitute 80% of program savings, appeared to come from measure configurations unlikely found in the program or were developed using commercial hours of operation.

Conclusion 3 – Customers satisfaction with EAP Plus is high. Not only did all respondents express satisfaction with the program, but the majority of respondents also indicated that the decision to participate the program was easy. Additionally, most participants were likely to recommend the program to a friend.

Conclusion 4 – EAP and EAP Plus struggle to enroll all eligible customers: To-date, fewer than 10% of the total eligible customers are enrolled in EAP, with even fewer enrolled in EAP Plus. A variety of reasons can explain why enrollment rates are so much lower than eligibility rates. This gap in uptake may stem from a variety of factors, including application burden, lack of awareness, landlord agreeableness, other logistical issues, stigma, and income volatility.

3.4.1 EDUCATIONAL OUTCOMES

Ninety percent of respondents noted that the energy report was helpful and included recommendations relevant to their home, and that the energy consultant was courteous, and the recommendations were easy to understand (Figure 10)

Twenty percent of respondents stated they remember receiving education materials, while 8% said they did not, and the reminding 72% could not remember. Of those who remembered, they stated that they received ‘booklets/brochures.’

The majority of respondents (80%, n=20) indicated that prior to participating in EAP Plus they were either somewhat or very familiar with energy saving behaviors like washing clothes with cold water, turning off the lights when not in use, and adjusting heating system settings. All respondents noted they turn off lights or unplug equipment when not in use, and about half noted they wash their clothes with cold water (Figure 8). Below, Table 19 shows reported energy savings behaviors before and after program participation.

Table 19: Energy Savings Behaviors Before and After Program Participation

Behavior	Before Participating	After Participating
Install energy efficient equipment with an incentive through the Energy Plus program	2	0
Install energy efficient equipment without an incentive from the Energy Plus program	1	1
Use programmable thermostats to better control ambient temperature	2	3
Turn off lights when not in use	23	22
Use motion sensing lights that turn off when no one is in the room	0	1
Wash clothes with cold water	12	12
Remove lint from dryer filter	5	5
Install energy efficient light bulbs (e.g. LEDS, CFLs)	9	10
Install power strips	2	5
Other:	6	8

Forty five percent of participants reported completing all efficiency improvements recommended to them after the assessment. An additional 18% stated they completed some of the improvements. 36% did not know.

3.5 Recommendations

Recommendation 1 – Require implementation contractors to provide sources or supporting documents for each UES proposed. Most measures did not state a source or the source was vague. In many cases, the UES did not correspond with the measure and measure configuration specified.

Recommendation 2 – Consider revising UES used for lighting and other measures. The Evaluators conducted a review of all UES used in the EAP Plus program. Specific suggested values and rationale for updates are discussed in section Appendix B: Review of EAP Plus UES.

Recommendation 3 – Collect email addresses: When enrolling participants into EAP and EAP Plus, AMP staff should collect customers' email addresses. Not only do emails provide an additional contact source for surveys and feedback forms, but more importantly, they provide AMP an additional marketing and communications outlet for promoting the program and increasing engagement.

Recommendation 4 – Diversify marketing strategies: Currently, EAP Plus fails to enroll all eligible participants. AMP should look to implementing more diverse and innovative marketing strategies in order to cast a wider net of applicants. Potential strategies include partnering with local community leaders, door-door canvassing, and more personalized push notifications (via phone, text, or email).

Recommendation 5 – Reduce application burden via categorical eligibility: Application burden, both on the side of the applicant and the administrator, is often one of the primary barriers to accessing social services and assistance. Although there are many ways in which AMP can reduce application burden, the Evaluators most strongly recommend the utility establishes categorical eligibility partnerships with other social service agencies, as well as allows for continuous enrollment. These strategies minimize the paperwork an applicant needs to submit, reduces the stigma associate with reporting income multiple times, as well as accounts for income volatility. A categorical eligibility partnership seems particularly relevant between AMP's EAP Plus

and PG&E's Energy Savings Assistance Program. Synergy manages both of these programs, and thus categorical eligibility, as well as automatic enrollment if feasible, would minimize the paperwork required for gas and electric customers to receive all the equipment upgrades their home needs (most notably weatherization measures for combo homes). This sort of partnership could also reduce stigma by reducing the number of times a customer needs to provide income information. Further, participation in PG&E CARE/FERA bill assistance programs for natural gas service can be used for this purpose as well.

Recommendation 6 – Increase landlord buy-in and engagement: AMP may be able to increase enrollment in EAP Plus through improved landlord engagement. Strategies to improve landlord engagement include providing discounted or free energy efficient upgrades to property owners who have a certain number of tenant participants, as well as through increase education regarding the marketability of energy efficient rental units. Landlords may be more amenable to tenant enrollment in EAP Plus if there is a direct benefit to them.

Recommendation 7 – Expand income eligibility criteria: Although the gap analysis demonstrates there is substantial room for increased engagement without expanding income eligibility criteria, AMP may consider expanding income eligibility criteria for its programs as a means of making the program more accessible to its service users. If AMP decides to expand its eligibility criteria, evaluators recommend using the Department of Housing and Urban Development's definition of "low income" (≤80% average median income for the county), as this is an accepted definition by other social service agencies.

Recommendation 8 – Phase out screw-in LEDs and LED fixtures: LED savings is premised on the assumption that baseline equipment is an incandescent or halogen lamp with adjusted baseline wattages compliant with EISA 2007 Regulations. The first of two advances of lighting standards from EISA 2007 Regulations were phased in from January 2012 to January 2014 and dictated higher efficiency for General Service Lamps (GSLs). Phase II took effect on July 25, 2022, stipulating that all GSLs sold in the United States (US) must achieve a minimum efficacy of 45 lumens/watt[7]. The ruling also significantly expands the definition of GSLs, extending the covered lumen range, base types, and shapes, while reducing the types of bulbs exempted[8].

The 45 lumen/watt efficacy requirement inherently disallows incandescent and halogen lamps, but the EISA backstop does not directly specify a technological standard to satisfy the efficacy requirement. LEDs are well beyond 45 lumens/W (very often operating at greater than 60 lumens/watt), and alternative technologies all fall below the new EISA backstop, effectively meaning that general service lamps which operate at 45 lumens/watts for common lighting categories are not available for purchase.

This precludes savings from LEDs in most program delivery channels however, the EAP Plus program relies on direct install of these items. Savings can still be realized through early replacement direct install program channels, where existing incandescent, halogen, CFL and other inefficient technologies can be directly identified. For this reason, direct install activities can continue after June 30, 2023 but no later than June 30, 2024: Incandescent and halogen lamps have roughly a one-year effective useful life, so any incandescent

[7] Federal Registrar document, page 27440: https://www.govinfo.gov/content/pkg/FR-2022-05-09/pdf/2022-09477.pdf
[8] Ibid.

lamp operating on June 30, 2023 will likely have burned out by June 30, 2024, with the only replacement option then being an LED.

Also, all projects that occur after June 30, 2023, should require that the program administrator “bag and tag” the old lamps, to be stored until a quarterly verification inspection is conducted by utility staff.

Please note that this recommendation is specific to screw-in LEDs and fixtures currently distributed by the program. The new regulations do not affect LED tubes used to replace fluorescent lamps – these lamps should remain in the program offerings for the foreseeable future.

4 APPENDIX A: METHODOLOGY

This section details general impact evaluation methodologies by program-type as well as data collection methods applied.

This section will present full descriptions of the following:

- Data collection procedures
- Gross savings estimation
- Sampling methodologies and
- Process evaluation methodologies.

4.1 Glossary of Terminology

As a first step to detailing the evaluation methodologies, the Evaluators would like to introduce a glossary of terms:

Ex Ante or Expected – Forecasted savings used for program and portfolio planning purposes (from the Latin for "beforehand").

Ex Post or Verified – Savings estimates reported by the Evaluators after the energy impact evaluation has been completed (From the Latin for "from something done afterward").

Measure – Energy saving device, unit, or service.

UES– **U**nit **E**nergy **S**avings is a single unitized savings estimate (e.g., savings per motor, savings per hp) that represent an average or weighted average of similar savings measures. UES measures were previously known as deemed savings measures.

Semi-custom Measure – An energy savings measure for which the savings estimates varies significantly depending on how or where the measure is used (project-specific parameters). Semi-custom measure savings are calculated using standard methodologies or standardized saving estimate models (e.g., spreadsheet models).

Custom measure – Any measure not defined by this manual as either a unit energy savings measure or a semi-custom measure. In more general terms, a custom measure is defined as an energy-related project, action, equipment change, or system improvement that reduces energy consumption

Realization Rate – Ratio of Ex Post Savings / Ex Ante Savings

Program Participant – Person, business or unique household receiving services or measures through program offerings.

The remainder of this section presents the general methodological approach taken in this evaluation, followed by individual program chapters, each of which cover the methodologies used in greater detail.

4.2 Overview of Methodology

This section discusses general methodology used in both impact and process evaluations.

4.2.1 DATA COLLECTION

Evaluation of both programs employed the following:

- A review of program tracking data
- A census review of projects completed
- Review of deemed savings parameters for custom projects
- Desk reviews of project documents, including invoices, photographs, narratives and internal reports
- Interviewing of program participants
- Interviews with program staff and implementors

4.2.2 IMPACT EVALUATION METHODS

The Evaluators used two major approaches to determining savings for AMP's residential and non-residential programs:

- **Deemed Savings:** This approach involves using stipulated savings for energy conservation measures for which savings values are well-known and documented. These are referred to as 'unit energy savings' (UES) by the CMUA TRM and CA eTRM. This approach was used in the evaluation of the EAP Plus program.
- **Partial Retrofit Isolation approach (IPMVP Option A):** For custom or otherwise non-deemed measures, the Evaluators reviewed the analyses and calculations that were used to develop savings values for the measures that are rebated through the program. An analysis for each measure was performed according to the degree to which the savings calculations are supported and defensible and documentation is adequate. To facilitate our review of savings calculations, the Evaluators used a checklist to record whether (1) the methodology used for the calculation was appropriate, (2) assumptions used were reasonable and appropriate, and (3) savings calculations were done correctly. This approach was used in the evaluation of the Energy Plus program.

Data for each program were collected through review of program materials provided by AMP. This included program tracking data, invoices, internal reports and narratives. The Evaluators reviewed program application documents for incented measures to verify the tracking data accurately represents the program documents. The Evaluators verified the quantity and quality of installations used to determine verified savings. The goal was to ensure that the proper measure unit savings were recorded and used in the calculation of AMP's ex-ante measure savings.

4.2.3 PROCESS EVALUATION METHODS

To assess program operations and effectiveness, the Evaluators completed a full process evaluation of both the Energy Plus and EAP plus programs.

Each evaluation included the following:

- **AMP Program Staff Interviews***.* The Evaluators conducted two in-depth interviews with AMP staff in charge of the Energy Plus and EAP Plus programs. These interviews are semi-structured, in having

general topics, without fully prescribed question and answer frameworks. The interviews focused on program operations, intended effects of the programs and program performance.

- **Implementation Staff Interviews**. The Evaluators conducted one in-depth interview with Synergy Companies staff, whose role it was to implement the EAP Plus program on behalf of AMP. The interview was are semi-structured, in having general topics, without fully prescribed question and answer frameworks. The interview focused on program operations, intended effects of the programs and program performance. Ecology Action, who implemented the Energy Plus program, were contacted multiple times for an interview, but declined.
- **Participant Surveys.** The Evaluators surveyed samples of participants in each program to collect feedback on sources of program awareness, the participation process, and satisfaction with the program. Participants were also asked questions about whether the equipment was still installed and operating.

The number of completed surveys for each program is summarized in Table 20.

Table 20: Number of Participant Surveys Completed

Program	# Completed
Energy Plus	4
EAP Plus	25

5 APPENDIX B: REVIEW OF EAP PLUS UES

As part of the evaluation, savings sources and Unit Energy Savings (UES) values for all program measures offered were inspected for accuracy and consistency, but also for appropriateness for the application. This review was performed on the more recent 2021 measures and savings list provided by AMP, which differs slightly from the savings list used during FY20 and FY21. The goal is not to discuss differences in the two lists or to audit a previous program year using newer sources, rather it is to ensure that the best possible savings estimates are being used going forward.

The California Municipal Utilities Association TRM (CMUA TRM) and California eTRM cover the majority of measures offered through the program and provide reliable and appropriate kWh savings estimates for the program. Below, we discuss measure savings which are not sourced from either of the above-mentioned sources, and well as provide suggestions for using different assumptions and thus different UES from the current values.

Note: The CMUA TRM includes a set of 505 spreadsheets that detail UES and provide calculators for various measures. Below, we reference the CMUA and calculator numbers used (e.g. CMUA TRM 204 would be spreadsheet #204, 'TRM204_residential LED_v3 15 2016').

5.1 Screw-In LEDs

This measure constitutes 45% of program expected savings.

Table 21: Screw-In LEDs Savings Suggestions

Measure	Unit	Current kWh/unit	Current Savings Source	Rec. kWh/unit	Rec. Savings Source
Screw-In LEDs	lamp	48	CMUA TRM 204 (as noted in program docs)	29	Actual wattages and deemed inputs from CMUA TRM 204

Rationale Original UES values or calculations supporting them were not available through the implementor. The Evaluators were able to obtain equipment specifications for these lamps, as well as the baseline lamps that they usually replaced in homes. No appropriate entries in the CMUA TRM or eTRM were applicable to these, as wattage range assumptions were not well-aligned. Using averaged pre and post wattages (67.5W, 10.5W, respectively) and deemed inputs from the CMUA TRM, the Evaluators calculated appropriate per-unit kWh values. The Evaluators recommend using a 29 kWh UES in future calculations for this measure.

5.2 LED Fixtures

This measure constitutes 30% of program expected savings.

Table 22: LED Fixtures Savings Suggestions

Measure	Unit	Current kWh/unit	Current Savings Source	Rec. kWh/unit	Rec. Savings Source

LED Fixtures	fixture	78	CMUA TRM 400 (as noted in program docs)	57	Actual wattages and deemed inputs from CMUA TRM 204

Rationale: Original UES values or calculations supporting them were not available through the implementor. The Evaluators were able to obtain equipment specifications for these lamps, as well as the baseline lamps that they usually replaced in homes. No appropriate entries in the CMUA TRM or eTRM were applicable to these, as wattage range assumptions were not well-aligned. Using averaged pre and post wattages (135W, 24W, respectively) and deemed inputs from the CMUA TRM, the Evaluators calculated appropriate per-unit kWh value.

The Evaluators recommend using 57 kWh in future calculations for this measure.

5.3 4 Foot T8/T12 to LED 1- bulb WITH ballast (high usage)

Table 23: 4' T8/T12 to LED Tube Savings Suggestions

Measure	Unit	Current kWh/unit	Current Savings Source	Rec. kWh/unit	Rec. Savings Source
4' T8/T12 to LED	lamp	83	CMUA TRM 400 (as noted in program docs)	17	Actual wattages and deemed inputs from CMUA TRM 204

Rationale: Original UES values or calculations supporting them were not available through the implementor. The Evaluators were able to obtain equipment specifications for these lamps, as well as the baseline lamps that they usually replaced in homes. The CA eTRM provides estimated savings for T8-to-LED conversions, but not for T12-to-LED. Using a post wattage (12W), provided by the implementors, and a baseline wattage (44W) sourced from the CMUA TRM400, plus and deemed inputs from the CMUA TRM, the Evaluators calculated appropriate per-unit kWh value.

The Evaluators recommend using a 17 kWh UES in future calculations for this measure.

5.4 Tier 2 Advanced Power Strips

Table 24: Advanced Power Strips Savings Suggestions

Measure	Unit	Current kWh/unit	Current Savings Source	Rec. kWh/unit	Rec. Savings Source
Tier 2 Advanced Power Strips	Power strip	212	CMUA TRM503	189	CA eTRM SWAP010-01

Rationale: The CA eTRM provides savings for both SF and MF and the Evaluators used program tracking data to develop a single weighted savings value applicable to both.

The Evaluators recommend using 189 kWh per power strip.

5.5 Programmable Thermostats

Rationale: It is unclear where 176 kWh/dwelling is sourced from or how it was derived.

The CA eTRM SWHC039-04 workbook provides estimates for direct install Programmable Smart Thermostats for both single family and multifamily dwellings (13 and 45.3 kWh, respectively). Using program tracking data from FY20 and FY21 EAP Plus, the Evaluators applied a weighted average to these values resulting in 30.2 in kWh savings.

Table 25: Programmable Thermostats Savings Suggestions

Measure	Unit	Current kWh/unit	Current Savings Source	Rec. kWh/unit	Rec. Savings Source
Programmable Thermostats	Thermostat	176	CMUA TRM 400 (as noted in program docs)	30	CA eTRM SWHC039-04

The Evaluators recommend using a 30 kWh UES in future calculations for this measure.

5.6 Weatherization: Window Caulking

Table 26: 4' T8/T12 to LED Tube Savings Suggestions

Measure	Unit	Current kWh/unit	Current Savings Source	Rec. kWh/unit	Rec. Savings Source
Wx: Window Caulking	home	19	proprietary	1.9	CA eTRM 'Reduced Building Leakage'

Rationale - Referencing TRM document 203_Reduced_Building_Leakage, we see that no value of whole-home reduced leakage produces more than 16 kWh in savings, lower than the claim of 19 kWh for window caulking alone. Apportioning whole-home savings from a 15% overall reduction in a single-story dwelling for each measure individually in a similar way to ex ante estimates yields 1.9 kWh in savings, more in line with other estimates. It is likely that "19" is a typo of "1.9."

The Evaluators recommend using a value of 2 kWh/home for expected savings.

6 APPENDIX C: COMMERCIAL SITE REPORTS

This section contains individual sites reports and projects details for each of the Energy Plus project evaluations.

Project Number: 1

Project Background

This participant is an office building that received rebates from AMP for exterior lighting retrofits. The Evaluators verified the participant had performed the following retrofits:

- (5) 17W LED PAR38s replaced (5) 75W MVs

M&V Methodology

The Evaluators reviewed all project-related data, such as program tracking data, invoices, savings calculations, photos and equipment specs sheets. Site personnel involved in the project were contacted in order to verify the installation and operation of the rebated equipment. This project contained retrofits in both conditioned and unconditioned spaces, as well as custom lighting annual hours of operation. Verified savings calculations used common default factors from the CMUA TRM and custom lighting hours of operation specific to the project were verified using project documents, site contact interviews and publicly-available information. Parameters used in calculating savings for this site are shown in Table A:

Table A. Savings Parameters

Facility Type	Lighting Annual Operating Hours	HVAC IEF_e
Exterior	Custom; 4,102	1.00

Savings Calculations

Using values from the tables above, the Evaluators calculated lighting savings as follows:

Table B. Lighting Retrofit Verified Savings Calculations

Measure	Quantity	Wattage		AOH	HVAC IEF_e	Expected kWh	Verified kWh	kWh RR
		Base	Post					
75W MVs to 17W LED PAR38s	5	93	17	4102	1.00	1,559	1,559	100.0%
Totals:						**1,559**	**1,559**	**100.0%**

Results

The kWh realization rate for project #1 is 100.0%.

Table C. Verified Gross Savings & Realization Rates

Measure	Verified kWh Savings	Realization Rate
75W MVs to 17W LED PAR38s	1,559	100.0%
Totals:	**1,559**	**100.0%**

Project Number: *2*

Project Background

This participant is an office building that received rebates from AMP for exterior lighting retrofits. The Evaluators verified the participant had performed the following retrofits:

- (1) 22W LED wall packs replaced (1) 100W MHs
- (3) 95W LED wall packs replaced (3) 250W MHs
- (4) 17W LED PAR38s replaced (4) 75W MVs

M&V Methodology

The Evaluators reviewed all project-related data, such as program tracking data, invoices, savings calculations, photos and equipment specs sheets. Site personnel involved in the project were contacted in order to verify the installation and operation of the rebated equipment. This project contained retrofits in both conditioned and unconditioned spaces, as well as custom lighting annual hours of operation. Verified savings calculations used common default factors from the CMUA TRM and custom lighting hours of operation specific to the project were verified using project documents, site contact interviews and publicly-available information. Parameters used in calculating savings for this site are shown in Table A:

Table A. Savings Parameters

Facility Type	Lighting Annual Operating Hours	HVAC IEF_e
Exterior	Custom; 4,102	1.00

Savings Calculations

Using values from the tables above, the Evaluators calculated lighting savings as follows:

Table B. Lighting Retrofit Verified Savings Calculations

Measure	Quantity	Wattage		AOH	HVAC IEF_e	Expected kWh	Verified kWh	kWh RR
		Base	Post					
100W MHs to 22W LED wall packs	1	128	22	4102	1.00	435	435	100.0%
250W MH s to 95W LED wall packs	3	295	95	4102	1.00	2,461	2,461	100.0%
75W MVs to 17W LED PAR38s	4	93	17	4102	1.00	1,247	1,247	100.0%
Totals:						**4,143**	**4,143**	**100.0%**

Results

The kWh realization rate for project #2 is 100.0%.

Table C. Verified Gross Savings & Realization Rates

Measure	Verified kWh Savings	Realization Rate
100W MHs to 22W LED wall packs	435	100.0%
250W MH s to 95W LED wall packs	2,461	100.0%
75W MVs to 17W LED PAR38s	1,247	100.0%
Totals:	**4,143**	**100.0%**

Project Number: *3*

Project Background

This participant is a grocery store that received rebates from AMP for interior lighting retrofits. The Evaluators verified the participant had performed the following retrofits:

- (3) 22W LED strips replaced (3) fluorescent T8s
- (5) 32W LED strips replaced (5) fluorescent T8s
- (1) 4W LED 'Exit' fixtures replaced (1) 15W incandescent 'Exit' sign fixtures
- (1) 22W LED strips replaced (1) fluorescent T8s
- (1) 22W LED strips replaced (1) fluorescent T8s
- (1) 32W LED strips replaced (1) fluorescent T8s
- (1) 4W LED 'Exit' fixtures replaced (1) 15W incandescent 'Exit' sign fixtures
- (1) 65W LED strips replaced (1) fluorescent T8s
- (1) 4W LED 'Exit' fixtures replaced (1) 15W incandescent 'Exit' sign fixtures

M&V Methodology

The Evaluators reviewed all project-related data, such as program tracking data, invoices, savings calculations, photos and equipment specs sheets. Site personnel involved in the project were contacted in order to verify the installation and operation of the rebated equipment. This project contained retrofits in both conditioned and unconditioned spaces, as well as custom lighting annual hours of operation. Verified savings calculations used common default factors from the CMUA TRM and custom lighting hours of operation specific to the project were verified using project documents, site contact interviews and publicly-available information. Parameters used in calculating savings for this site are shown in Table A:

Table A. Savings Parameters

Facility Type	Lighting Annual Operating Hours	HVAC IEFe
Grocery	Custom, varies by space	0.87

Savings Calculations

Using values from the tables above, the Evaluators calculated lighting savings as follows:

Table B. Lighting Retrofit Verified Savings Calculations

Measure	Quantity	Wattage		AOH	HVAC IEFe	Expected kWh	Verified kWh	kWh RR
		Base	Post					
fluorescent T8s to 22W LED strips	3	93	22	5,840	0.87	1,445	1,082	74.9%
fluorescent T8s to 32W LED strips	5	93	32	5,840	0.87	1,870	1,550	82.9%
15W incandescent 'Exit' sign fixtures to 4W LED 'Exit' fixtures	1	30	4	8,760	0.87	239	198	82.8%
fluorescent T8s to 22W LED strips	1	93	22	5,840	0.87	482	361	74.9%
fluorescent T8s to 22W LED strips	1	60	22	5,840	0.87	268	193	72.0%
fluorescent T8s to 32W LED strips	1	60	32	5,840	0.87	172	142	82.6%

Measure	Quantity	Wattage		AOH	HVAC IEFe	Expected kWh	Verified kWh	kWh RR
		Base	Post					
15W incandescent 'Exit' sign fixtures to 4W LED 'Exit' fixtures	1	30	4	8,760	0.87	239	198	82.8%
fluorescent T8s to 65W LED strips	1	219	65	5,840	0.87	944	782	82.8%
15W incandescent 'Exit' sign fixtures to 4W LED 'Exit' fixtures	1	30	4	8,760	0.87	239	198	82.8%
fluorescent T8s to 22W LED strips	3	93	22	5,840	0.87	1,445	1,082	74.9%
fluorescent T8s to 32W LED strips	5	93	32	5,840	0.87	1,870	1,550	82.9%
15W incandescent 'Exit' sign fixtures to 4W LED 'Exit' fixtures	1	30	4	8,760	0.87	239	198	82.8%
Totals:						**5,898**	**4,705**	**79.8%**

Results

The kWh realization rate for project #3 is 79.8%. Measure realization varies by line as ex ante savings calculations used energy interactive factors specific to the room, rather than the overall building or large space type. HVAC interactive factors are developed using simulation models of specific building types and do not vary room-by-room like custom lighting hours may; they are applicable to a building as a whole. Building type-specific interactive factors were used in the calculation of verified savings for conditioned spaces, resulting in variation in measure-level realization and lower realization overall. This is the driver of the low kWh realization rate.

Table C. Verified Gross Savings & Realization Rates

Measure	Verified kWh Savings	Realization Rate
fluorescent T8s to 22W LED strips	1,082	74.9%
fluorescent T8s to 32W LED strips	1,550	82.9%
15W incandescent 'Exit' sign fixtures to 4W LED 'Exit' fixtures	198	82.8%
fluorescent T8s to 22W LED strips	361	74.9%
fluorescent T8s to 22W LED strips	193	72.0%
fluorescent T8s to 32W LED strips	142	82.6%
15W incandescent 'Exit' sign fixtures to 4W LED 'Exit' fixtures	198	82.8%
fluorescent T8s to 65W LED strips	782	82.8%
15W incandescent 'Exit' sign fixtures to 4W LED 'Exit' fixtures	198	82.8%
Totals:	**4,705**	**79.8%**

Project Number: *4*

Project Background

This participant is a religious gathering facility that received rebates from AMP for interior and exterior lighting retrofits. The Evaluators verified the participant had performed the following retrofits:

- (8) 9W LED lamps replaced (8) 18W CFLs
- (2) LED PAR30 lamps replaced (2) incandescent PAR90 lamps
- (14) 31W LED fixtures replaced (14) fluorescent T8s
- (4) 7W LED lamps replaced (4) 13W CFLs
- (2) 7W LED lamps replaced (2) 13W CFLs
- (11) 7W LED lamps replaced (11) 13W CFLs
- (1) 7W LED lamps replaced (1) 13W CFLs
- (9) 18W LED lamps replaced (9) 23W CFLs
- (18) 7W LED lamps replaced (18) 13W CFLs
- (1) 9W LED lamps replaced (1) 60W incandescent lamps
- (4) LED T8 tubes replaced (4) fluorescent T8s
- (4) LED BR20 lamps replaced (4) incandescent PAR50 lamps
- (1) LED T8 tubes replaced (1) fluorescent T8s
- (1) LED T8 tubes replaced (1) fluorescent T8s
- (1) 18W LED fixtures replaced (1) 45W CFL fixtures
- (1) 18W LED fixtures replaced (1) 45W CFL fixtures
- (1) 18W LED fixtures replaced (1) 45W CFL fixtures
- (1) 18W LED fixtures replaced (1) 45W CFL fixtures
- (1) 18W LED fixtures replaced (1) 45W CFL fixtures
- (1) 18W LED fixtures replaced (1) 45W CFL fixtures
- (3) LED T8 tubes replaced (3) fluorescent T8s
- (1) LED T8 tubes replaced (1) fluorescent T12s
- (3) LED T8 tubes replaced (3) fluorescent T8s
- (3) LED BR20 lamps replaced (3) incandescent PAR50 lamps
- (6) 18W LED fixtures replaced (6) 36W CFL fixtures
- (1) 18W LED fixtures replaced (1) 45W CFL fixtures
- (3) 18W LED lamps replaced (3) 23W CFLs
- (1) LED T8 tubes replaced (1) fluorescent T8s

M&V Methodology

The Evaluators reviewed all project-related data, such as program tracking data, invoices, savings calculations, photos and equipment specs sheets. Site personnel involved in the project were contacted in order to verify the installation and operation of the rebated equipment. This project contained retrofits in both conditioned and unconditioned spaces, as well as custom lighting annual hours of operation. Verified savings calculations used common default factors from the CMUA TRM and custom lighting hours of operation specific to the project were verified using project documents, site contact

interviews and publicly-available information. Parameters used in calculating savings for this site are shown in Table A:

Table A. Savings Parameters

Facility Type	Lighting Annual Operating Hours	HVAC IEFe
Assembly	Custom, varies by space	1.02
Exterior	Custom, varies by space	1.00

Savings Calculations

Using values from the tables above, the Evaluators calculated lighting savings as follows:

Table B. Lighting Retrofit Verified Savings Calculations

Measure	Quantity	Wattage		AOH	HVAC IEFe	Expected kWh	Verified kWh	kWh RR
		Base	Post					
23W CFLs to 9W LEDs	8	23	9	2,086	1.02	238	238	100.0%
23W CFLs to 9W LEDs	18	23	9	2,919	1.02	817	750	91.8%
18W CFLs to 9W LEDs	1	18	9	4,368	1.00	39	39	100.0%
18W CFLs to 9W LEDs	8	18	9	4,368	1.00	315	314	99.7%
incandescent PAR90 lamps to LED PAR30 lamps	2	90	13	4,102	1.00	632	632	100.0%
fluorescent T8s to 31W LED fixtures	14	89	31	2,184	1.02	1,809	1,809	100.0%
13W CFLs to 7W LEDs	4	13	7	1,456	1.02	36	36	100.0%
13W CFLs to 7W LEDs	2	13	7	730	1.02	9	9	100.0%
13W CFLs to 7W LEDs	11	13	7	2,184	1.02	147	147	100.0%
13W CFLs to 7W LEDs	1	13	7	2,184	1.02	14	13	92.9%
23W CFLs to 18W LEDs	9	23	18	2,086	1.02	103	96	93.2%
13W CFLs to 7W LEDs	18	13	7	2,592	1.02	311	286	92.0%
60W incandescent lamps to 9W LEDs	1	60	9	730	1.02	41	38	92.7%
fluorescent T8s to LED tubes	4	60	30	2,086	1.02	263	255	97.0%
incandescent PAR50 lamps to LED BR20 lamps	4	50	6	2,592	1.02	465	465	100.0%
fluorescent T8s to LED tubes	1	109	58	1,560	1.02	84	81	96.4%
fluorescent T8s to LED tubes	1	109	58	1,560	1.02	84	81	96.4%
45W CFL fixtures to 18W LED fixtures	1	45	18	2,086	1.02	59	57	96.6%
45W CFL fixtures to 18W LED fixtures	1	45	18	2,592	1.02	73	71	97.3%
45W CFL fixtures to 18W LED fixtures	1	45	18	2,086	1.02	59	57	96.6%
45W CFL fixtures to 18W LED fixtures	1	45	18	2,086	1.02	59	57	96.6%
45W CFL fixtures to 18W LED fixtures	1	45	18	2,086	1.02	59	57	96.6%
45W CFL fixtures to 18W LED fixtures	1	45	18	2,086	1.02	59	57	96.6%
fluorescent T8s to LED tubes	3	60	30	2,086	1.02	197	191	97.0%
fluorescent T12s to LED tubes	1	120	58	2,592	1.02	178	164	92.1%
fluorescent T8s to LED tubes	3	60	30	2,086	1.02	208	191	91.8%
incandescent PAR50 lamps to LED BR20 lamps	3	50	6	1,560	1.02	216	210	97.2%
36W CFL fixtures to 18W LED fixtures	6	36	18	1,560	1.02	177	172	97.2%
45W CFL fixtures to 18W LED fixtures	1	45	18	2,086	1.02	59	57	96.6%
23W CFLs to 18W LEDs	3	23	18	2,592	1.02	41	40	97.6%
fluorescent T8s to LED tubes	1	109	58	1,560	1.02	84	81	96.4%
						6,935	**6,756**	**97.4%**

Results

The kWh realization rate for project #4 is 97.4%. Measure realization varies by line as ex ante savings calculations used energy interactive factors specific to the room, rather than the overall building or large space type. HVAC interactive factors are developed using simulation models of specific building types and do not vary room-by-room like custom lighting hours may; they are applicable to a building as a whole. Building type-specific interactive factors were used in the calculation of verified savings for conditioned spaces, resulting in variation in measure-level realization and lower realization overall.

Table C. Verified Gross Savings & Realization Rates

Measure	Verified kWh Savings	Realization Rate
23W CFLs to 9W LED lamps	238	100.0%
23W CFLs to 9W LED lamps	750	91.8%
18W CFLs to 9W LED lamps	39	100.0%
18W CFLs to 9W LED lamps	314	99.7%
incandescent PAR90 lamps to LED PAR30 lamps	632	100.0%
fluorescent T8s to 31W LED fixtures	1,809	100.0%
13W CFLs to 7W LED lamps	36	100.0%
13W CFLs to 7W LED lamps	9	100.0%
13W CFLs to 7W LED lamps	147	100.0%
13W CFLs to 7W LED lamps	13	92.9%
23W CFLs to 18W LED lamps	96	93.2%
13W CFLs to 7W LED lamps	286	92.0%
60W incandescent lamps to 9W LED lamps	38	92.7%
fluorescent T8s to LED T8 tubes	255	97.0%
incandescent PAR50 lamps to LED BR20 lamps	465	100.0%
fluorescent T8s to LED T8 tubes	81	96.4%
fluorescent T8s to LED T8 tubes	81	96.4%
45W CFL fixtures to 18W LED fixtures	57	96.6%
45W CFL fixtures to 18W LED fixtures	71	97.3%
45W CFL fixtures to 18W LED fixtures	57	96.6%
45W CFL fixtures to 18W LED fixtures	57	96.6%
45W CFL fixtures to 18W LED fixtures	57	96.6%
45W CFL fixtures to 18W LED fixtures	57	96.6%
fluorescent T8s to LED T8 tubes	191	97.0%
fluorescent T12s to LED T8 tubes	164	92.1%
fluorescent T8s to LED T8 tubes	191	91.8%
incandescent PAR50 lamps to LED BR20 lamps	210	97.2%
36W CFL fixtures to 18W LED fixtures	172	97.2%
45W CFL fixtures to 18W LED fixtures	57	96.6%
23W CFLs to 18W LED lamps	40	97.6%
fluorescent T8s to LED T8 tubes	81	96.4%
Totals:	**6,935**	**97.4%**

Project Number: *5*

Project Background

This participant is an office building that received rebates from AMP for interior and exterior lighting retrofits. The Evaluators verified the participant had performed the following retrofits:

- (7) 95W LED wall packs replaced (7) 250W MHs
- (4) 17W LED PAR38s replaced (4) 75W MVs
- (3) 37W LED strips replaced (3) fluorescent T8s

M&V Methodology

The Evaluators reviewed all project-related data, such as program tracking data, invoices, savings calculations, photos and equipment specs sheets. Site personnel involved in the project were contacted in order to verify the installation and operation of the rebated equipment. This project contained retrofits in both conditioned and unconditioned spaces, as well as custom lighting annual hours of operation. Verified savings calculations used common default factors from the CMUA TRM and custom lighting hours of operation specific to the project were verified using project documents, site contact interviews and publicly-available information. Parameters used in calculating savings for this site are shown in Table A:

Table A. Savings Parameters

Facility Type	Lighting Annual Operating Hours	HVAC IEFe
Large Office	Custom	1.11
Exterior	Custom; 4,102	1.00

Savings Calculations

Using values from the tables above, the Evaluators calculated lighting savings as follows:

Table B. Lighting Retrofit Verified Savings Calculations

Measure	Quantity	Wattage		AOH	HVAC IEFe	Expected kWh	Verified kWh	kWh RR
		Base	Post					
250W MH s to 95W LED wall packs	7	295	95	4,102	1.00	5,743	5,743	100.0%
75W MVs to 17W LED PAR38s	4	93	17	4,102	1.00	1,247	1,247	100.0%
fluorescent T8s to 37W LED strips	3	109	37	4,102	1.11	984	983	99.9%
Totals:						**7,974**	**7,973**	**100.0%**

Results

The kWh realization rate for project #5 is 100.0%.

Table C. Verified Gross Savings & Realization Rates

Measure	Verified kWh Savings	Realization Rate
250W MH s to 95W LED wall packs	5,743	100.0%

75W MVs to 17W LED PAR38s	1,247	100.0%
fluorescent T8s to 37W LED strips	983	99.9%
Totals:	**7,973**	**100.0%**

Project Number: 6

Project Background

This participant is an office building that received rebates from AMP for exterior lighting retrofits. The Evaluators verified the participant had performed the following retrofits:

- (5) 22W LED wall packs replaced (5) 100W MHs
- (4) 95W LED wall packs replaced (4) 250W MHs
- (9) 17W LED PAR38s replaced (9) 75W MVs

M&V Methodology

The Evaluators reviewed all project-related data, such as program tracking data, invoices, savings calculations, photos and equipment specs sheets. Site personnel involved in the project were contacted in order to verify the installation and operation of the rebated equipment. This project contained retrofits in both conditioned and unconditioned spaces, as well as custom lighting annual hours of operation. Verified savings calculations used common default factors from the CMUA TRM and custom lighting hours of operation specific to the project were verified using project documents, site contact interviews and publicly-available information. Parameters used in calculating savings for this site are shown in Table A:

Table A. Savings Parameters

Facility Type	Lighting Annual Operating Hours	HVAC IEFe
Exterior	Custom; 4,102	1.00

Savings Calculations

Using values from the tables above, the Evaluators calculated lighting savings as follows:

Table B. Lighting Retrofit Verified Savings Calculations

Measure	Quantity	Wattage		AOH	HVAC IEFe	Expected kWh	Verified kWh	kWh RR
		Base	Post					
100W MHs to 22W LED wall packs	5	128	22	4,102	1.00	2,174	2,174	100.0%
250W MH s to 95W LED wall packs	4	295	95	4,102	1.00	3,282	3,282	100.0%
75W MVs to 17W LED PAR38s	9	93	17	4,102	1.00	2,806	2,806	100.0%
Totals:						**8,262**	**8,261**	**100.0%**

Results

The kWh realization rate for project #6 is 100.0%.

Table C. Verified Gross Savings & Realization Rates

Measure	Verified kWh Savings	Realization Rate
100W MHs to 22W LED wall packs	2,174	100.0%
250W MH s to 95W LED wall packs	3,282	100.0%
75W MVs to 17W LED PAR38s	2,806	100.0%
Totals:	**8,261**	**100.0%**

Project Number: *7*

Project Background

This participant is a religious gathering facility that received rebates from AMP for interior and exterior lighting retrofits. The Evaluators verified the participant had performed the following retrofits:

- (8) LED tubes replaced (8) fluorescent T12s
- (32) LED tubes replaced (32) fluorescent T12s
- (1) LED tubes replaced (1) fluorescent T8s
- (3) LED tubes replaced (3) fluorescent T8s
- (3) LED tubes replaced (3) fluorescent T12s
- (17) LED tubes replaced (17) fluorescent T8s
- (21) LED tubes replaced (21) fluorescent T8s
- (1) LED tubes replaced (1) fluorescent T12s
- (1) LED tubes replaced (1) fluorescent T8s
- (8) 4W LED 'Exit' sign fixtures replaced (8) 40W incandescent lamps

M&V Methodology

The Evaluators reviewed all project-related data, such as program tracking data, invoices, savings calculations, photos and equipment specs sheets. Site personnel involved in the project were contacted in order to verify the installation and operation of the rebated equipment. This project contained retrofits in both conditioned and unconditioned spaces, as well as custom lighting annual hours of operation. Verified savings calculations used common default factors from the CMUA TRM and custom lighting hours of operation specific to the project were verified using project documents, site contact interviews and publicly-available information. Parameters used in calculating savings for this site are shown in Table A:

Table A. Savings Parameters

Facility Type	Lighting Annual Operating Hours	HVAC IEFe
Assembly	Custom, varies by space	1.02
Exterior	Custom; 2,184	1.00

Savings Calculations

Using values from the tables above, the Evaluators calculated lighting savings as follows:

Table B. Lighting Retrofit Verified Savings Calculations

Measure	Quantity	Wattage		AOH	HVAC IEFe	Expected kWh	Verified kWh	kWh RR
		Base	Post					
fluorescent T12s to LED tubes	8	192	59	1,460	1.02	1,709	1,585	92.7%
fluorescent T12s to LED tubes	32	96	30	1,460	1.02	3,392	3,145	92.7%
fluorescent T8s to LED tubes	1	89	45	1,460	1.02	71	66	93.0%
fluorescent T8s to LED tubes	3	59	30	261	1.02	25	23	92.0%
fluorescent T12s to LED tubes	3	192	59	1,460	1.02	641	594	92.7%

Measure	Quantity	Wattage		AOH	HVAC IEFe	Expected kWh	Verified kWh	kWh RR
		Base	Post					
fluorescent T8s to LED tubes	17	59	30	1,560	1.02	846	784	92.7%
fluorescent T8s to LED tubes	21	59	30	1,460	1.02	934	907	97.1%
fluorescent T12s to LED tubes	1	56	22	2,184	1.00	74	74	100.0%
fluorescent T8s to LED tubes	1	59	30	261	1.02	8	8	100.0%
40W incandescent lamps to 4W LED 'Exit' sign fixtures	8	40	4	8,760	1.02	2,800	2,573	91.9%
Totals:						**10,499**	**9,759**	**93.0%**

Results

The kWh realization rate for project #7 is 93.0%. Measure realization varies by line as ex ante savings calculations used energy interactive factors specific to the room, rather than the overall building or large space type. HVAC interactive factors are developed using simulation models of specific building types and do not vary room-by-room like custom lighting hours may; they are applicable to a building as a whole. Building type-specific interactive factors were used in the calculation of verified savings for conditioned spaces, resulting in variation in measure-level realization and lower realization overall.

Table C. Verified Gross Savings & Realization Rates

Measure	Verified kWh Savings	Realization Rate
fluorescent T12s to LED tubes	1,585	92.7%
fluorescent T12s to LED tubes	3,145	92.7%
fluorescent T8s to LED tubes	66	93.0%
fluorescent T8s to LED tubes	23	92.0%
fluorescent T12s to LED tubes	594	92.7%
fluorescent T8s to LED tubes	784	92.7%
fluorescent T8s to LED tubes	907	97.1%
fluorescent T12s to LED tubes	74	100.0%
fluorescent T8s to LED tubes	8	100.0%
40W incandescent lamps to 4W LED 'Exit' sign fixtures	2,573	91.9%
Totals:	**9,759**	**93.0%**

Project Number: *8*

Project Background

This participant is an office building that received rebates from AMP for exterior lighting retrofits. The Evaluators verified the participant had performed the following retrofits:

- (10) 75W LED fixtures replaced (10) 400W MHs

M&V Methodology

The Evaluators reviewed all project-related data, such as program tracking data, invoices, savings calculations, photos and equipment specs sheets. Site personnel involved in the project were contacted in order to verify the installation and operation of the rebated equipment. This project contained retrofits in both conditioned and unconditioned spaces, as well as custom lighting annual hours of operation. Verified savings calculations used common default factors from the CMUA TRM and custom lighting hours of operation specific to the project were verified using project documents, site contact interviews and publicly-available information. Parameters used in calculating savings for this site are shown in Table A:

Table A. Savings Parameters

Facility Type	Lighting Annual Operating Hours	HVAC IEFe
Exterior	Custom; 4,368	1.00

Savings Calculations

Using values from the tables above, the Evaluators calculated lighting savings as follows:

Table B. Lighting Retrofit Verified Savings Calculations

Measure	Quantity	Wattage		AOH	HVAC IEFe	Expected kWh	Verified kWh	kWh RR
		Base	Post					
400W MH s to 75W LED fixtures	10	458	75	4,368	1.00	16,729	16,729	100.0%
Totals:						**16,729**	**16,729**	**100.0%**

Results

The kWh realization rate for project #8 is 100.0%.

Table C. Verified Gross Savings & Realization Rates

Measure	Verified kWh Savings	Realization Rate
400W MHs to 75W LED wall packs	16,729	100.0%
Totals:	**16,729**	**100.0%**

Project Number: *9*

Project Background

This participant is an outdoor space that received rebates from AMP for street lighting retrofits. The Evaluators verified the participant had performed the following retrofits:

- (10) 50W LED fixtures replaced (10) 150W HPSs
- (14) 100W LED fixtures replaced (14) 250W HPSs

M&V Methodology

The Evaluators reviewed all project-related data, such as program tracking data, invoices, savings calculations, photos and equipment specs sheets. Site personnel involved in the project were contacted in order to verify the installation and operation of the rebated equipment. This project contained retrofits in both conditioned and unconditioned spaces, as well as custom lighting annual hours of operation. Verified savings calculations used common default factors from the CMUA TRM and custom lighting hours of operation specific to the project were verified using project documents, site contact interviews and publicly-available information. Parameters used in calculating savings for this site are shown in Table A:

Table A. Savings Parameters

Facility Type	Lighting Annual Operating Hours	HVAC IEFe
Exterior	Custom; 4,368	1.00

Savings Calculations

Using values from the tables above, the Evaluators calculated lighting savings as follows:

Table B. Lighting Retrofit Verified Savings Calculations

Measure	Quantity	Wattage		AOH	HVAC IEFe	Expected kWh	Verified kWh	kWh RR
		Base	Post					
150W HPSs to 50W LED fixtures	10	188	49	4,368	1.00	6,072	6,072	100.0%
250W HPSs to 100W LED fixtures	14	295	100	4,368	1.00	11,925	11,925	100.0%
Totals:						**17,996**	**17,996**	**100.0%**

Results

The kWh realization rate for project #9 is 100.0%.

Table C. Verified Gross Savings & Realization Rates

Measure	Verified kWh Savings	Realization Rate
150W HPSs to 50W LED fixtures	6,072	100.0%
250W HPSs to 100W LED fixtures	11,925	100.0%
Totals:	**17,996**	**100.0%**

Project Number: *10*

Project Background

This participant is an office building that received rebates from AMP for exterior lighting retrofits. The Evaluators verified the participant had performed the following retrofits:

- (33) 75W LED fixtures replaced (33) 250W HPSs
- (52) 54W LED fixtures replaced (52) 70W HPSs
- (16) 18.5W LEDs replaced (16) 42W CFLs

M&V Methodology

The Evaluators reviewed all project-related data, such as program tracking data, invoices, savings calculations, photos and equipment specs sheets. Site personnel involved in the project were contacted in order to verify the installation and operation of the rebated equipment. This project contained retrofits in both conditioned and unconditioned spaces, as well as custom lighting annual hours of operation. Verified savings calculations used common default factors from the CMUA TRM and custom lighting hours of operation specific to the project were verified using project documents, site contact interviews and publicly-available information. Parameters used in calculating savings for this site are shown in Table A:

Table A. Savings Parameters

Facility Type	Lighting Annual Operating Hours	HVAC IEFe
Exterior	Custom; 4,004	1.00

Savings Calculations

Using values from the tables above, the Evaluators calculated lighting savings as follows:

Table B. Lighting Retrofit Verified Savings Calculations

Measure	Quantity	Wattage		AOH	HVAC IEFe	Expected kWh	Verified kWh	kWh RR
		Base	Post					
250W HPSs to 75W LED fixtures	33	295	75	4,004	1.00	29,069	29,069	100.0%
70W HPSs to 54W LED fixtures	52	95	54	4,004	1.00	8,537	8,537	100.0%
42W CFLs to 18.5W LEDs	16	42	19	4,004	1.00	1,473	1,473	100.0%
Totals:						**39,079**	**39,079**	**100.0%**

Results

The kWh realization rate for project #10 is 100.0%.

Table C. Verified Gross Savings & Realization Rates

Measure	Verified kWh Savings	Realization Rate
250W HPSs to 75W LED fixtures	29,069	100.0%
70W HPSs to 54W LED fixtures	8,537	100.0%
42W CFLs to 18.5W LEDs	1,473	100.0%
Totals:	**39,079**	**100.0%**

Project Number: *11*

Project Background

This participant is a fast food restaurant that received rebates from AMP for interior and exterior lighting retrofits. The Evaluators verified the participant had performed the following retrofits:

- (7) 136W LED fixtures replaced (7) 400W MHs
- (4) 50W LED fixtures replaced (4) 250W MHs
- (14) 40W LED fixtures replaced (14) 175W MHs
- (1) 50W LED fixtures replaced (1) 500W halogen lamps
- (32) LED T8 tubes replaced (32) fluorescent T8s
- (3) 39W LED fixtures replaced (3) fluorescent T8s
- (3) 18W CFL fixtures replaced (3) 20W CFLs
- (7) 18W CFL fixtures replaced (7) 20W CFLs
- (1) LED T8 tubes replaced (1) fluorescent T8s
- (5) 39W LED fixtures replaced (5) fluorescent T8s
- (15) LED T8 tubes replaced (15) fluorescent T8s
- (1) 10W LED fixtures replaced (1) 45W CFL fixtures
- (1) 29W LED fixtures replaced (1) fluorescent T8s
- (13) LED T8 tubes replaced (13) fluorescent T8s
- (1) LED T8 tubes replaced (1) fluorescent T8s

M&V Methodology

The Evaluators reviewed all project-related data, such as program tracking data, invoices, savings calculations, photos and equipment specs sheets. Site personnel involved in the project were contacted in order to verify the installation and operation of the rebated equipment. This project contained retrofits in both conditioned and unconditioned spaces, as well as custom lighting annual hours of operation. Verified savings calculations used common default factors from the CMUA TRM and custom lighting hours of operation specific to the project were verified using project documents, site contact interviews and publicly-available information. Parameters used in calculating savings for this site are shown in Table A:

Table A. Savings Parameters

Facility Type	Lighting Annual Operating Hours	HVAC IEFe
Fast Food Restaurant	Custom, varies by space	1.02
Exterior	Custom, 4,102	1.00

Savings Calculations

Using values from the tables above, the Evaluators calculated lighting savings as follows:

Table B. Lighting Retrofit Verified Savings Calculations

Measure	Quantity	Wattage		AOH	HVAC IEFe	Expected kWh Savings	Verified kWh Savings	kWh RR
		Base	Post					
400W MHs to 136W LED fixtures	7	458	136	4,102	1.00	9,247	9,246	100.0%
175W MHs to 40W LED fixtures	28	215	40	4,102	1.00	20,101	20,100	100.0%
fluorescent T8s to 39W LED fixtures	15	112	39	6,387	1.02	6,994	7,134	102.0%
fluorescent T8s to LED tubes	20	59	30	6,387	1.02	3,705	3,779	102.0%
fluorescent T8s to 39W LED fixtures	26	112	39	6,387	1.02	12,123	12,365	102.0%
fluorescent T8s to 39W LED fixtures	3	59	39	6,387	1.02	383	391	102.1%
fluorescent T8s to LED tubes	5	59	30	6,387	1.02	1,028	945	91.9%
fluorescent T8s to LED tubes	15	24	14	6,387	1.02	958	977	102.0%
fluorescent T8s to 16W LED u-bends	2	60	32	6,387	1.02	397	365	91.9%
						54,935	**55,300**	**100.7%**

Results

The kWh realization rate for project #11 is 99.7%. Measure realization varies by line as ex ante savings calculations used energy interactive factors specific to the room, rather than the overall building or large space type. HVAC interactive factors are developed using simulation models of specific building types and do not vary room-by-room like custom lighting hours may; they are applicable to a building as a whole. Building type-specific interactive factors were used in the calculation of verified savings for conditioned spaces, resulting in variation in measure-level realization and lower realization overall. Further, ex ante calculations assumed no conditioning for several interior spaces that were conditioned. Verified savings calculations used interactive factors for these spaces.

Table C. Verified Gross Savings & Realization Rates

Measure	Verified kWh Savings	Realization Rate
400W MHs to 136W LED fixtures	9,246	100.0%
250W MHs to 50W LED fixtures	4,020	98.8%
175W MHs to 40W LED fixtures	10,050	100.0%
500W halogen lamps to 50W LED fixtures	2,628	99.4%
fluorescent T8s to LED T8 tubes	5,528	102.0%
fluorescent T8s to 39W LED fixtures	894	102.1%
20W CFLs to 18W CFL fixtures	214	101.9%
20W CFLs to 18W CFL fixtures	500	91.9%
fluorescent T8s to LED T8 tubes	316	91.9%
fluorescent T8s to 39W LED fixtures	1,489	102.0%
fluorescent T8s to LED T8 tubes	2,591	102.0%
45W CFL fixtures to 10W LED fixtures	285	101.8%
fluorescent T8s to 29W LED fixtures	83	101.2%
fluorescent T8s to LED T8 tubes	2,246	91.9%
fluorescent T8s to LED T8 tubes	173	92.0%
Totals:	**40,263**	**99.7%**

Project Number: *12*

Project Background

This participant is a supermarket that received rebates from AMP for EC motor retrofits on refrigerated display cases. The Evaluators verified the participant had performed the following retrofits:

- (61) EC motors replaced shaded-pole evaporator fan motors on refrigerated display cases

M&V Methodology

The Evaluators reviewed all project-related data, such as program tracking data, invoices, savings calculations, photos and equipment specs sheets. Site personnel involved in the project were contacted in order to verify the installation and operation of the rebated equipment. Verified savings calculations used unit energy savings (UES) from the CMUA TRM. UES used in calculating savings for this site are shown in Table A:

Table A. Savings Parameters

Measure	Quantity	kWh UES
Refrigerated Display Case EC Motor	61 (motors)	710

Savings Calculations

Using values from the tables above, the Evaluators calculated savings as follows:

Table B. Verified Savings Calculations

Measure	Quantity	kWh UES	Expected kWh Savings	Verified kWh Savings	kWh Realization Rate
Refrigerated Display Case EC Motor	61 (motors)	710	43,249	43,310	100.1%
Totals:			**43,249**	**43,310**	**100.1%**

Results

The kWh realization rate for project #12 is 100.1%. Ex ante calculations assumed 709 kWh per motor, which is an average of four TRM building vintage values. Verified savings values used the value from the actual building vintage (1984), resulting in a slightly high realization rate for this measure.

Table C. Verified Gross Savings & Realization Rates

Measure	Verified kWh Savings	Realization Rate
Refrigerated Display Case EC Motor	43,310	100.1%
Totals:	**43,310**	**100.1%**

Project Number: *13*

Project Background

This participant is a retail service that received rebates from AMP for interior and exterior lighting retrofits. The Evaluators verified the participant had performed the following retrofits:

- (10) 60W LED wall packs replaced (12) 400W MHs
- (6) 17W LED PAR38s replaced (6) incandescent PAR90 lamps
- (18) 48W LED High Bay s replaced (18) fluorescent T5s
- (6) 48W LED High Bays replaced (7) fluorescent T5s
- (6) LED T8 tubes replaced (6) fluorescent T8s
- (2) LED T8 tubes replaced (2) fluorescent T8s
- (2) LED T8 tubes replaced (2) fluorescent T8s
- (2) LED T8 tubes replaced (2) fluorescent T8s
- (4) LED T8 tubes replaced (4) fluorescent T8s
- (10) LED T8 tubes replaced (10) fluorescent T8s
- (14) LED T8 tubes replaced (14) fluorescent T12s
- (1) LED T8 tubes replaced (1) fluorescent T8s
- (8) LED T8 tubes replaced (8) fluorescent T8s

M&V Methodology

The Evaluators reviewed all project-related data, such as program tracking data, invoices, savings calculations, photos and equipment specs sheets. Site personnel involved in the project were contacted in order to verify the installation and operation of the rebated equipment. This project contained retrofits in both conditioned and unconditioned spaces, as well as custom lighting annual hours of operation. Verified savings calculations used common default factors from the CMUA TRM and custom lighting hours of operation specific to the project were verified using project documents, site contact interviews and publicly-available information. Parameters used in calculating savings for this site are shown in Table A:

Table A. Savings Parameters

Facility Type	Lighting Annual Operating Hours	HVAC IEFe
Small Retail	Custom, varies by space	1.06
Exterior	Custom; 4,102 & 4,180	1.00

Savings Calculations

Using values from the tables above, the Evaluators calculated lighting savings as follows:

Table B. Lighting Retrofit Verified Savings Calculations

Measure	Quantity	Wattage		AOH	HVAC IEFe	Expected kWh	Verified kWh	kWh RR
		Base	Post					
400W MH s to 60W LED wall packs	10	458	60	4,102	1.00	20,085	20,083	100.0%

Measure	Quantity	Wattage		AOH	HVAC IEFe	Expected kWh	Verified kWh	kWh RR
		Base	Post					
incandescent PAR90 lamps to 17W LED PAR38s	6	90	17	4,180	1.00	1,221	1,831	150.0%
fluorescent T5s to 48W LED High Bays	18	234	69	3,650	1.00	10,840	10,841	100.0%
fluorescent T5s to 48W LED High Bays	6	234	48	3,650	1.00	4,927	4,928	100.0%
fluorescent T8s to LED tubes	6	59	30	3,650	1.06	705	673	95.5%
fluorescent T8s to LED tubes	2	59	30	2,346	1.06	151	144	95.4%
fluorescent T8s to LED tubes	2	59	30	2,346	1.06	151	144	95.4%
fluorescent T8s to LED tubes	2	59	30	3,650	1.06	235	224	95.3%
fluorescent T8s to LED tubes	4	59	30	1,251	1.06	161	154	95.7%
fluorescent T8s to LED tubes	10	59	30	52	1.06	16	16	100.0%
fluorescent T12s to LED tubes	14	192	30	2,346	1.00	5,587	5,321	95.2%
fluorescent T8s to LED tubes	1	33	22	1,043	1.06	13	12	92.3%
fluorescent T8s to LED tubes	8	59	30	3,650	1.00	889	847	95.3%
						44,981	**45,218**	**100.5%**

Results

The kWh realization rate for project #13 is 100.5%. Measure realization varies by line as ex ante savings calculations used energy interactive factors specific to the room, rather than the overall building or large space type. HVAC interactive factors are developed using simulation models of specific building types and do not vary room-by-room like custom lighting hours may; they are applicable to a building as a whole. Building type-specific interactive factors were used in the calculation of verified savings for conditioned spaces, resulting in variation in measure-level realization and lower realization overall. Further, ex ante calculations assumed no conditioning for several interior spaces that were conditioned. Verified savings calculations used interactive factors for these spaces.

Table C. Verified Gross Savings & Realization Rates

Measure	Verified kWh Savings	Realization Rate
400W MH s to 60W LED wall packs	20,083	100.0%
incandescent PAR90 lamps to 17W LED PAR38s	1,831	150.0%
fluorescent T5s to 48W LED High Bay s	10,841	100.0%
fluorescent T5s to 48W LED High Bays	4,928	100.0%
fluorescent T8s to LED T8 tubes	673	95.5%
fluorescent T8s to LED T8 tubes	144	95.4%
fluorescent T8s to LED T8 tubes	144	95.4%
fluorescent T8s to LED T8 tubes	224	95.3%
fluorescent T8s to LED T8 tubes	154	95.7%
fluorescent T8s to LED T8 tubes	16	100.0%
fluorescent T12s to LED T8 tubes	5,321	95.2%
fluorescent T8s to LED T8 tubes	12	92.3%
fluorescent T8s to LED T8 tubes	847	95.3%
Totals:	**45,218**	**100.5%**

Project Number: *14*

Project Background

This participant is a fast food restaurant that received rebates from AMP for interior and exterior lighting retrofits. The Evaluators verified the participant had performed the following retrofits:

- (7) 136W LED fixtures replaced (7) 400W MH s
- (28) 40W LED fixtures replaced (28) 175W MH s
- (15) 39W LED fixtures replaced (15) fluorescent T8s
- (20) LED T8 tubes replaced (20) fluorescent T8s
- (26) 39W LED fixtures replaced (26) fluorescent T8s
- (3) 39W LED fixtures replaced (3) fluorescent T8s
- (5) LED T8 tubes replaced (5) fluorescent T8s
- (15) LED T8 tubes replaced (15) fluorescent T8s
- (2) 16W LED u-bends replaced (2) fluorescent T8s

M&V Methodology

The Evaluators reviewed all project-related data, such as program tracking data, invoices, savings calculations, photos and equipment specs sheets. Site personnel involved in the project were contacted in order to verify the installation and operation of the rebated equipment. This project contained retrofits in both conditioned and unconditioned spaces, as well as custom lighting annual hours of operation. Verified savings calculations used common default factors from the CMUA TRM and custom lighting hours of operation specific to the project were verified using project documents, site contact interviews and publicly-available information. Parameters used in calculating savings for this site are shown in Table A:

Table A. Savings Parameters

Facility Type	Lighting Annual Operating Hours	HVAC IEFe
Fast Food Restaurant	Custom, varies by space	1.02
Exterior	Custom, 4,102	1.00

Savings Calculations

Using values from the tables above, the Evaluators calculated lighting savings as follows:

Table B. Lighting Retrofit Verified Savings Calculations

Measure	Quantity	Wattage		AOH	HVAC IEFe	Expected kWh Savings	Verified kWh Savings	kWh RR
		Base	Post					
400W MHs to 136W LED fixtures	7	458	136	4,102	1.00	9,247	9,246	100.0%
175W MHs to 40W LED fixtures	28	215	40	4,102	1.00	20,101	20,100	100.0%
fluorescent T8s to 39W LED fixtures	15	112	39	6,387	1.02	6,994	7,134	102.0%
fluorescent T8s to LED tubes	20	59	30	6,387	1.02	3,705	3,779	102.0%
fluorescent T8s to 39W LED fixtures	26	112	39	6,387	1.02	12,123	12,365	102.0%
fluorescent T8s to 39W LED fixtures	3	59	39	6,387	1.02	383	391	102.1%
fluorescent T8s to LED tubes	5	59	30	6,387	1.02	1,028	945	91.9%
fluorescent T8s to LED tubes	15	24	14	6,387	1.02	958	977	102.0%
fluorescent T8s to 16W LED u-bends	2	60	32	6,387	1.02	397	365	91.9%
Totals:						**54,935**	**55,300**	**100.7%**

Results

The kWh realization rate for project #14 is 100.7%. Measure realization varies by line as ex ante savings calculations used energy interactive factors specific to the room, rather than the overall building or large space type. HVAC interactive factors are developed using simulation models of specific building types and do not vary room-by-room like custom lighting hours may; they are applicable to a building as a whole. Building type-specific interactive factors were used in the calculation of verified savings for conditioned spaces, resulting in variation in measure-level realization and lower realization overall. Further, ex ante calculations assumed no conditioning for several interior spaces that were conditioned. Verified savings calculations used interactive factors for these spaces.

Table C. Verified Gross Savings & Realization Rates

Measure	Verified kWh Savings	Realization Rate
400W MH s to 136W LED fixtures	9,246	100.0%
175W MH s to 40W LED fixtures	20,100	100.0%
fluorescent T8s to 39W LED fixtures	7,134	102.0%
fluorescent T8s to LED T8 tubes	3,779	102.0%
fluorescent T8s to 39W LED fixtures	12,365	102.0%
fluorescent T8s to 39W LED fixtures	391	102.1%
fluorescent T8s to LED T8 tubes	945	91.9%
fluorescent T8s to LED T8 tubes	977	102.0%
fluorescent T8s to 16W LED u-bends	365	91.9%
Totals:	**55,300**	**100.7%**

Project Number: *15*

Project Background

This participant is warehouse used for manufacturing that received rebates from AMP for a lighting retrofit. The Evaluators verified the participant had performed the following retrofits:

- (228) 15W LED fixtures replaced (228) 250W MHs

M&V Methodology

The Evaluators reviewed all project-related data, such as program tracking data, invoices, savings calculations, photos and equipment specs sheets. Site personnel involved in the project were contacted in order to verify the installation and operation of the rebated equipment. This project contained retrofits in both conditioned and unconditioned spaces, as well as custom lighting annual hours of operation. Verified savings calculations used common default factors from the CMUA TRM and custom lighting hours of operation specific to the project were verified using project documents, site contact interviews and publicly-available information. Parameters used in calculating savings for this site are shown in Table A:

Table A. Savings Parameters

Facility Type	Lighting Annual Operating Hours	HVAC IEFe
Light Manufacturing	Custom; 4,004	1.04

Savings Calculations

Using values from the tables above, the Evaluators calculated lighting savings as follows:

Table B. Lighting Retrofit Verified Savings Calculations

Measure	Quantity	Wattage		AOH	HVAC IEFe	Expected kWh	Verified kWh	kWh RR
		Base	Post					
250W MH s to 15W LED fixtures	228	295	206	4,368	1.04	92,181	92,181	100.0%
Totals:						**92,181**	**92,181**	**100.0%**

Results

The kWh realization rate for project #15 is 100.0%.

Table C. Verified Gross Savings & Realization Rates

Measure	Verified kWh Savings	Realization Rate
250W MH s to 15W LED fixtures	92,181	100.0%
Totals:	**92,181**	**100.0%**

Project Number: *16*

Project Background

This participant is an exterior space that received rebates from AMP for street lighting retrofits. The Evaluators verified the participant had performed the following retrofits:

- (72) 150W LED fixtures replaced 400W metal halides
- (72) 35W LED fixtures replaced 175W metal halides

M&V Methodology

The Evaluators reviewed all project-related data, such as program tracking data, invoices, savings calculations, photos and equipment specs sheets. Site personnel involved in the project were contacted in order to verify the installation and operation of the rebated equipment. This project contained retrofits in both conditioned and unconditioned spaces, as well as custom lighting annual hours of operation. Verified savings calculations used common default factors from the CMUA TRM and custom lighting hours of operation specific to the project were verified using project documents, site contact interviews and publicly-available information. Parameters used in calculating savings for this site are shown in Table A:

Table A. Savings Parameters

Facility Type	Lighting Annual Operating Hours	HVAC IEFe
Exterior	Custom; 4,368	1.00

Savings Calculations

Using values from the tables above, the Evaluators calculated lighting savings as follows:

Table B. Lighting Retrofit Verified Savings Calculations

Measure	Quantity	Wattage		AOH	HVAC IEFe	Expected kWh	Verified kWh	kWh RR
		Base	Post					
400W MH to 150W LED fixture	72	458	150	4,368	1.00		96,865	
175W MH to 35W LED fixture	23	215	35	4,368	1.00		18,083	
Totals:						**114,948**	**114,948**	**100.0%**

Results

The kWh realization rate for project #16 is 100.0%.

Table C. Verified Gross Savings & Realization Rates

Measure	Verified kWh Savings	Realization Rate
400W MH to 150W LED fixture	96,865	
175W MH to 35W LED fixture	18,083	
Totals:	**114,948**	**100.0%**

Project Number: *17*

Project Background

This participant is a supermarket that received rebates from AMP for retrofitting vertical refrigerated case doors on medium temperature coolers. The Evaluators verified the participant had performed the following retrofits:

- (178 feet) Refrigerated display case doors on medium temperature coolers

M&V Methodology

The Evaluators reviewed all project-related data, such as program tracking data, invoices, savings calculations, photos and equipment specs sheets. Site personnel involved in the project were contacted in order to verify the installation and operation of the rebated equipment. Expected savings calculations used the Sacramento Municipal Utility District's (SMUD) Custom Program Display Case Door Calculator as opposed to CMUA TRM EUS.

Savings Calculations

The Evaluators reviewed the calculator inputs and savings algorithm for appropriateness. Parameters and savings calculations are shown in Table A:

Table A. Savings Calculations

Description	Baseline	Post-Retrofit
Refrigerated Case, Cooler, Load (Btu/h)	1,727	1,727
Refrigerated Case, Cooler, Temperature (degF)	35.0	38.0
Cooler Refrigeration Compressor Duty Cycle (%)	70%	62%
Cooler Refrigeration System Efficiency	2.1	2.1
Annual Operating Hours (Hour)	8,760	8,760
Fraction of Infiltration Load (%)	82%	14%
Fraction of Conduction & Radiation Load (%)	13%	13%
Store Space Temperature (degF)	69	69
HVAC System Cooling Efficiency	3.4	3.4
HVAC System Heating Efficiency (%)	78.0%	78.0%
Annual Cooling Degree Days (CDD)	2,702	2,702
Annual Heating Degree Days (HDD)	1,470	1,470
12 Ft Case Lighting Power (Watts)	56	56
Lighting Power per LF (W/LF)	5	5
Cooler Electric Energy Consumption (kWh per LF)	918	166
Refrigerated Case, Cooler, Qty (LF)	178	
Total Energy Consumption (kWh)	163,479	29,598
kWh Savings (baseline-post)	**133,881**	

Results

The kWh realization rate for project 17 is 100.0%.

Table C. Verified Gross Savings & Realization Rates

Measure	Verified kWh Savings	Realization Rate
Refrigerated display case doors on medium temperature coolers	133,881	100.0%
Totals:	**133,881**	**100.0%**

Project Number: *18*

Project Background

This participant is a naval hanger that has been converted into an office and received rebates from AMP for a lighting retrofit. The Evaluators verified the participant had performed the following retrofits:

- (171) 15W LED fixtures replaced (171) 400W MHs

M&V Methodology

The Evaluators reviewed all project-related data, such as program tracking data, invoices, savings calculations, photos and equipment specs sheets. Site personnel involved in the project were contacted in order to verify the installation and operation of the rebated equipment. This project contained retrofits in both conditioned and unconditioned spaces, as well as custom lighting annual hours of operation. Verified savings calculations used common default factors from the CMUA TRM and custom lighting hours of operation specific to the project were verified using project documents, site contact interviews and publicly-available information. Parameters used in calculating savings for this site are shown in Table A:

Table A. Savings Parameters

Facility Type	Lighting Annual Operating Hours	HVAC IEFe
Unconditioned Storage	Custom; 4,004	1.00

Savings Calculations

Using values from the tables above, the Evaluators calculated lighting savings as follows:

Table B. Lighting Retrofit Verified Savings Calculations

Measure	Quantity	Wattage		AOH	HVAC IEFe	Expected kWh	Verified kWh	kWh RR
		Base	Post					
400W MH s to 15W LED fixtures	171	458	150	4,004	1.00	218,072	218,072	100.0%
Totals:						**254,064**	**254,064**	**100.0%**

Results

The kWh realization rate for project #18 is 100.0%.

Table C. Verified Gross Savings & Realization Rates

Measure	Verified kWh Savings	Realization Rate
400W MH s to 15W LED fixtures	218,072	100.0%
Totals:	**254,064**	**100.0%**

Project Number: *19*

Project Background

This participant is a supermarket that received rebates from AMP for EC motor retrofits on refrigerated display cases, anti-sweat heater door controls on dairy walk-ins and strip curtains on frozen food and meat walk-ins. The Evaluators verified the participant had performed the following retrofits:

- (352) EC motors replaced shaded-pole evaporator fan motors on refrigerated display cases
- (33) feet of display case were retrofitted with ASH controllers
- (80) strip curtain strips were installed on walk-in coolers
- M&V Methodology

The Evaluators reviewed all project-related data, such as program tracking data, invoices, savings calculations, photos and equipment specs sheets. Site personnel involved in the project were contacted in order to verify the installation and operation of the rebated equipment. Verified savings calculations used unit energy savings (UES) from the CMUA TRM. UES used in calculating savings for this site are shown in Table A:

Table A. Savings Parameters

Measure	Quantity	kWh UES
Refrigerated Display Case EC Motor	352 (motors)	704
ASH Controller	33 (ft. of display case)	370.9
Strip Curtains	80 (strips)	120

Savings Calculations

Using values from the tables above, the Evaluators calculated savings as follows:

Table B. Verified Savings Calculations

Measure	Quantity	kWh UES	Expected kWh Savings	Verified kWh Savings	kWh Realization Rate
Refrigerated Display Case EC Motor	352 (motors)	704	249,568	247,808	99.3%
ASH Controller	33 (ft. of display case)	370.90	12,243	12,240	100.0%
Strip Curtains	80 (strips)	120	9,600	9,600	100.0%
Totals:			**271,411**	**269,648**	**99.4%**

Results

The kWh realization rate for project #19 is 99.4%. Ex ante calculations assumed 709 kWh per motor, which is an average of four TRM building vintage values. Verified savings values used the value from the actual building vintage (2006), resulting in a slightly low realization rate for this measure. Calculations for ASH controllers were carried out correctly, with the minor discrepancy likely due to rounding of such

small numbers. Also note, while the implementation contractor carried out strip curtain calculations correctly, weighted average UES were used instead of values specific to coolers or freezers. Had the IC used more specific UES, the project could have claimed an additional 4,600 kWh in savings.

Table C. Verified Gross Savings & Realization Rates

Measure	Verified kWh Savings	Realization Rate
Refrigerated Display Case EC Motor	247,808	99.3%
ASH Controller	12,240	100.0%
Strip Curtains	9,600	100.0%
Totals:	**269,648**	**99.4%**

1Table D. Causes of Discrepancies

Discrepancy	Explanation
Averaged UES	Ex ante calculations used 709 kWh per motor, which is a rounded-up average of values from the four building vintages shown in the TRM. Verified savings calculations used 704 kWh/unit, specific to the building's 2006 vintage.

Project Number: *20*

Project Background

This participant is a public streetlight retrofit project. Insufficient information was available to perform an analysis.

Table C. Verified Gross Savings & Realization Rates

Measure	Verified kWh Savings	Realization Rate
Streetlight Retrofit	328,031	100.0%
Totals:	**328,031**	**100.0%**

7 APPENDIX D: SURVEY INSTRUMENTS

7.1 Energy Plus

Client: Alameda Municipal Power

Program(s): Energy Plus

Group**:** Energy Plus participants

Mode: / Telephone

Recruitment Text

Dear [CONTACT NAME],

Hello, Alameda Municipal Power is interested in your feedback about its Energy Plus program! Our records indicate your company participated in this program by receiving some energy efficiency upgrades (ex: LED lights, occupancy sensors, commercial equipment) through the program, and we were hoping you could answer a few questions about your experience.

This survey should not take more than 15-20 minutes and your feedback would greatly help Alameda Municipal Power improve its Energy Plus program moving forward! If you are interested, please let me know some times you are available to chat and I will give you a call.

If you have questions or require technical assistance, please contact Heather Polonsky at heather.polonsky@admenergy.com. If you wish to no longer receive call about this survey, please let me know and we will remove you from the list.

We treat all data collected in this study confidentially. If you have questions about how we treat collected data, please see ADM's privacy policy at https://www.admenergy.com/privacy

Thank you for your time.

Best,

ADM Associates / Contractor to Alameda Municipal Power

Pre-Defined Variables

Variable	Definition
CONTACT NAME	Customer contact first and last name
COMPANY	Customer company name
LOCATION	Address in form of “street in city”
YEAR	Program Year

Program Awareness

1. We have it in your records that **[COMPANY]** participated in Alameda Municipal Power’s Energy Plus program in **[YEAR].** Do you remember participating in the Energy Plus program?
    1. Yes
    2. No **[END SURVEY]**

    98. I don’t know **[END SURVEY]**

2. What is your job title or role?
    1. Facilities Manager
    2. Energy Manager
    3. Other facilities management/maintenance position
    4. Chief Financial Officer
    5. Other financial/administrative position
    6. Proprietor/Owner
    7. President/CEO
    8. Manager
    9. Other (Specify) ____
    98. I don’t know

3. How did you learn about AMP’s Energy Plus Program? **[MULTI SELECT]**
    1. AMP customer service representative
    2. AMP’s website
    3. Email from AMP
    4. Mailing/bill insert from AMP
    5. Contractor
    6. Friends or colleagues
    7. Social media post (e.g., Facebook, Twitter, Instagram, TikTok)
    8. Internet search (e.g., Google)
    9. Media advertisement (internet, radio, television)
    10. Other (please explain)
    98. I don’t know

Energy Efficiency Behaviors and Motivation for Participation

The next set of questions asks you about your energy saving behaviors and your motivation for enrolling in the Energy Plus Program.

4. What actions do you currently take to conserve energy? **[MULTI SELECT]**
   1. Install energy efficient (like ENERGY STAR) equipment with an incentive through the Energy Plus program
   2. Install energy efficient (like ENERGY STAR) equipment without an incentive from the Energy Plus program
   3. Use programmable or smart thermostats to better control ambient temperature
   Use building automation systems
   5. Use motion sensing lights that turn off when no one is in the room
   6. Turn off equipment/heavy machinery when not in use
   7. Install energy efficient lighting
   8. Install power strips
   9. Other (open-ended)

5. Which of the following factors helped you decide to participate in the program? **[MULTI SELECT]**
   1. Save money on energy bills
   2. Save energy
   3. Protect the environment
   4. Financial incentive
   5. Replacing old/broken equipment
   6. Other
   98. I don't know

6. Before participating in the Energy Plus program, had you installed any equipment or measure similar to the energy efficient equipment you received through the program?
   1. Yes
   2. No
   98. I don't know

7. Do you have plans to upgrade existing equipment to more energy efficient models or perform any efficiency services?
   1. Yes
   2. No
   98. I don't know

Program Participation

The next few questions are about the program participation process.

8. Which measures did you receive from the Energy Plus Program in **[YEAR]**? **[MULTISELECT]**
    1. Lighting and lighting controls
    2. Heating, ventilation, and air condition equipment (HVAC)
    4. Boilers
    5. Refrigeration equipment
    6. Other (please specify)

9. Did you receive any technical services, such as a facility assessment or assistance with identifying and selecting equipment for an energy saving project, from an AMP or Ecology Action representative, when enrolled in Energy Plus?
    1. Yes
    2. No
    98. I don't know

[DISPLAY Q10 IF Q9 =1]

10. Did the program representative recommend the equipment you installed?
    1. Yes
    2. No
    98. I don't know

11. Is the **[PIPE IN RESPOSE FROM Q8]** still installed and operating? (**REPEAT FOR EVERY MEASURE CHOSEN IN Q8)**
    1. Yes
    2. No
    98. I don't know

12. When you were first approached about the program, did you have any concerns about participating or was it an easy decision?
    1. I had some concerns
    2. It was an easy decision
    98. I don't know

[DISPLAY Q13 IF Q12=1]

13. What were your concerns?
[OPEN ENDED]

[DISPLAY Q14 IF Q12=1]

14. Why did you decide to participate despite your concerns?
[OPEN ENDED]

15. Which of the following people worked on completing your application for program incentives (including gathering required documentation)? **[MULTISELECT]**
    1. Yourself
    2. Another member of your company
    3. A contractor
    4. An equipment vendor
    5. A designer or architect
    6. Someone else (please specify)
    98. I don't know

[DISPLAY Q16 if Q0=1]

16. Thinking back to the application process, please rate <u>the clarity of information</u> on how to complete the application.

Not at all clear				Completely clear	I don't know	Refuse to answer
1	2	3	4	5	98	99

[DISPLAY Q17 ONLY IF Q16 < 4]

17. What information, including instructions on forms, needs to be further clarified?
[OPEN ENDED]

18. Did you have a clear sense of whom you could go to for assistance with the application process?
    1. Yes
    2. No
19. How did final incentive payment that you received compare to what you were expecting when you enrolled in the program? Would you say that …
    1. It was much less
    2. It was somewhat less
    3. It was about the amount expected
    4. It was somewhat more
    5. It was much more
    98. I don't know

Program Satisfaction

The next set of questions are about your overall satisfaction with the Energy Plus program and AMP as your utility provider.

20. Using a scale of 1 to 5, where one is "very dissatisfied", 5 is "very satisfied", and a 3 is neither particularly dissatisfied nor satisfied, please rate how satisfied or dissatisfied you are with each of the following

	1 – Very Dissatisfied	2	3	4	5 – Very Satisfied	I don't know
a. how long it took program staff to address your questions or concerns	1	2	3	4	5	98
b. how thoroughly they addressed your question or concern	1	2	3	4	5	98
c. the project support you received from the program representative	1	2	3	4	5	98
d. the amount of time it took to get the rebate or incentive	1	2	3	4	5	98
e. the range of equipment that qualifies for the program	1	2	3	4	5	98
f. the steps you had to take to get through the program	1	2	3	4	5	98
g. the program overall	1	2	3	4	5	98

[DISPLAY Q21 IF ANY IN Q20 <3]

21. You indicated some dissatisfaction. Why were you dissatisfied?

[OPEN ENDED]

[DISPLAY Q22 IF Q20e <3]

22. You indicated dissatisfaction with the range of equipment that qualifies for the program. What additional measures would you like to see included?

[OPEN ENDED]

23. Would you say that your participation in AMP's Energy Plus Program has:
    1. Greatly increased your satisfaction with AMP as your electrical service provider
    2. Somewhat increased your satisfaction with AMP] electrical service provider
    3. Did not affect your satisfaction with AMP electrical service provider
    4. Somewhat decreased your satisfaction with AMP electrical service provider
    5. Greatly decreased your satisfaction with AMP electrical service provider
    6. I don't know

24. The Energy Plus program is currently closed, however AMP is interested in continuing to serve its commercial customers with energy efficiency. Do you have any suggestions for the types of services you would like to see provided?
    [OPEN ENDED]

25. What types of measures/services would you have liked to have included in the program?

[OPEN ENDED]

26. Do you participate in any other commercial energy efficiency programs through AMP?
    1. I do not participate in any other energy efficiency services offered to businesses
    2. Electric Vehicle (EV) Rebates for Businesses
    3. Heat Pump Water Heater Rebates – Commercial
    4. HVAC Rebates
    5. Commercial Customized Rebates
    6. Lighting Retrofit (Self Install)
    7. New Construction
    8. Energy Benchmarking
    9. Lighting Savings Calculator
    10. Smart Meters
    11. Food Service Equipment Rebates
    12. Other (please specify)

27. How did your experience with Energy Plus compare to your experience with **[INSERT RESPONSES FROM Q26]**?
    [OPEN ENDED]

28. What services did Energy Plus offer that the other programs (**[INSERT RESPONSES FROM Q26]**) you participated in have not offered?
    [OPEN ENDED]

29. What did you like most about the Energy Plus program?
    [OPEN ENDED]

30. What would you change about the Energy Plus Program?
    [OPEN ENDED]

Firmographics

Thank you for your responses. I have just a few more questions about your business.

31. Which best describes your business?
    1. College / University
    2. K-12 School

3. Grocery or convenience store

4. Hotel / Motel

5. Industrial / Manufacturing

6. Medical / Healthcare

7. Office

8. Religious worship

9. Restaurant

10. Retail

11. Warehouse

12. Other (please specify)

98. I don't know

32. How many people are employed at your business located at **[LOCATION]**?

1. 1-10 employees

2. 11-30 employees

3. 31-49 employees

4. 50-99 employees

5. 100-149 employees

6. 150-299 employees

7. More than 300 employees

33. How would you describe your company's facility located at **[LOCATION]**?

1. Your company's only location
2. One of several locations owned by your company
3. The headquarter location of a company with several locations
98. I don't know

[DISPLAY Q34 IF Q33=2 or 3]

34. Did the company's other locations participate in the Energy Plus Program?

1. Yes

2. No

98. I don't know

35. Does your company rent, own and occupy, or own and rent the facility to someone else at this location?

1. Rent
2. Own and occupy
3. Own and rent to someone else

4. Own, occupy, and rent to someone else

98. I don't know

36. Does your company pay the electric bill for this location?
    1. Yes

    2. No

    98. I don't know

37. Do you have any other comments that you would like to relay to AMP about energy efficiency in the commercial and industrial sector or about their programs?
    [OPEN ENDED]

Thank you for taking the time today. That concludes the survey.

7.2 EAP Plus

Client: Alameda Municipal Power

Program(s): EAP Plus

Group**:** EAP Plus participants

Mode: Email / Telephone

Recruitment Text

Dear [CONTACT NAME],

Hello, Alameda Municipal Power is interested in learning how it can improve its energy savings program and wants your feedback! Our records indicate your household received some energy efficiency upgrades (ex: LED lights, occupancy sensors, weatherization measures) through the program, and we were hoping you could answer a few questions about your experience.

This survey should not take more than 15-20 minutes, and your feedback would greatly help Alameda Municipal Power improve its EAP Plus program moving forward!

Please follow this link to the Survey:
[LINK]

Or copy and paste the URL below into your internet browser:
[LINK]

If you have questions or require technical assistance, please contact Heather Polonsky at zephaniah@admenergy.com If you wish to no longer receive calls about this survey, please letme know and we will add you to the “do not call” list.

Thank you for your time.

Best,

ADM Associates / Contractor to Alameda Municipal Power

Pre-Defined Variables

Variable	**Definition**
CONTACT NAME	Customer contact first and last name
LOCATION	Address in form of “street in city”

YEAR	Participation year
MEAURES	Measures received

Screening

1. We have it in your records someone in your household participated in Alameda Municipal Power's EAP Plus program in **[YEAR].** Do you remember participating in the EAP Plus program?
    1. Yes
    2. No **[END SURVEY]**

    98. I don't know **[END SURVEY]**

Program Awareness / Motivation to Participate

This first set of questions is about your first learned about the EAP Plus program and become enrolled in the program.

1.
2. How did you learn about Alameda Municipal Power's (AMP) EAP Plus Program? **[MULTI SELECT]**
    1. AMP customer service representative
    2. AMP's website
    3. Completion of home energy review
    4. Email from AMP
    5. Landlord or property manager
    6. Mailing/bill insert from AMP
    7. Contractor
    8. Information at a retailer
    9. Friends or colleagues
    10. Social media post (e.g., Facebook, Twitter, Instagram, TikTok)
    11. Internet search (e.g., Google)
    12. Internet ad
    13. Radio or television ad
    14. Newspaper or magazine ad
    15. Other (please explain)
    98. I don't know

3. Why did you decide to participate in the AMP EAP Plus Program? **[MULTISELECT]**
    1. Save money on energy bills

    2. Save energy

    3. Protect the environment

    4. Financial incentive

    5. Replacing old/broken equipment

    6. It was my landlord's decision

7. Other

98. I don't know

[DISPLAY Q4 IF MORE THAN ONE SELECTED IN Q3]

4. What would you say is the *main* reason that drove you to participate in the program?
    1. Save money on energy bills
    2. Save energy
    3. Protect the environment
    4. Financial incentive
    5. Replacing old/broken equipment
    6. It was my landlord's decision
    7. Other
    98. I don't know

Home Energy Assessment

The next set of questions are about the home energy assessment you received when you first enrolled in the program

5. Do you remember receiving a home energy assessment through the EAP Plus Program?
    1. Yes
    2. No [SKIP TO NEXT BLOCK]
    98. I don't know

6. How did the experience of scheduling your home energy assessment go for you? On a scale of 1 to 5, where 1 is "very difficult" and 5 is "very easy," how would you rate the process of scheduling of your home energy assessment?
    1. 1 – Very difficult
    2. 2
    3. 3
    4. 4
    5. 5 – Very easy
    98. I don't know

[DISPLAY Q7 if Q6 < 4]

7. What about the process was not easy?
    [OPEN ENDED]

8. Where there any additional topics you wish the energy consultant went over with you during the assessment?
    [OPEN ENDED]

9. On a scale of 1 to 5, where 1 means “strongly disagree” and 5 means “strongly agree”, please indicate how much you agree with the following statements regarding your experience your home energy assessment:
   [MATRIX. 1 strongly disagree, 2, 3, 4, 5 strongly agree, I don’t know]
   2. a. The energy saving recommendations were easy to understand
   3. b. My energy consultant was courteous and professional
   4. c. The energy recommendations were relevant for my home
   5. d. The energy report is helpful.

10. Since the assessment, would you say you have completed or plan to complete all/most of the recommended energy efficiency improvements, some of the improvements, or none of the improvements?
    1. Completed all
    2. Some, but not all
    3. I have not completed any
    98. I don’t know

[DISPLAY Q11 if Q10=2 or 3]

11. What energy efficient improvement recommendations have you not implemented?
    [OPEN ENDED]

[DISPLAY Q12 if Q10=2 or 3]

12. What were the primary reasons you have not implemented these improvements? **[MULTISELECT]**
    1. Cost
    2. Do not have time
    3. Waiting for equipment to fail
    4. Do not feel they need to be done/will save energy
    5. Do not own the property
    6. Need more information
    7. Still planning to implement in the future
    9. Other (please specify)
    98. I don’t know

13. Did your energy consultant provide you with information about other AMP energy efficiency programs during your appointment?
    1. Yes
    2. No
    98. I don’t know

Program Participation

The next few questions are about the program participation process.

14. Which measures did you receive from the EAP Plus program? Please select all that apply. **[MULTISELECT]**
    1. Refrigerator replacement

2. Efficient LED lighting
3. Lighting occupancy sensors
4. Advanced power strips
5. Weatherization measures (door weatherstripping, sweeps, thresholds; outlet cover plates and gaskets)
6. Low flow devices (bathroom faucet aerator; kitchen faucet aerator)
7. Smart thermostats
8. Night lights
9. Other (please specify)

15. Did you receive any educational materials are part of your participation in the program?
    1. Yes
    2. No
    98. I don't know

[DISPLAY IF Q15=1]

16. What types of educational materials did you receive?
    [OPEN ENDED]

[LOOP THROUGH Q17-Q18 FOR EACH OF THE RESPONSES FROM Q14]

17. Is the [INSERT RESPONSE FROM Q14] still installed and working?
    1. Yes
    2. No
    98. I don't know

[DISPLAY IF Q17=2]

18. Why did you uninstall [INSERT RESPONSE FROM Q14]? Select all that apply.
    [MULTI SELECT]
    1. It was not working properly
    2. I purchased a new [INSERT RESPONSE FROM Q14] that I liked more
    3. I liked my old [INSERT RESPONSE FROM Q14] more, so I reinstalled it
    4. I performed some remodeling or maintenance that require the removal of the **[INSERT RESPONSE FROM Q14]**
    5. I did not like the way the new [INSERT RESPONSE FROM Q14] looked
    6. Other (please specify)
    98. I don't know

Energy Efficiency Behaviors and Motivation for Participation

6. The next set of questions asks you about your energy saving behaviors.

15. Prior to participating in the EAP Plus Program, how familiar were you with various residential energy saving activities such as washing clothes with cold water, turning off the lights when not in use, and adjusting heating system settings?
    1. Very unfamiliar
    2. Somewhat unfamiliar
    3. Neither unfamiliar nor familiar
    4. Somewhat familiar
    5. Very familiar
    98. I don't know

16. Before participating in the EAP Plus Program, what actions did you take to conserve energy? [MULTISELECT]
    7. 1. Install energy efficient equipment with an incentive through the Energy Plus program
    8. 2. Install energy efficient equipment without an incentive from the Energy Plus program
    9. 3. Use programmable thermostats to better control ambient temperature
    10. 4. Turn off lights when not in use
    5. Use motion sensing lights that turn off when no one is in the room
    6. Wash clothes with cold water
    7. Remove lint from dryer filter
    8. Install energy efficient light bulbs (e.g. LEDS, CFLs)
    9. Install power strips
    98. Other (please specify)

17. After participating in the program, what actions do you now take to conserve energy? [MULTISELECT]
    11. 1. Install energy efficient equipment with an incentive through the Energy Plus program
    12. 2. Install energy efficient equipment without an incentive from the Energy Plus program
    13. 3. Use programmable thermostats to better control ambient temperature
    14. 4. Turn off lights when not in use
    5. Use motion sensing lights that turn off when no one is in the room
    6. Wash clothes with cold water
    7. Remove lint from dryer filter
    8. Install energy efficient light bulbs (e.g. LEDS, CFLs)
    9. Install power strips
    98. Other (please specify)

18. Before participating in the EAP Plus Program, how interested were you in making improvements to your home that would:
    [MATRIX: Very interested 5 --- Not at all interested 1; I don't know]
    a. Increase its energy efficiency

b. Improve your comfort?
c. Improve your health and safety?

19. Before participating in the EAP Plus program, had you installed any equipment or measure similar to the energy efficient equipment you received through the program?
    1. Yes
    2. No
    98. I don't know

20. As a result of the program, are you now planning to perform any other upgrades to your home?
    1. Yes
    2. No
    98. I don't know

[DISPLAY Q21 if Q20=1]

21. What upgrades are you planning to make?
    [OPEN ENDED]

22. When you were first learned about the program, did you have any concerns about participating or was it an easy decision?
    1. I had some concerns
    2. It was an easy decision
    98. I don't know

15.
16. **[DISPLAY Q13 IF Q12=1]**
23. What were your concerns?
17. **[OPEN ENDED]**
18.
19. **[DISPLAY IF Q12=2]**
24. Why was it an easy decision?
20. **[OPEN ENDED]**

Satisfaction

The following set of questions asks you about your satisfaction with the EAP Plus Program and Alameda Municipal Power more generally.

25. Not counting any contractors or energy consultants that you hired, in the course of completing the project, did you contact program staff from AMP with questions about completing your project?
    1. Yes
    2. No
    98. I don't know

26. Using a scale of 1 – 5, where 1 is “very dissatisfied” and 5 is “very satisfied”, please rate your satisfaction level with each of the following areas:
    [MATRIX – 1 “very dissatisfied, 5 “very satisfied”; 98 “I don’t know”]
    a. **[DISPLAY IF Q25=1]** How long it took program staff to address your questions or concerns
    b. **[DISPLAY IF Q25=1]** How thoroughly program staff addressed your questions or concerns
    c. The program participation process
    d. The energy savings on your utility bill
    e. The quality of your energy assessment
    f. The refrigerator installed
    g. The LEDs installed
    h. The light occupancy sensors installed
    i. The advanced powerstrips installed
    j. The weatherization measures installed
    k. The program overall
21.
27. You indicated some dissatisfaction. Why were you dissatisfied with [PIPE IN FIELDS FROM Q26, IF ANSWER < 3]

28. Are there any other services you wised AMP provided?
    1. Yes
    2. No

    [DISPLAY Q28 IF Q29=1]
29. What additional services do you wish AMP provided?
    [OPEN ENDED]

30. How dissatisfied or satisfied were you with the program?
    1. Very dissatisfied
    2. Somewhat dissatisfied
    3. Neither dissatisfied nor satisfied
    4. Somewhat satisfied
    5. Very satisfied
    98. I don’t know

    [DISPLAY Q31 if Q30<3]
31. Why were you dissatisfied with the program?

32. How dissatisfied or satisfied are you with Alameda Municipal Power as your electrical service provider?
    1. Very dissatisfied
    2. Somewhat dissatisfied
    3. Neither dissatisfied nor satisfied
    4. Somewhat satisfied
    5. Very satisfied
    98. I don’t know

33. In your experience, how reliable is Alameda Municipal Power as a source of information about saving energy in your home? Would you say they are…
    1. Very reliable
    2. Somewhat reliable
    3. Neither reliable nor unreliable
    4. Somewhat unreliable
    5. Very unreliable
    98. I don't know

34. What impact did participating in the EAP Plus Program have on your satisfaction with Alameda Municipal Power. Would you say your participation in EAP Plus…
    1. Greatly increased your satisfaction with Alameda Municipal Power
    2. Somewhat increased your satisfaction with Alameda Municipal Power
    3. Did not affect your satisfaction with Alameda Municipal Power
    4. Somewhat decreased your satisfaction with Alameda Municipal Power
    5. Greatly decreased your satisfaction with Alameda Municipal Power
    98. I don't know

35. How likely are you to recommend the EAP Plus program to to a friend, relative or colleague?
    1. Very unlikely
    2. Somewhat unlikely
    3. Neither unlikely nor likely
    4. Somewhat likely
    5. Very likely
    98. I don't know

Demographics/Household Characteristics

Now I have just a few final questions about your household. This information will be kept anonymous, but you do not need to answer any question you do not want to answer.

36. Do you rent, own and occupy, or own and rent the residence at **[LOCATION]**?
    22. 1. Rent
    23. 2. Own and occupy
    24. 3. Own and rent to someone else
    4. Own, occupy, and rent to someone else
    98. I don't know

[DISPLAY IF Q36=2]

37. Do you or pay the electric bill for **[LOCATION]**?
    1. Yes

2. No

98. I don't know

38. Who pays the electric bill for **[LOCATION]**?
[OPEN ENDED]

[DISPLAY IF Q36=1]

39. Did your landlord know about EAP Plus Program when you approached them get approval to participate in the EAP Plus Program?
    1. Yes
    2. No
    98. I don't remember

[DISPLAY IF Q36=1]

40. Did your landlord recommend the program to you?
    1. Yes
    2. No
    98. I don't remember

[DISPLAY IF Q36=1]

41. How did your landlord react when you approached them to get approval to participate in EAP Plus Program?
    1. They agreed to give me approval without question
    2. They agreed to give me approval, and asked for more information to provide to other tenants
    3. They agreed to give me approval, but wanted to speak to an AMP representative first
    4. They did not agree to give me approval
    98. I don't remember

42. What is the main fuel used for heating your home?
    1. Electricity
    2. Natural Gas
    3. Propane
    4. Something else (Please specify)
    5. Don't heat home
    98. I don't know

43. Do you use a central air conditioning system in your home?
    1. Yes

    2. No

    98. I don't know

44. Including yourself, how many people lived in your household?
    1. 1 person

2. 2 people
3. 3 people
4. 4 people
5. 5 people
6. 6 people
7. 7 people
8. 8 or more people

45. What is your age?
    1. 18-24
    2. 25-34
    3. 35-44
    4. 45-54
    5. 55-65
    6. 65-74
    7. 75+
    98. Prefer not to answer

46. Including all money earned from wages, salaries, tips, commissions, workers' compensation, unemployment insurance, child support, or other sources, about how much was your total annual household income?
    1. Less than $10,000
    2. $10,000 to less than $20,000
    3. $20,000 to less than $30,000
    4. $30,000 to less than $40,000
    5. $40,000 to less than $50,000
    6. $50,000 to less than $75,000
    7. $75,000 to less than $100,000
    8. $100,000 to less than $150,000
    9. $150,000 to less than $200,000
    10. $200,000 or more
    98. I don't know

47. What language(s) do you speak at home? Please select all that apply
    1. English
    2. Spanish
    3. Mandarin
    4. Vietnamese
    5. Tagalog
    6. Armenian
    7. Korean
    8. Russian

9. Persian (including Farsi, Dari)
10. Other

48. Do you have any other comments that you would like to relay to AMP about your experience with EAP Plus Program?
    [OPEN ENDED]