Uplifting Rentals: Decarbonizing Affordable Housing

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ABSTRACT

As utilities shift towards cleaner sources of electricity, strategic building electrification presents a new opportunity to reduce greenhouse gas emissions. Heat pumps and other electrification technologies are finally gaining traction, with more market actors and customers considering the switch, but extra effort is needed to make sure that no one is left behind. Renters make up two-thirds of the low-income population in the state. Half of these income-eligible renters live in multifamily units.

While some researchers have addressed the topic of residential building electrification, there are few studies on equitable pathways for underserved customer segments such as low-income households and renters. This paper provides the lessons learned from a statewide low income renter needs assessment and one innovative program pilot that offered weatherization, energy efficiency measures, and electrification to low-income multifamily households from 2017 to 2023. This pilot that was designed to overcome many of the barriers to energy upgrades and electrification faced by low-income renters. You will read the perspectives of the pilot administrator, program implementer, contractors, property owners/managers, and tenants. We quantify the impacts that the pilot interventions had on energy usage, utility bill costs, greenhouse gas emissions, rental costs, and tenant turnover.

This paper will provide a clear example of how electrification programs can be molded to address the unique needs and barriers of underserved communities.

Introduction

This paper presents findings from an evaluation of a pilot program focused on serving renters in multifamily subsidized affordable housing in California, demonstrating how one program administrator is assisting residents who are underserved by existing programs. We use findings from the evaluation of this pilot to share lessons for other programs that are looking to:

1. Address barriers within target communities;
2. Consider new outreach strategies;
3. Develop metrics to track progress towards equity-focused goals; and/or
4. Facilitate residential building electrification.

Role of MCE. MCE, formerly known as Marin Clean Energy, was the first local not-for-profit Community Choice Aggregator (CCA) in California. It provides electric service to more than 1.5 million residences and businesses across four counties in the North and East Bays: Contra Costa, Marin, Napa, and Solano. MCE was established in 2010 and has joined Pacific Gas and Electric (PG&E) as a provider of electric generation in these communities, supplying more energy from clean, renewable power sources. For all customers in the area, PG&E continues to deliver the electricity from the grid to each customer, address outages, maintain the

wires, and manage the billing. MCE sources generation and delivers programs. Customers were automatically transferred to MCE, with an option to opt out and continue receiving services from PG&E.

Regulatory Context and Existing Programs. California established aggressive goals in its efforts to decarbonize. These goals were established in California's Global Warming Solutions Act of 2006 (AB 32), and SB 32 in 2016 set statewide limits on greenhouse gas emissions (GHGs) to 40 percent below 1990 levels by 2030 (EDF 2022). Senate Bill 350 affirmed the 40 percent goal, while also setting a 2050 goal of reducing GHGs to 80 percent below 1990 levels (State of California 2015). Electricity from renewable sources has significantly lower GHG emissions than natural gas, propane, or wood combustion. To achieve these emissions reduction goals, utilities have begun incentivizing electrification.

Over time, the state has further committed to low-income and disadvantaged communities, recognizing that these communities and the people in them are most burdened by the impacts of climate change and least able to cope (UW 2018). There are three statewide utility programs available to low-income customers; these include the California Alternate Rates for Energy (CARE) program and the Family Electric Rate Assistance (FERA) program, which provide reduced electricity and gas rates to low-income households, as well as the Energy Savings Assistance (ESA) program, which provides no-cost weatherization services to households with incomes below 250 percent of the federal poverty level (FPL) (CPUC 2021c). These programs have helped thousands of Californians consume cleaner energy, make their homes safer, manage their energy cost burden, and improve comfort.

Unfortunately, gaps still exist with many low-income renters still in need of energy assistance. The barriers to participation in these communities are well documented, including, for instance, the landlord/tenant split incentive issue, which makes incentivizing in-unit energy efficiency in multifamily buildings even harder. The split incentive issue arises as renters who do not have the economic incentive to invest in a property they do not own, including investing in energy efficient or electrification upgrades, avoid making these changes. In addition, landlords who do not pay the energy bills also have little incentive to equip units with new appliances (despite the benefits of energy efficiency and lower indoor air pollution) when they will not benefit from doing so directly.

Pilot Program Design

MCE launched the Low-Income Families and Tenants (LIFT) pilot in 2017, providing incentives to multifamily buildings (5+ units) with low-income residents. The LIFT pilot incentivized energy upgrades (e.g., lighting, windows, faucet aerators, showerheads, insulation) and electrification (e.g., heat pumps and electrical upgrades) in tenant units, as well as central systems (i.e., hot water or space conditioning). These incentives are reserved for multifamily **property owners** whose tenants are predominantly low-income (<200% of the FPL).[1] On average, LIFT treated five properties per year. Each property had an average of 41 tenant units,

[1] An eligible household is one that meets the Energy Savings Assistance (ESA) eligibility criterion, for example a household income at or below 200 percent of the federal poverty level. This threshold was increased to 250% starting July 2022. If at least 80% of tenants meet the household income threshold, then LIFT funds can be used to treat all units at the property.

installed 12 heat pumps, and received $68,500 in incentives (including $41,650 for the heat pumps and $27,230 for other efficiency measures).

The LIFT pilot mimics the design of MCE's Multifamily Energy Savings (MFES) program, which was open to all multifamily properties regardless of income.[2] MFES and LIFT have different funding sources, which makes it possible for multifamily properties to leverage incentives from both programs. The two programs share the same implementer, the Association for Energy Affordability (AEA), providing a **single point of contact** (SPOC) and **stackable incentives**.

Property owners could learn about the LIFT program through online marketing, coordination with PG&E, direct outreach from the implementer (i.e., AEA), community-based workshops with property owners, local government (county and city), and affordable housing organizations. Property managers apply for LIFT through an online interest form on MCE's website. As the program implementer, AEA, is responsible for the following activities:

1. Reviewing the application
2. Conducting desktop analysis of opportunities and program fit
3. Performing an onsite energy audit and pre-construction site visits
4. Coordinating between owners and the owner-selected contractor(s) to develop and finalize the scope of work (SOW), technical feasibility, etc.
5. Providing technical assistance throughout the projects to support the owner and contractor
6. Completing measure submittal and interim site visits for quality assurance/quality control
7. Providing post-construction install verification
8. Authorizing incentive payments by MCE to the property owner
9. Completing energy savings calculations and savings claims reporting

The LIFT pilot was originally approved by the CPUC to run under the ESA program. This was followed by several extensions that allowed the LIFT program to continue as a pilot through 2023 (CPUC 2016, CPUC 2021b).[3] Table 1 provides a comparison between the ESA program and LIFT pilot program approaches to treating multifamily properties, at the time the pilot was first proposed in 2017. Both programs upgraded income-eligible tenant units at multifamily properties, but approaches differed for recruitment, income verification, program integration, contractor engagement, measures, and incentives.[4]

[2] MFES eventually became an equity program for deed restricted properties.

[3] CPUC Decision D. 16-11-022 approved MCE's LIFT pilot program under the investor-owned utilities (IOU) Energy Savings Assistance (ESA) and California Alternate Rates for Energy (CARE) Programs and Budget Applications. D.21-06-015, issued June 7, 2021, authorized an extension of the LIFT pilot program through 2023 and directed the IOUs to develop a multifamily whole building (MFWB) offering.

[4] In 2021, four years after the LIFT pilot was approved, the IOUs were directed to develop a Multifamily whole building (MFWB) variation of the ESA program with a single point-of-contact (SPOC), property-manager outreach, and whole building upgrades. In this way, the IOU ESA program began adopting many elements of the LIFT pilot design.

Table 1: Comparison between ESA and LIFT, when the pilot was first proposed in 2017

Attributes	Energy Savings Assistance (ESA), for Multifamily	Low Income Families and Tenants (LIFT)
Recruitment	• Community outreach to tenants • Individual unit treatment • The property owner must give permission for upgrades. ESA provides a form that the tenant fills out, is signed by the property manager, and sent to the contractor.	• Outreach to property owners, affordable housing organizations, housing authorities, and shelters • Whole property treatment, encourages comprehensive energy savings property wide • Property owners informed and involved in the project process
Income Verification	Tenant income verification (e.g., pay stubs) or proof that they receive other forms of income-qualified public assistance (e.g., Medicaid)	Property owner affidavit, does not require the tenants to disclose personal information (e.g., name)
Program Integration	ESA provides referrals to other energy assistance programs	Layered incentives with other MCE programs; using a single point of contact and shared application
Contractors	ESA contractors perform direct install service within the unit	The property manager chooses their own contractor (if approved by AEA); they have flexibility on how and when to begin construction
Measures	Set program measure list; energy efficiency measures only	Energy efficiency and electrification measures (i.e., heat pumps and electrical upgrades). Properties can choose which measures to install (contingent on approval by AEA)
Incentives	No-cost measures	Cash incentives for property owners

The types of properties targeted by LIFT face the well-documented split incentives issue where the person paying for improvements (the property owner) is often not the same person paying the utility bills (the tenant). Renters are often worried about their relationship with their landlord, sharing personal information, and providing documentation (e.g., for undocumented residents). These potential downsides are weighed by tenants against the benefits of upgrades (increased comfort, reduced energy burdens, improved health and safety) on a property where they have no stake in ownership. LIFT intentionally focused on recruiting property owners and managers directly to get approval for the upgrades to all tenant units concurrently. The program implementation staff worked with property managers directly to help them understand the benefits of the upgrades on operating costs, tenure, affordability, health, comfort, and safety.

The LIFT program was designed to target communities that had been overlooked by the existing **equity** programs. By focusing on in-unit upgrades, LIFT helped residents receive efficient appliances, reducing their energy costs. Most of the LIFT incentives were exclusively

for in-unit measurers, with one of the few exceptions being master-metered heat pump water heaters. LIFT was also the first ever low-income program to offer **electrification** fuel-switching from propane; a common scenario in some rural MCE communities that have limited access to natural gas. These efficiency and electrification upgrades have had the potential to lower customers' energy bills but also improve their health, comfort, and safety. The LIFT pilot also was faced with the challenge of **educating** customers about lesser-known technologies (such as heat pumps) and the benefits of electrification.

Figure 1 provides a logic model for the LIFT pilot, showing how each of the formal and informal activities are linked to expected program outcomes. This model was developed by Evergreen through a review of program documentation and discussions with key program staff in 2022.

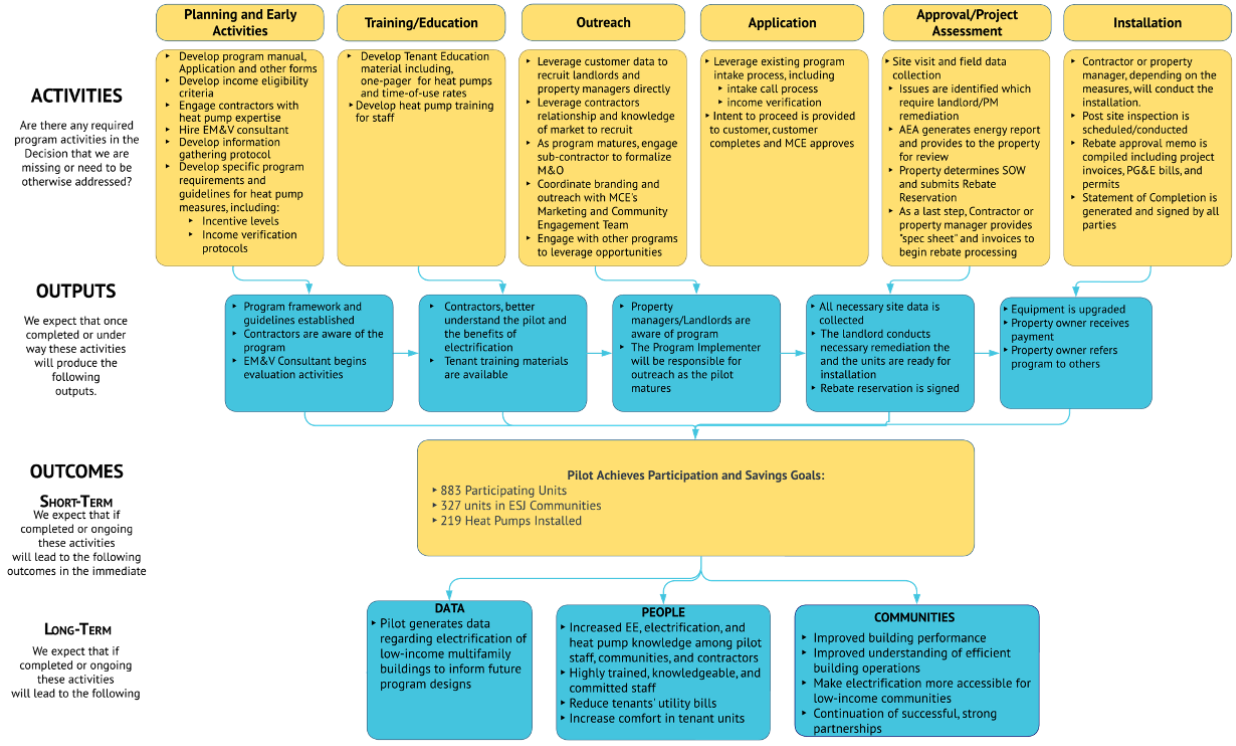

Figure 1. Lift pilot program logic model

Evaluation Methodology

The evaluation included a series of research activities conducted between 2022 and 2024 to test whether the LIFT pilot program has achieved its objectives.[5] These research activities included:

1. **A literature review** to identify any additional measures or programs from which MCE can learn, and then document the costs and expected impacts of fuel switching.

[5] This is the second evaluation of the LIFT pilot. The first was completed by DNV in 2021.

2. **A logic model** to map the formal and informal activities to the expected programmatic outcomes (shown above, in Figure 1).
3. **Program tracking and data review** (n=31 properties with 1,271 treated tenant units and 27 distinct measure types) to estimate energy savings and costs and characterize program participation including quantifying overlaps including but not limited to participation, savings, and measures between the LIFT and MFES programs.
4. **Energy and bill impact analysis** to estimate impacts of installed measures on energy consumption, bill costs (with and without rate changes), and the persistence of savings.
5. **Multi-mode tenant surveys** (n=213 of 1,271) to assess outreach, ease of participation, remaining barriers, and comfort/satisfaction with measures from the tenant perspective. This was a bi-lingual mail survey with postcard reminders and a web option. Tenants were offered a $5 cash pre-incentive with the first mailer and a $10-15 cash incentive on completion. We mailed 619 surveys and achieved a 38 percent response rate. The first round of the surveys was sent in August 2022, and the second was sent in January 2024.
6. **Property owner/manager interviews** (n=7 of 18) to assess ease of participation and remaining barriers. The first round of the interviews began in February 2023, and the second round began in January 2024.
7. **Contractor in-depth interviews** (n=6 of 20) to identify barriers and opportunities to achieving savings with a focus on improving marketing, education, and outreach (ME&O) activities. The first round of the interviews began in February 2023, and the second round began in January 2024.

The evaluation was designed to explore the unique elements of the program design including:

- The process of blending the LIFT pilot with the broader MFES program;
- Engaging property managers instead of going directly to tenants;
- Addressing barriers including the lack of access to and benefits of electrification measures for low-income households, and the multifamily split incentive issue;
- The impact of heat pumps and efficiency measures on consumption and bill costs; and
- The persistence of impacts (from measures installed in the first few years of the pilot).

Evaluation Findings

This section provides findings from the 2017-2023 LIFT evaluation report, organized by unique elements of the program design. You will see the perspectives of the pilot administrator, program implementer, contractors, property owners/managers, and tenants.

Overview of Pilot Activities

Between 2017 and 2023, the LIFT pilot served 1,208 income-eligible tenant units and 63 additional tenant units at 31 affordable multifamily properties.[6] As shown in Table 2, the program started in 2017 but there was not enough time for any projects to be completed in that

[6] The LIFT pilot rules allow all units to be treated at a property (even some moderate-income households) if at least 80 percent of the tenant units are income-eligible.

first year. The number of treated units gradually increased until 2022, when the pilot was put on hold while MCE waited for the program extension request to be approved by the CPUC. There was a lot of interest in 2023, but many projects were unable to complete the installation before the end of the year. There are 12 properties, 308 tenant units, and 229 heat pumps with a rebate reserved that plan to complete their installations by the end of 2024. Most of the properties (78%) were dual treated by LIFT and MFES, receiving incentives from both programs. Almost half of the treated tenant units (36%) were in underserved regions (as defined by the Environmental and Social Justice [ESJ] Action Plan), and 75 percent were in high-cost regions, (as defined by the CPUC Affordability Ratio [AR]).[7]

Table 2. LIFT program activity by year

Rebate Year	Count of Properties	Count of Eligible & Treated Tenant Units	Count of Heat Pumps
2018	4	30	0
2019	4	120	68
2020	9	162	80
2021	7	697	71
2022	1	28	42
2023	6	171	97
Total Installed	**31**	**1,208**	**358**
Rebate Reserved	12	308	229

As shown in Figure 2, renters treated by LIFT were mostly income-eligible ratepayers. The **high proportion of seniors (72%)** and disabled renters (35%), as well as low proportions of households with children (19%) and high occupancy residences (5%) is likely due to the large number of senior housing properties that applied for LIFT.

[7] The CPUC established the Environmental and Social Justice Communities (ESJ) Action Plan and adopted a definition for ESJ communities to address some of the effects of energy inequality in the state (CPUC 2019). We have defined ESJ as CalEnviroScreen 4.0 Disadvantaged Communities (OEHHA 2021), state-recognized tribal lands, and low-income census tracts (tract income is <80% area median income). The CPUC Affordability Report identifies the highest cost regions (Census Public Use Microdata Areas [PUMA]) as those with an affordability ratio of greater than 20 (CPUC 2021a). In other words, a household at the 20th percentile of income faces an electric affordability ratio of 6 percent or higher in these regions.

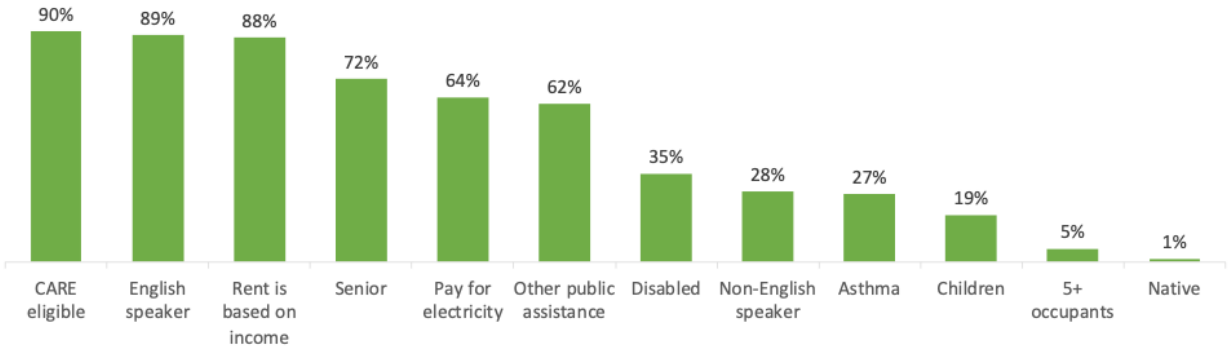

Figure 2. Characteristics of renters treated by LIFT

Treating every unit and shared system in an affordable housing complex **usually takes longer than a year**, with many administrative hurdles from the landlord (and housing authority) as well as remediation requirements to prepare these properties for the installations. As shown in Figure 3, many projects took one to two years to progress from the application to the final stage. Almost a third of projects (29%) took more than three years, not counting the months or years spent on recruitment or getting properties ready to apply. Properties that were considering **electrification measures took longer to reach the application stage**, as they spent more time discussing details of the project plan with the AEA and getting ready to submit their application. Properties that received measures from multiple programs took an average of six months longer to complete. **A two+ year project timeline is challenging if program dollars and success metrics are tied to an annual cycle**, as program dollars spent on recruitment and on-sites will usually occur at least one year before measure savings can be claimed.

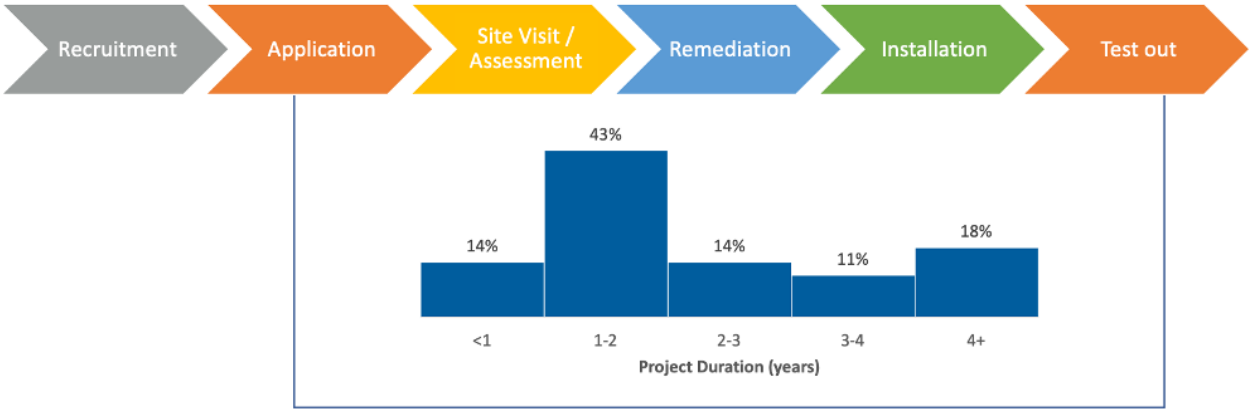

Figure 3. Timeline of engagement with each property

Unfortunately, there is limited documentation to pinpoint the source of delays within these projects. According to MCE and the program implementer, COVID and electrification were the two biggest sources of delays. The COVID-19 pandemic beginning in 2020 caused unforeseen delays in site visits, installations, and supply chain interruptions. Around the time that COVID restrictions loosened, there was more interest in electrification. As the LIFT pilot electrified all tenant units simultaneously, they had to request transmission and distribution system upgrades to handle the increase in electrical load, leading to additional costs and delays.

Engaging Property Managers instead of Tenants

To compare the LIFT pilot's outreach approach to the existing PG&E Energy Savings Assistance (ESA) program, we provided the property managers with a description of the landlord approval process for no-cost installations that was available to renters through the ESA program. We asked whether they would have approved upgrades to individual tenant units. Individual tenant unit upgrades were unlikely to have been approved in four of the seven examples; yet, all seven had been treated by LIFT. This suggests that LIFT's outreach method is successfully reaching some tenants who were not able to be served by the ESA program design. When we asked tenants a similar question, 55 percent of tenants would have been hesitant to accept the *same* bundle of measures from LIFT if they received the offer directly from the utility at no cost (Figure 4). This further supports the conclusion that **LIFT successfully treated many tenants who would not have been served by the ESA program, with tenant-direct recruitment**.

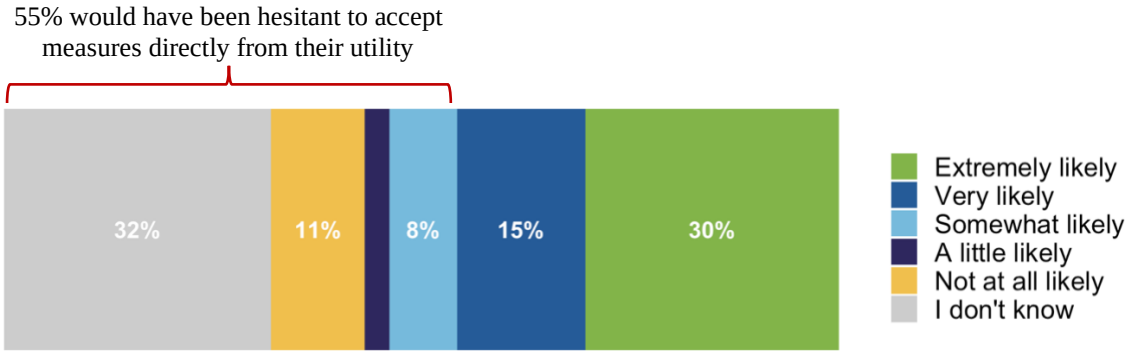

Figure 4. Tenant willingness to accept no-cost upgrades to their unit

We prompted tenants with a list of reasons why some customers hesitate to receive no-cost measures from their utility, as shown in Figure 5. The tenants' top concern was the **possibility of rent increasing** after the upgrades (61%). This concern was shared by program staff, who intentionally targeted deed restricted housing to reduce the likelihood that upgraded properties would displace low-income renters. Despite the survey being issued in late 2022, after COVID vaccinations, these renters were still afraid of **COVID exposure** (47% concerned) during installation. There are many venerable populations (e.g., seniors, asthmatics, disabled) living in affordable housing who are at higher risk of complications from COVID than the general population. The green bars in Figure 6 highlight concerns that apply more to ESA's tenant-direct program delivery model, which the LIFT program was designed to address (e.g., skepticism, landlord approval).

There were three concerns that were less prevalent for renters treated by LIFT than the average income-eligible renter in California: 1) that they do not want or need new appliances (22% vs. 65%), 2) getting approval from the landlord (29% vs. 52%), and 3) skepticism that the measures are really free (31% vs. 44%) (Evergreen 2022). These traits may be associated with affordable housing, with differences in the condition of the property and in the tenant/landlord dynamic.

Figure 5. Concerns about accepting no-cost measures

Figure 6 reflects all LIFT tenant concerns by housing type, which confirms that there are some important differences between senior (orange) and conventional housing (dark purple), even when we focus on deed restricted properties. Statistically significant differences are emphasized with brackets. **Tenants living in conventional housing were significantly *more* concerned than seniors** about the risk of a utility bill increase, allowing strangers into their home, the process taking too long or not being convenient, getting approval from the landlord, and trusting utility programs. This suggests that **recruiting the property manager to upgrade all eligible tenant units is an important pathway for treating conventional affordable housing** as the tenants face many additional barriers to receiving measures from a utility program.

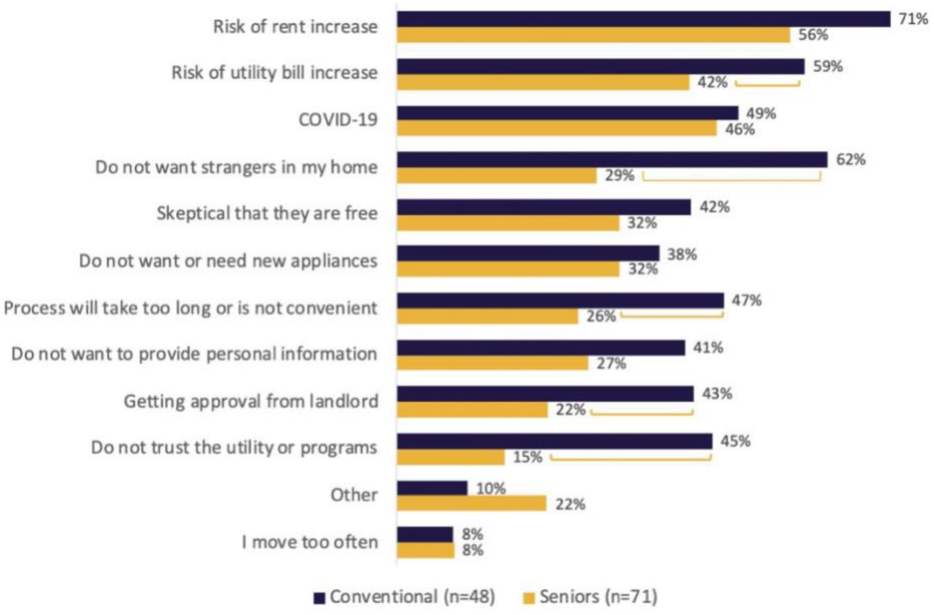

Figure 6. Concerns about accepting no-cost measures by housing type

Two-thirds (65%) of tenants were aware of the upgrades made to their unit and 74 percent were not aware of the LIFT program. Since the tenants were not recruited by the program and most did not know that MCE was involved in the upgrades, MCE **will not experience the benefits of an improved relationship with the customer after the installation.** This is unfortunate, as nearly all the tenants served by this program are low-income (90%) and many are disabled (32%). These customers would benefit from other forms of assistance offered by MCE (e.g., income-qualified rates, debt forgiveness, medical baseline). If participants had been referred to these other assistance programs, it would have reduced their electric bills ($).

Overcoming Barriers

The previous section provided responses from property manager interviews and tenant surveys, which suggest that many of the tenants treated by LIFT would have been unable or unwilling to receive the measures from the existing low-income program, PG&E's ESA. Next, we will talk about the barriers faced by property managers and contractors. Overall, every property manager (n=7) and contractor (n=6) that we interviewed reported being satisfied with the program.

Five of the seven property managers did not report facing any challenges during their participation in LIFT. The other two property managers reported that they had challenges with:

- Keeping the owner on track (n=1 of 7),
- Inspectors (e.g., permit) not giving the required 24-hour notice to tenants (n=1), and/or
- Tenants struggling to get used to the heat pumps (n=1).

None of the **contractors** that we interviewed (n=6) reported any significant obstacles to completing the installations; the process was smooth and efficient. They reported that the onsite assessment was thorough, and no additional issues were identified on-site during the installation.

Impacts of Heat Pumps and Efficiency Measures

Energy and bill impacts. By the end of 2023, LIFT installed 358 heat pumps at 16 properties. Half of the heat pumps were fuel replacing gas heat (n=183 of 358, 51%), half were electric upgrades (n=160 of 358, 45%), and a small number replaced propane (n=15 of 358, 4%).

Figure 7 shows the average kWh, therms, simulated electric bill ($), and actual electric bill $ savings for each common area and tenant unit treated by LIFT.[8] As a reminder, most of these properties (72%) were dual treated by two programs (LIFT and MFES), sometimes funding the same measure. When the two programs were separated by a full year, we modeled the impact of LIFT on its own. In all other cases, we measured the total impact of all installations at the meter and then allocated the impacts to the two programs based on the *ex ante* reported savings.

[8] MCE is an electric service provider. They have access to gas usage (therms) for customers who also receive gas service from PG&E. Unfortunately, they do not have gas bills ($) or gas rates (e.g., $/therm) for these customers. For this reason, the results of the billing analysis are limited to energy usage (kWh and therms) and electric bill ($) impacts.
The only measures installed in common areas were central systems that serve tenant units, such as water heaters and HVAC.

MFES energy efficiency measures (shown in blue) provided gas and electric savings in both common areas (on the left) and tenant units (on the right). When we held rates constant in the simulated electric bills, MFES led to positive bill savings. This confirmed that MFES would have led to bill savings if it had not been for the rate changes and time-of-use (TOU) transitions that occurred during this time. Instead of providing actual bill savings, the MFES **energy efficiency measures reduced the magnitude of the bill increase that customers experienced**.

LIFT energy efficiency and heat pumps (shown in green) led to an overall increase in electric kWh consumption (negative savings) in both common areas and tenant units, as well as **significant gas savings in common areas**. This was expected, as LIFT incentivized fuel switching, which trades gas and propane savings for an increase in electricity.

When we investigated the variability in savings across properties, most of the properties (n=20 of 22) fit the patterns exhibited in these program-level findings. Only 2 of the 22 properties that installed energy efficiency through LIFT exhibited an unexplained increase in energy usage after the measures were installed. Every property had increases in their electric bill after the installations (whether they installed efficiency or heat pumps) except two properties that had onsite solar generation.

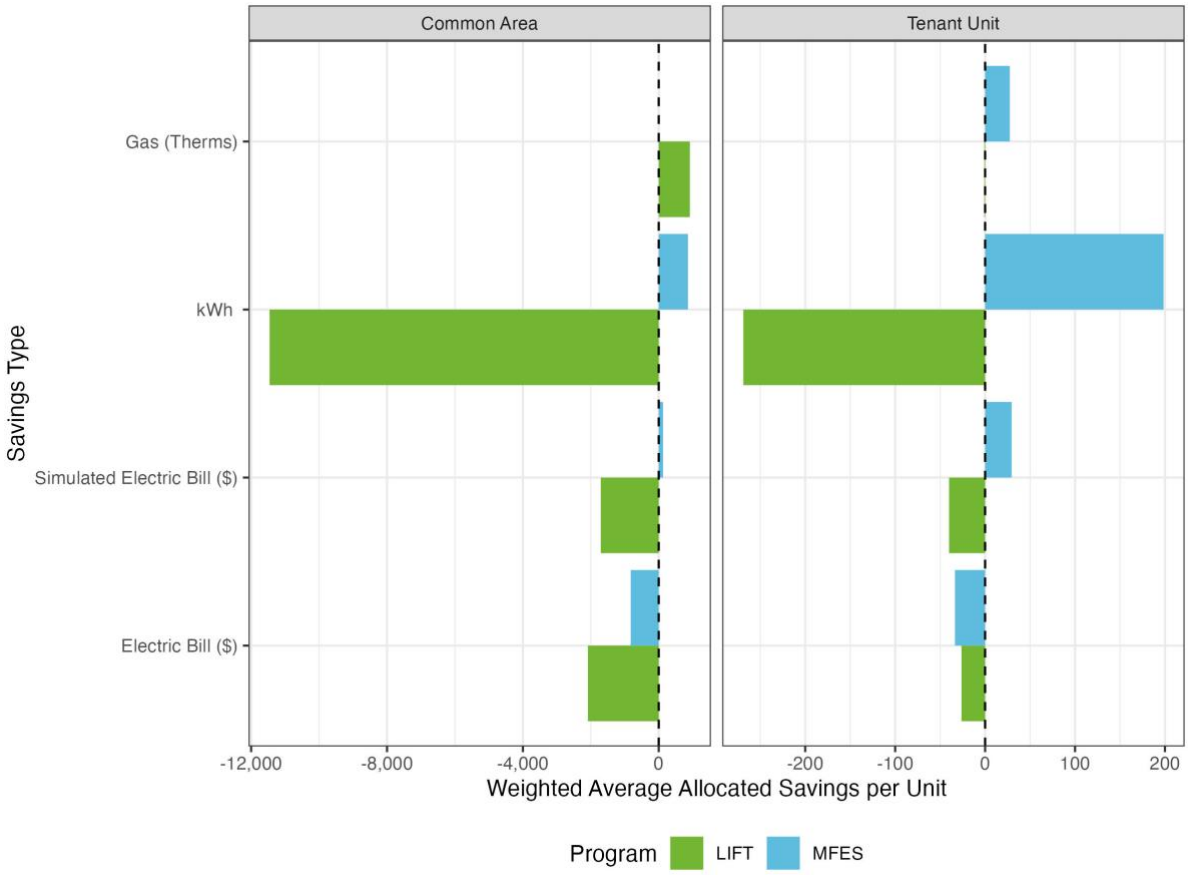

Figure 7. Energy and bill impact estimates for LIFT and MFES

GHG Emissions. We applied GHG multipliers to our estimated electric and gas energy impacts (as shown in Figure 8) and the *ex ante* propane impacts from fuel-switching. In the first year, LIFT measures produced a large reduction in CO_2 emissions, with small increases in NO_X and

SOx, as shown in Table 3. As California gets closer to the goal of 100 percent renewable energy generation, GHG emissions from electricity will continue to drop (Senate Bill No. 100).

Table 3. First Year GHG Impacts per Unit

Program	GHG	Common Area	Tenant Unit
LIFT	CO^2	-6,647.9	-97.0
	NOx	5.3	-0.1
	SOx	0.3	0.0
MFES	CO^2	-428.5	-469.1
	NOx	-0.4	-0.1
	SOx	-0.0	-0.0

Awareness. Most of the tenants (75%) who received heat pumps were unaware of heat pump technology before the installation, and **27 percent are still unsure what a heat pump is**.

Indoor air quality. Among the 39 tenants we surveyed who lived in the units before and after they were electrified with heat pumps, 48 percent noticed an improvement in indoor air quality, 47 percent saw no change, and 5 percent noticed a decrease.[9] One-fifth (17%) of these tenants who had been living in the unit before the installations said that they have experienced asthma or allergy symptoms (e.g., red/watery eyes, runny nose, coughing) that they attributed to their home environment, symptoms that improve when they leave the home. After the upgrades, there was no statistically significant change in their symptoms.

Safety. Less than 1 percent of tenants reported having experienced carbon monoxide leaks, fires from faulty wiring/equipment/lighting, or gas leaks while living at these properties. These issues could potentially be addressed by fuel switching (gas to electric) and electric upgrades, offered by LIFT; though the sample size was too small to detect impacts.[10] The most common safety issues tenants experienced at the properties treated by LIFT were pest infestations (19%) and water leaks (9%). These issues are worth noting, as they impact the health and safety of tenants, though they cannot be addressed with utility program funds.

Tenure. We asked tenants to rate the likelihood that they would move out of their unit within the next year. Most (81%) said they were not at all likely to move, and only 2 percent were very or extremely likely to move. When we asked if the energy upgrades had any impact on their decision, 90 percent said that the upgrades had no impact, 8 percent were more motivated to stay, and 2 percent were more motivated to move. This suggests that LIFT had little to no impact on tenure.

[9] The survey asked: "Ever since the home upgrades in <<Year>>, have you noticed any changes in your indoor air quality?" with the following options: "Yes, air quality improved", "Yes, air quality worsened", "No change", or "I don't know". This was only asked of tenants who had been living in the unit before the first measure was installed.
[10] The survey asked: "Have you experienced any of the following incidents at this residence?" with the following options: "Fire caused by faulty wiring, heating equipment, or lighting", "Carbon monoxide leak from equipment/appliances", "Gas leak from equipment/appliances", "Water leak", "Pest infestation", "Other:_____", and "None".

Satisfaction. Tenant satisfaction with heat pumps was lower than expected, with 45 percent responding that they were somewhat or not at all satisfied. The most common complaints about the heat pumps were that the controls were difficult (18%) or that something was wrong with the heating (12%).

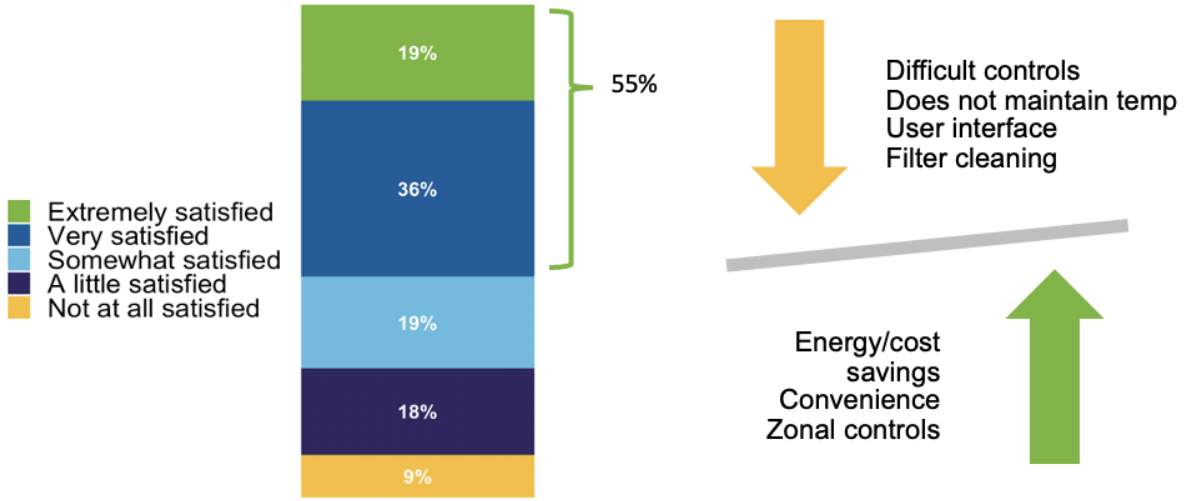

Figure 8. Tenant satisfaction with heat pumps

Approximately half (46%) of the tenants remember receiving instructions on how to operate the heat pump. Of those who received instructions, 71 percent still want more help. When we prompted tenants with a list of challenges that they may have had, there was a clear split where customers who received instructions were less likely to report any challenges that those who did not receive instructions (22% vs. 50%). This suggests that instructions helped, even if they were not "adequate". Whether or not they received instructions, 19 percent had difficulty with the controls. This suggests that **controls are an important subject for tenant education; they** are struggling to figure out the controls without additional help from program staff.

Questions about upgrades. Approximately half of the tenants (45%) had questions about the new equipment and most of them turned to their property manager (59%). Program staff should provide training and educational materials to the property manager to better prepare them to field questions.

Conclusions

Addressing the multifamily sector, reaching low-income customers, and adopting newer technologies such as heat pumps all present unique program implementation challenges that are becoming more common as regulators and utilities begin to place more emphasis on equity. The LIFT pilot program has been facilitating electrification of multifamily affordable housing for six years, offering many lessons learned for program design and implementation. The LIFT program's efforts to recruit property managers to treat all eligible units at a property served tenants who would not have been reached effectively by existing programs. LIFT achieved its recruitment targets for ESJs and AR_{20}; there were no targets by demographics and LIFT

accidentally overrepresented senior housing and underrepresented conventional housing. Property managers were satisfied with the program and did not report any systemic issues with the process. Contractors were also satisfied and agree that the installations went smoothly. Tenants had only moderate satisfaction with heat pumps and needed help to learn how to effectively control the new equipment. Two downsides of directly recruiting property manager are that the projects span multiple years (because they are treating all eligible tenants, instead of just one unit) and that tenants were mostly unaware of the program that their property managers were engaging with. LIFT is a great example of how the next generation of energy efficiency and electrification programs can be molded to address the unique needs and barriers of underserved communities.

Recommendations.

Based on our findings from the LIFT pilot program evaluation, we have the following recommendations that can be leveraged to improve other equity and/or electrification programs:

1. Define program success metrics and goals for underserved communities.
2. Document all program targeting and the rationale for these decisions.
3. Set incremental goals to track progress of projects than can span more than a year.
4. Talk about operating costs when recruiting property managers.
5. Continue to offer a pathway for property managers to upgrade all tenant units.
6. Refine tenant education on heat pump controls, efficiency, and optimization.
7. Prepare property managers to answer questions from tenants about new equipment.
8. Look for opportunities to educate treated tenants on other energy assistance offerings.

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