

From Propane to Progress: Clean Energy Pilots to Address Air Quality and Energy Equity in Disadvantaged Communities

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ABSTRACT

California's San Joaquin Valley (SJV) has a high concentration of environmentally disadvantaged communities (DACs). This is a major equity concern, as the poor air quality in this region is primarily caused by the emissions in coastal urban areas drifting inland and settling in the valley. Within these communities, many households rely on propane and wood for space heating, water heating, cooking, and drying clothes. These fuels are costly, high emitters, and exacerbate the poor air quality.

Three investor-owned utilities (IOUs) in the SJV offered novel pilots, installing cleaner electric and natural gas appliances such as heat pumps for space and water heating in 827 homes. The pilots also offered funding for home remediation, infrastructure upgrades, utility bill protection discounts, and referrals to other utility programs. Local residents were hired to perform outreach, build trust, and encourage their neighbors to apply. While the benefits of converting homes from gas to electricity have been extensively documented, there are few examples of programs incentivizing conversions from non-utility fuels.

This paper examines the program process, impacts, and overall ability of the pilots at reducing energy costs and greenhouse gas emissions. Our analysis provides insights into the impact of fuel switching on greenhouse gas emissions, customer energy costs, energy consumption, non-energy benefits, and satisfaction. This study also provides an example of how equity and environmental justice goals can be integrated into a new evaluation framework. By integrating societal metrics with quantitative and behavioral insights, this study sets a precedent for evaluating the multifaceted impacts of electrification.

Background

This paper summarizes process and impact evaluation findings for the San Joaquin Valley Disadvantaged Communities pilot (SJV DAC pilot). The pilot had an overall goal of offering cleaner, more affordable energy options to residents of DACs in the SJV, where many households lack access to natural gas and rely on propane and wood for cooking and heating (Campbell, Elliott, and Feizi 2022). By definition, DACs are identified based on a combination of pollution burden and population characteristics developed by The California Office of Environmental Health Hazard Assessment and this pilot narrowed down the target audience to a region with higher prevalence of reliance on wood and propane (11 communities in the SJV).

Each of the four Program Administrators offered a slightly different version of the pilot. The pilot programs offered dryers, water heaters, ACs, and stoves to all households in the designated communities. Three of the four program administrators (all but one being a utility) expanded access to electricity while one utility expanded natural gas access.

The program was developed in response to statewide legislation that directed the California Public Utilities Commission (CPUC) to ensure that residents in disadvantaged communities (DACs) are able to take part in a cleaner energy future, including gaining access to rooftop solar (Assembly Bill [AB] 327) and affordable, clean energy for households that rely on propane and wood for cooking and heating (AB 2672). This research focuses on the latter goals related to ensuring access to cleaner energy for homes that live in DACs, given their additional pollution burden.

Methodology

This research was conducted across three individual impact evaluations covering each utility and a single process evaluation that combined findings across each program administrator.

Process Evaluation

For the process evaluation we began by preparing an overarching logic model that provided a summary of the pilot, encompassing the activities of the Pilot Administrators (PAs), Community Energy Navigator Program Manager (CPM), Community Energy Navigators (CENs), and pilot implementers (PIs). The overarching logic model provided a broad overview of the pilot including planning, outreach, application, assessment, remediation, and installation. The logic model allowed for a demonstration of how implementation was hypothesized to lead to intended outcomes. These outcomes were then mapped to metrics which allowed the evaluation to consider if the implementation strategies had their intended effect.

At the time of the 2022 process evaluation, a total of 254 households had participated in the program (Evergreen Economics 2022). Evergreen conducted surveys with participants, non-participants, and customers who had opted out of the program. The evaluation team also did ride-alongs with the CENs (community-based organizations [CBOs] and community members) as they went door to door to recruit customers for the pilot.

Impact Evaluations

The impact evaluations were commissioned to assess the impacts of the pilot programs on energy usage and energy bills as well as identify any non-energy benefits (e.g., health, greenhouse gas [GHG] emission reductions). Energy impacts included changes in electricity usage based on pre- and post-participation utility billing data as well as estimates of changes in propane and wood usage based on participant self-report and imputation based on ResStock data.

Regarding both impact evaluations, Evergreen Economics gathered and analyzed the following:

- Outreach data (collected by outreach staff);
- Program data (collected by implementers);
- Annual and quarterly reports from administrators;
- Participant, non-participant, and opt-out surveys (i.e., customers who applied to be a participant in the pilots but never received any appliances) conducted by Evergreen for both impact evaluations; and
- Southern California Edison (SCE) and Pacific Gas and Electric (PG&E) electric usage and bill costs and secondary data (e.g., the price of propane and wood [propane only for PG&E]).

To estimate **program bill impacts** for SCE, we developed site-level regression models to normalize pre- and post-electric bills to the same weather conditions. The analysis measured how much the

participants usage and costs changed above and beyond any natural changes (e.g., increased costs from rising electric rates, the impact of the income graduated fixed charge starting in 2026, and the increasing price of wood and propane throughout the evaluation period) that were observed in a matched comparison group of similar untreated homes from the pilot communities. Our estimates for bulk fuels were based on self-reported propane and wood costs (from receipts or memory) and calculated estimates of residual propane and wood consumption. The uncertainty around bulk fuel costs adds uncertainty to our overall impact findings. However, they still represent our best estimates within the study limitations (Evergreen Economics, 2025)

For **bill protection analysis** for PG&E, we developed site-level variable-base degree day regression models to adjust for any changes in weather and then assessed the variability in total energy costs across participants. To estimate **program net impacts**, we developed a separate, pooled regression model that incorporated a comparison group of similar, untreated homes in the pilot communities. This analysis measured how much participants bills changed, above and beyond any natural changes that were observed in the comparison group (e.g., increased electric rates) (Evergreen Economics, 2024).

Results

The results from both the process and impact evaluations are intermingled to share the program evaluation findings chronologically with the program progression. The pilot was designed early on to address known barriers of trust and home remediation. Before sharing impact findings (bill savings and non-energy benefits), we share information about program implementation and how the program was received by residents. By assessing both customer perception of changes and comparing those perceptions with data on bill changes, we can better inform future program design.

Program implementation. The pilot was conducted across three IOU service territories and implemented by four program administrators. There were key differences including varied approaches to bill protection and differing approaches to participation requirements. As an example, PG&E¹ and Richard Heath and Associates (RHA), two of the three electric PAs, allowed for all-electric homes to participate whereas SCE did not include pre-existing all-electric homes.

Table 1: Summary of implementation differences across PA²

	Natural gas PA	Electric PA		
	Southern California Gas (SoCalGas)	PG&E	RHA	SCE
Served customers	Single community, California City	All-electric homes are able to participate across selected communities		Preexisting all-electric homes not able to participate across selected communities
Propane tank removal	No reimbursement for propane tank removal			
Infrastructure upgrades	Gas line extension	Panel upgrade with possible need for transmission and distribution upgrades		

¹ Among PG&E/RHA participants with propane or wood appliances, the pilot electrified 90 percent of the water heaters and space heating units. Among participants with existing electric appliances, 86 percent of the water heaters were upgraded to higher efficiency electric heat pumps, as were 57 percent of the space heating units.

² The electric PAs provided each participating home with a set of induction-ready cookware.

	Natural gas PA	Electric PA		
	Southern California Gas (SoCalGas)	PG&E	RHA	SCE
Bill protection	\$500 over three years	20 percent monthly discount for five years followed by bill evaluation that can lead to continued bill discount or if no increase in energy costs, discount is reduced to 10 percent		

Customer engagement and trust. Across each PA, CENs were responsible for initial outreach through the application process with customers. Self Help Enterprises (SHE) hires and manages CENs and "Community" CENs, who are CENs who live in the targeted communities.

CENs found in-person outreach, which resumed in June 2020, to be the most effective form of outreach; this was corroborated by participants, who heard most often about the pilot from project staff (SoCalGas and RHA) and from a flyer left from an in-person visit at their door (SCE and PG&E).

SJV DAC eligible residents showed a **high degree of trust in the CENs**. A very high percentage of participants reportedly found program outreach aspects to be very or extremely easy to understand and rated the CENs very highly. Not all CENs had the same level of experience within a community. Where the CEN had less experience in a community (such as in California City for SoCalGas), PAs helped to engage residents.

Outreach for the pilot projects began in early 2020. Table 2 shows the initial estimates of eligible households,³ the number of households that received outreach and were engaged by the CEN, and the number that progressed to each subsequent stage of pilot participation through 2024. **The pilot staff reached 92 percent of all potential households and completed pilot applications for over half of those contacted.** This high participation rate is likely due to the partnered, multimodal and repetitive outreach done by a community organization side by side with well-known members of the community. Currently 466 homes had pilot measures installed, with another nearly 356 having completed an in-home assessment.

Table 2: Summary of pilot activities

Pilot Administrator (PA)	Initial estimate of eligible households	Received outreach	Completed application	Completed assessment	Pilot measure(s) installed
PG&E	316	307 (97%)	214 (68%)	195 (62%)	159 (50%)
RHA	914	814 (89%)	424 (46%)	387 (42%)	89 (10%)
SCE	449	404 (90%)	201 (45%)	150 (33%)	135 (30%)
SoCalGas	235	235 (100%)	101 (43%)	90 (38%)	83 (35%)
Total (# of households)	1,914	1,760	940	822	466
Total (% of potential participants)	100%	92%	49%	43%	24%
Data source	CPUC Decision 18-12-015	Pilot 2024 Quarterly Progress Reports, Process Evaluation			

³ For each community, CPUC Decision 18-12-015 initially estimated the total number of eligible households based on geographic boundaries. However, eligibility was ultimately determined during enrollment. The actual number of eligible households was likely much lower than the initial estimate based on a variety of reasons. For example, some homes were found to be all-electric, already had natural gas appliances, are businesses or apartments, or were vacant.

Note: PG&E served three communities in this pilot, RHA served five, SCE served three, and SoCalGas served one.

Remediation. For the PG&E and RHA implementation of the program, the largest barriers to completing pilot upgrades were remediation (i.e., home improvements to get the home ready for new appliances), obtaining landlord permission, customers moving during their participation, and customers becoming unreachable after submitting the application. Remediation and delays from utility infrastructure upgrades were especially challenging for mobile homes in the area of the SJV served by PG&E.

The SJV DAC pilot partly addressed remediation barriers by including up to \$5,000 per household to make remediations to the home to support the installation of the new equipment. For those homes that needed remediation, the most common types needed were for water heaters (relocating water lines and/or units, replacing enclosures), heating (patch work required after removing propane furnaces and non-operating roof evaporative coolers), ventilation, and air conditioning (HVAC) units, and/or electrical issues (trenching to run new conduit and electrical wiring tied to panel upgrades) (Southern California Edison, 2023). While there was pushback to the CPUC to make this cap to be shared across a community rather than on a per household basis, the CPUC held to the \$5,000 cap per household. Our research identified a grey area between what may be considered remediation costs and what are considered to be installation costs though the CPUC was careful to draw a distinction in costs that were for electrical upgrades to protect ratepayer funds. To this end, having more clearly outlined expectations for these activities and costs may be useful to ensure most program costs are associated with energy needs rather than home improvement needs. Mobile and manufactured homes were identified as having large remediation needs, with one home's remediation cost estimated to likely exceed the value of the home itself. In response to the evaluation's recommendations, the Leadership Council for Justice and Accountability suggested that it would help to change the cap for certain housing types to ensure that as many SJV residents as possible are able to participate. Remediation was less of an issue for the community that opted for a natural gas pilot and measures, which is likely the reason for the higher satisfaction with the pilot among this group compared to the participants in the all-electric versions of the pilot. However, as previously stated, with the move toward electrification to meet state GHG goals, natural gas line extensions are not likely to be part of the clean energy conversation going forward.

Customer satisfaction. As shown in Figure 1, participating residents reported being generally satisfied with the pilot project experience, with 74 percent of the 151 surveyed participants rating their satisfaction with the overall project experience as extremely or very satisfied. Participants were even more satisfied with the new appliances they received, with 80 percent of surveyed participants noting they are extremely or very satisfied with their new appliances. The number of responses was too small to test for statistically significant differences across PAs (even when combining PG&E and RHA), so all three electric PAs were combined to test for significant differences. The distributions shown by electric and gas PAs in this figure are statistically significant. SoCalGas participating residents reported being extremely or very satisfied more often than the participating residents from the electric PAs (the distributions were statistically significantly different for both the overall experience and the response time, and the satisfaction with the new appliances was not statistically significantly different). This may be in part to the avoidance of delays tied to panel upgrades that were not necessary when gas appliances were being installed.

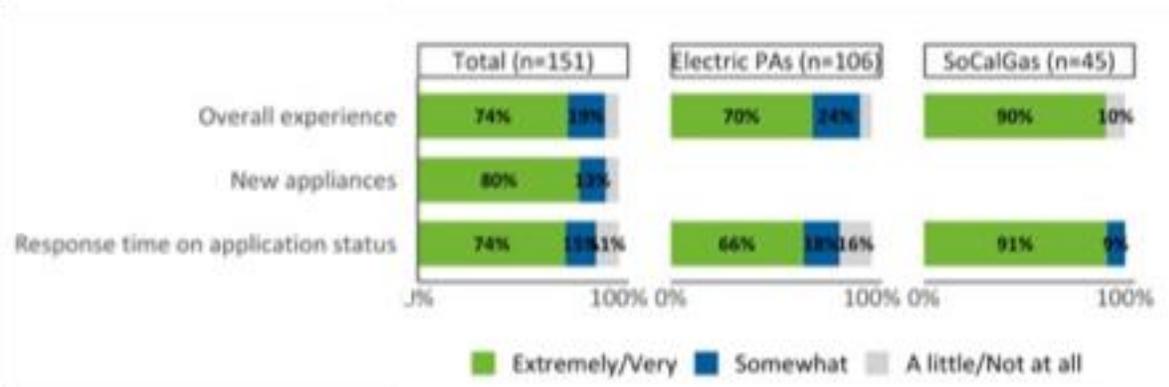


Figure 1: Participant survey responses – satisfaction with project experience

Fuel change impacts and perceptions. The pilot provided cleaner energy options to customers with propane and wood burning appliances, but it was difficult to gather exact costs for propane and wood since participants often do not keep receipts (though most could provide estimates). The majority of SJV DAC customers were using propane because of a lack of natural gas access, rather than due to a preference (Opinion Dynamics 2021). At least seven of the 151 survey respondents noted that what they liked about their appliances was that they no longer had to rely on propane or wood, but a few participants did have concerns about how much longer the dryer took to dry their clothes:

- “The electric dryer takes longer than propane, and is a bit confusing. The detection mode of dryness sometimes gets confused and it leaves the clothes damp.”
- “Electric dryer takes longer to dry than propane, and it is a bit confusing and its smartness of turning off even though the clothes are not dry yet but it is an ok trade if it is less cost to operate”

When asked for suggestions, only one of 78 responding customers expressed concerns about being dependent on electricity: “don’t eliminate propane and make us dependent on electricity.” Generally, respondents were happy to transition away from propane, and 15 respondents posed this transition as what they liked most about the pilot.

Changes in energy consumption. The pilot saw a significant reduction in the use of propane and wood (though there was some residual usage) and an increase in electricity usage (25% for SCE, 10% for PG&E/RHA), for an overall reduction in BTUs.

The SCE pilot interventions led to participants using 93 percent less propane (saving 423 gallons per year) and 73 percent less wood (0.08 cords less), but SCE participants’ electricity use went up by 2,193 kWh annually (25%) relative to similar untreated homes. The electric appliances (HVAC, stove, water heating, and an electric dryer) were more energy efficient, leading to a 45 percent overall reduction in energy consumption across fuels in SCE homes (for discussion of actual bill changes and estimates in difference in costs for propane versus electricity, see ‘Bill Changes’).

The average SCE pilot net savings were 33.8 million British thermal units (MMBTUs) per household (a 45% reduction). **The SCE pilot successfully reduced overall energy consumption** through electrification and upgrades to existing electric appliances.

Non-energy benefits and GHG reductions. In the SCE SJV DAC pilot, the program had a significant positive impact on participants relative to similar untreated homes in terms of their general health (36% net improvement), winter comfort (46%), and summer comfort (45%). Non-energy impacts were self-

reported in the 2025 customer survey, where we asked customers to report any changes they could recall over the study period.

Evergreen also calculated the average change in GHG emissions attributable to the SCE SJV DAC program. Table 2 shows the change in GHG emissions by fuel type per average treated household. The SCE program saved a total of 347 metric tons of carbon dioxide (CO₂), 335 kilograms of nitrogen oxides (NO_x), and 6 kilograms of sulfur oxides (SO_x). This reduction in CO₂ emissions is equivalent to removing 81 passenger vehicles off the road for one year. The program interventions reduced emissions of all three GHGs, providing both local and societal benefits.

Table 2: Impact of program on GHG emissions by fuel for the average household

Fuel	CO ₂ (mt)	NO _x (kg)	SO _x (kg)
Propane	-2.43	-2.49	-0.02
Wood	-0.26	-0.27	-0.04
Electricity*	0.41	0.57	0.01
Total emissions impact	-2.28	-2.19	-0.05

*Electric emissions are based on the average GHG emissions caused by electricity generation associated with SCE’s service territory between 2020 and 2024.

In the PG&E RHA SJV DAC pilot, eight out of 12 surveyed participants who experienced asthma and allergy symptoms prior to receiving their new appliances reported an improvement in symptoms after receiving new appliances, representing 13 percent of total participants. Approximately half of surveyed PG&E participants (31 of 59) reported experiencing fewer uncomfortable indoor temperatures after their new equipment was installed. Two of the fifteen participants who received new cooking appliances and reported using them more often attributed this to the new equipment being safer.

The PG&E RHA SJV DAC program interventions successfully reduced emissions of three GHGs. To put the annual impact of the program in context, we have also translated these emissions savings into real-world equivalents leveraging data we analyzed from various sources as listed below:

- The reduction of 906 metric tons of CO₂ is equivalent to removing 211 passenger vehicles off the road for one year, or the amount of carbon that is sequestered by 909 acres of forest in one year (US EPA 2024).
- The reduction of 929 kilograms of NO_x is equivalent to removing 150 passenger vehicles off the road for one year (US Department of Transportation 2024).
- The reduction of 11 kilograms of SO_x is equivalent to removing 344 passenger vehicles off the road for one year (Federal Highway Administration and Statista 2024).

These reductions in GHG emissions improve air quality, providing local health benefits as well as broader societal benefits.

Bill Changes

Fears of bills rising. All participants were offered bill protection, either via a bill credit (the gas PA) or a bill percentage discount (the electric PAs). This was modified during the course of implementation and may have been described differently to customers depending on when they heard about the program. This made it challenging to assess understanding of the bill protection element. There was lower

understanding of bill protection compared to other pilot components and worries about bill changes was one of the more common barriers to participation amongst non-participants.

Residents reported concerns over potential bill increases, which appeared to be the most significant barrier for non-participants. As such, clearly conveying the bill protection benefit associated with the project may increase interest in the pilot.

The price of propane is variable, so it is hard for some households to understand actual (or likely) changes in overall energy costs, and receipts were challenging to collect when requested.

Actual bill changes. The pilot significantly reduced participants' annual net energy costs by \$539 per year for PG&E and RHA compared with \$1,268 for SCE. The difference is driven by the types of homes treated, where PG&E and RHA treated many all-electric homes with appliance upgrades, which led to much smaller energy cost savings than electrifying bulk fuel homes (which was SCE's focus). In most cases, SCE participants received the 20 percent SJV bill protection credit and a 20 percent TCSD credit on their electric bills. Because these results differ, they are presented by PA below the table.

Table 3 shows a comparison of the net gross impacts or program-driven changes for the SCE and PG&E/RHA impact evaluations.

Table 3: Comparison of program-driven changes across both SCE and PG&E/RHA

Fuel	SCE SJV DAC	PG&E RHA DAC
Propane	-\$924	-\$657
Wood	-\$28	-\$7
Electricity	-\$316	\$125
Program-Driven Change (Net)	-\$1268	-\$539

SCE bill changes. On average, SCE participant energy costs decreased by \$828 per year after the program intervention (the gross impact). Without the program, our analysis indicates that their bills would have increased by \$440 due to natural changes (e.g., increases in electric rates) versus similar untreated homes in pilot communities. Therefore, the program intervention saved participants an average of \$1,268 per year in energy costs (net impacts), reflecting both the gross savings and avoiding the natural increase in energy costs (-\$828-\$440 = \$1,268).

Figure 2 provides our estimates of SCE participant energy costs in the baseline and after treatment by fuel type, normalized to baseline year. Average annual energy costs per participant were \$2,601 before participation and \$1,773 after, a decrease of \$828 (the gross change). When we remove the natural increases in the cost of electricity and bulk fuels (shown in orange), we were able to isolate the \$1,268 of program-driven changes. The reduction in propane and wood costs outweighed the increase in electric costs caused by the program.



Figure 1: Annual energy costs of treated homes

The SCE pilot program treatment included new appliances (i.e., measures) and electric bill credits. These bill credits provided much larger savings (\$952 per year) than the savings due to the fuel-switching and efficiency gains of the new appliances (\$316 per year). Without the pilot, participants would have faced a \$440 increase in energy costs due to natural changes such as rate increases. The measures alone would not have been sufficient to offset this increase. If the SJV bill protection and Transitional Community Solar Discount (TCSD) credits had not been offered, the overall net impact of the program would have been a \$316 decrease in energy costs due solely to the installed equipment (instead of a \$1,268 decrease from the combination of equipment and bill credits). Therefore, while the efficiency measures did reduce costs compared to doing nothing, the bill credits were necessary to fully protect participants from the natural rising costs of energy.

PG&E bill changes. On average, PG&E participants saw their total energy costs increase slightly after the installations (by an average of \$26 per year), but without the SJV bill protection discount, they would have gone up more drastically (approximately \$565). While the bill discount did help offset the increases in electric rates, this may not be sustainable for a larger program. Overall, 51 percent of participants saw their costs drop, and 49 percent saw increases in their energy costs. Savings were more likely if they electrified their heating system.

Non-participants for PG&E living in similar homes in these pilot communities also saw an increase in their energy costs over this same period (2020 to 2024). They slightly reduced their energy consumption by 43 kWh, and yet their electricity bills increased by \$657 per year. This increase had nothing to do with the SJV DAC pilots and provides our best estimate for what would have happened to participants if the program had not existed. Figure 3 provides our estimates of participant energy costs by fuel type in the baseline and what they would have become without treatment. Participant energy costs would have increased from \$2,556 to \$3,213 without treatment, due to a natural increase in the cost of electricity.



Figure 2: Natural changes in energy costs over time. The bracket indicates what the predicted participant energy cost would have become without treatment, due to natural increase in the cost of electricity.

On average, PG&E participant energy costs increased by \$117 after the program intervention (the gross impact).⁴ Without the program, we would have expected their bills to increase by \$657 due to natural changes such as increases in electric rates. Therefore, **the program intervention saved participants \$539 per year in energy costs (net impacts)**, by avoiding the full natural increase in energy costs ($\$657 - \$117 = \$539$).

Figure 4 provides our estimates of PG&E participant energy costs in the baseline and after treatment by fuel type. Their average annual energy costs were \$2,556 before participation and \$2,673 after, a total increase of \$117 (the gross change). When we remove the natural changes in the cost of electricity (shown in orange), we were able to isolate these program-driven changes. The reduction in propane and wood costs outweighed the increase in electric costs caused by the program.

⁴ In this analysis, the program intervention includes all measures and bill discounts.

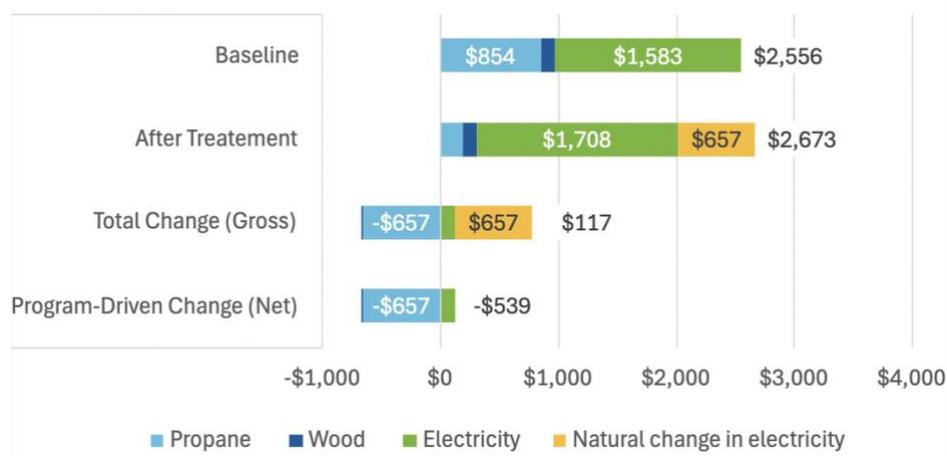


Figure 3: Program impact on participant energy costs

Note: By random chance, the value of the reduction in propane costs happens to align with the value of the natural change in electricity (when rounded to the nearest dollar). This is not a labeling error.

Conclusions

Overall, the pilot had positive impacts on comfort (based on self-report), saw a net reduction in emissions, had high participation (using both landlord agreements and known community members for outreach), and saw an overall reduction in BTUs. Future research will investigate the economic feasibility of expanding this pilot and it will be valuable to consider the sustainability of bill protection offerings.

Energy usage: The pilot saw a significant reduction in the use of propane and wood (though there was some residual usage which varies based on participant behavior and original equipment types) and an increase in electricity usage (25% for SCE, 10% for PG&E/RHA), for an overall reduction in BTUs.

Energy costs: The pilot significantly reduced participants' annual net energy costs by \$539 per year for PG&E and RHA compared to \$1,268 for SCE.

The difference is driven by the types of homes treated. PG&E and RHA treated many all-electric homes with appliance upgrades, which led to much smaller energy cost savings than electrifying bulk fuel homes (which was SCE's focus).

Measures vs. Discounts: The bill protection and TCSDs provided more energy cost savings than the measures themselves.

Without the discounts, SCE participants would still have had net savings, but PG&E/RHA participants would have had a net increase - likely because of the milder savings from upgrading all-electric homes).

Outreach methods: The program outreach team took time and effort to ensure that multiple opportunities were made to contact eligible customers and ensure they were met with known members of the community. The program also made efforts to ensure landlords would not raise rents due to improvements in the space. These efforts likely add cost to implementation but also ensure more access to residents who may not be as available at different points of outreach due to obligations including work and caregiving roles.

GHGs: There was a net reduction in emissions of CO₂, NO_x, and SO_x. This improves air quality, providing local health benefits and broader societal benefits.

- SCE's pilot reduced CO₂ by 377 metric tons per year, equivalent to removing 81 cars off the road.
- PG&E and RHA's pilot impacts were equal to 211 cars off the road (household savings were smaller compared to SCE but there were more homes treated).

NEIs: The SJV DAC pilots had significant positive net impacts on winter and summer comfort (for PG&E, RHA, SCE, and SoCalGas) based on self-reported findings.

- Electrification pilots had significant positive net impacts on health (significant for PG&E/RHA and SCE, but no significant net impacts were identified for SoCalGas).
- There were no significant impacts on health severity, draftiness, mold/mildew/fungus, noise, or safety.

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