Community-Led Residential Energy Efficiency: A Holistic Approach to Home Energy Upgrades

Charlotte Marrow, Evergreen Energy
Haley Mountain, Community Energy Project
Kris Grube, Portland Clean Energy Community Benefits Fund (PCEF)
Lindsey Diercksen, LD Consulting

ABSTRACT

This paper presents a priority community-centered model for residential energy efficiency and electrification that builds upon Portland Clean Energy Community Benefit Fund's community grants initiative, where community-based organizations transitioned into full-service home performance providers, completing more than 540 retrofit projects over four years. The new residential program focuses on households with the greatest need, offering whole-home energy upgrades using a wraparound services approach.

These upgrades are designed to reduce the risk of bill increases associated with electrification and include funding for critical home repairs, which are often a barrier to participation for low-income households. The program also includes renters and small in-home care businesses, populations frequently excluded from traditional energy programs. Green infrastructure elements, such as tree planting and rain gardens, are integrated to enhance carbon sequestration and neighborhood resilience.

Key program roles:

- Client Navigators, who represent the communities they serve, guide participants through every step of the process. They provide and coordinate language support, accessibility accommodations, and education on energy technologies, fostering trust and informed decision-making.
- Community-Based Organization Steering Committee anchors the program in cultural responsiveness and equity, contributing to strategy, outreach, materials review, and accountability.
- Contractors are recruited from frontline and underrepresented communities, creating local economic opportunities.

Workforce development is supported through on-the-job training grants, equipment assistance, a tool lending library, and Building Performance Institute certification cohorts. Partnerships with Energy Trust of Oregon, non-profit home retrofit programs, and local government support services help align resources and amplify impact. This model demonstrates how equity-driven design and community leadership can achieve measurable energy savings while advancing health, resilience, and economic opportunity.

Introduction to the Portland Clean Energy Community Benefits Fund

The Portland Clean Energy Community Benefits Fund (PCEF) is a community-driven climate investment program established by Portland voters in 2018 to advance climate change mitigation alongside social and economic justice. Funded through a 1% surcharge on large

retailers, PCEF centers community leadership in funding decisions through a grant committee guided by principles of equity, accountability, and community power. PCEF prioritizes investments for communities historically under-resourced by energy and sustainability programs, referred to as Priority Populations[1], including people with low incomes, people with disabilities, and communities of color. These populations also experience disproportionately high energy burdens, with low-income households spending three times the share of income on energy on average compared to higher-income households, and in some cases exceeding 15% of income (Drehobl et al. 2020; ACEEE 2024 update). Program performance is tracked through climate, equity, and economic metrics available on the program's public dashboard.[2]

Since 2020, PCEF has allocated approximately $732 million across 262 community-led projects focused on greenhouse gas emission reduction, energy efficiency, transportation decarbonization, carbon sequestration, and workforce development. Within this portfolio, ten organizations have delivered 540 home retrofit projects, saving approximately 629,790 kWh, 79,791 therms and 10,544 gal of fuel oil annually, while reducing energy burden and improving health and comfort outcomes.

In 2023, PCEF developed the Climate Investment Plan (CIP) in response to higher than projected revenue. The CIP is a five-year roadmap for carbon reduction, economic opportunity, and climate resilience.[3] It introduced new funding pathways, including Strategic Programs which would be larger, program designed initiatives developed through extensive community and subject matter expert engagement to be implemented by partnerships with nonprofits, government entities and businesses.

Launched in 2026, Strategic Program 3 residential program, Energy Friendly Homes, will invest $140 million over five years to deliver whole-home energy upgrades to more than 3,100 low- and moderate-income households. The program targets up to 30% reductions in energy use and emissions while lowering housing cost burdens and improving comfort and health. It is also designed to expand access to clean energy services, generate local economic opportunity, and support a more inclusive clean energy workforce.

This paper examines the equity-centered design and early outcomes of the Energy Friendly Homes Program, including its integration of client navigation, quality assurance, community-based outreach, workforce development, and whole-home retrofit strategies.

Energy Friendly Homes Program Design

Conventional energy efficiency programs often place significant administrative and financial burdens on participants, limiting engagement among underserved households (Amann, Tolentino, and York 2023). The Energy Friendly Homes program addresses these barriers through a community-centered delivery model that reduces participation burden and improves accessibility. Key elements of the program design include client navigation, independent quality assurance, and community-based input.

[1] See more on PCEF priority population definition https://www.portland.gov/bps/cleanenergy/about#toc-priority-populations

[2] See https://www.portland.gov/bps/cleanenergy/climate-investment-plan/dashboard for PCEF's current dashboard of metrics

[3] See https://www.portland.gov/bps/cleanenergy/climate-investment-plan for more information on the Climate Investment Plan.

Client Navigators

Client Navigators provide a single point of contact throughout the project lifecycle from intake through one-year post-installation for Tier 1 clients (clients with incomes of lower than 80% of the area median income), reducing complexity and improving participant experience. Navigators support households with application processes, accessing language and accessibility services, contractor coordination, and understanding energy efficient technologies or installations made to their home. To ensure consistency in service delivery, Navigators are trained in program processes, building science fundamentals, and customer engagement practices. Continued follow-up after installation helps promote proper system use and maintenance, build trust, and support persistence of energy savings over time.

Quality Assurance Provider

The program integrates a third-party quality assurance (QA) process to ensure adherence to building science standards and prioritize high-impact measures. All project scopes are reviewed prior to installation, followed by post-installation inspections and resolution of any identified issues.

Community-Based Organization Steering Committee

A steering committee composed of nine community-based organizations across the Portland region provide ongoing input into program design and implementation. This structure embeds community perspectives into decision-making and strengthens accountability and transparency. The committee meets monthly to review program strategies, outreach approaches, and implementation challenges, and contributes to co-developing processes such as referral pathways, outreach materials, and engagement strategies. Members also provide implementation support, including client referrals and translation review.

Energy Friendly Homes Program Design Elements

The program applies a whole-home, building science approach aligned with Building Performance Institute (BPI) standards (Building Performance Institute 2021). Certified contractors conduct comprehensive home energy assessments, including diagnostic testing such as blower door analysis. Results are modeled using Snugg Pro to prioritize measures that maximize energy savings while addressing health and safety concerns.

Project scopes consistently include foundational improvements such as air sealing and insulation, with electrification measures, particularly heat pumps and heat pump water heaters, incorporated when feasible. The program does not fund fossil fuel appliances, aligning retrofit strategies with long-term emissions reduction goals while allowing flexibility based on household conditions.

A critical design feature is the allocation of up to 30% of project budgets for necessary health and safety repairs. This provision addresses a major barrier to participation, particularly for low-income households living in older housing with deferred maintenance. While this funding does not fully meet repair needs in all cases, it has significantly reduced project deferrals and enables coordination with partner programs to address more extensive repairs when necessary. Recent research finds that approximately 19% of income-eligible households are initially deferred from weatherization programs due to issues such as roof damage, unsafe electrical systems, or structural deficiencies. This program design addresses a major barrier to participation, particularly for low-income households living in older housing with deferred

maintenance (Farrell et al. 2025). While the program designers realized that 30% percent of project funds would be inadequate to meet the significant need to fund deferred maintenance as a means of supporting housing stability, they also knew that some critical repair funding was essential to include in project budgets.

To reduce participation barriers and proactively design solutions related to delivering a whole-home retrofit approach with critical repair funding in PCEF's Priority Populations, the program developed a client journey map to identify where households may encounter challenges throughout the retrofit process. This mapping informed the integration of client navigation, culturally responsive outreach, informational materials, and quality assurance support across all stages, including intake, scope development, installation, and post-project follow-up. This map supported the development of a process map that is continuously updated to help provide additional clarity on collaboration points across implementers, data collection, and coordination of language and accessibility services.

Energy Friendly Homes' Equity Framework

The Energy Friendly Homes program applies a targeted universalism[4] framework, which establishes shared program goals while tailoring strategies to address the specific barriers faced by different populations (Powell, Menendian, and Ake 2022). This approach prioritizes low-to-moderate income households and those households experiencing the greatest climate and economic burdens, particularly those facing high housing cost burdens. In Portland, 37% of homeowners and nearly half of renters meet this definition. Rather than relying on a single program model, the framework supports differentiated strategies to ensure equitable access to outcomes. This includes expanded eligibility pathways for renters and in-home care providers, groups that are often excluded from traditional energy efficiency programs.

Clients

The program strives to reach communities that have been historically underserved by traditional energy-efficiency programs. Utility-administered programs built around cost-effectiveness, reimbursement-based incentives, and English-only outreach were designed around a default customer who was English-speaking, financially stable, and a homeowner with good credit, effectively filtering out the households most in need of intervention. Distrust of government institutions that grew out of histories of discriminatory policy enforcement further suppressed participation from immigrant, Indigenous, and Black communities. As a result, the benefits of decades of public investment in energy efficiency have flowed disproportionately to wealthier, white households, while low-income communities of color have continued to spend outsized shares of their incomes on energy, a disparity that ACEEE and others have documented as one of the most persistent and under-addressed shortcomings of the American clean energy transition (Drehobl, Ross, and Ayala 2020).

Based on feedback from our Client Navigator, Community Energy Project[5], Energy Friendly Homes refers to participants as clients. This is to reframe the relationship dynamics toward centering the participant and their needs versus the program reaching its goals. To reach intended recipients and to prioritize those with the greatest need, program eligibility is income-

[4] See https://belonging.berkeley.edu/targeted-universalism for more information on targeted universalism.
[5] For more information on CEP and their work visit https://www.communityenergyproject.org/.

based, with the majority of program investment directed towards homeowner and renters with incomes at or above 80% area median income (AMI).

Table 1: Program Eligibility

Tier	Household Type	Energy Saving Target	Energy Efficiency Investment Per Home	Critical Repair Upgrades
Tier 1	Homeowners <80% AMI	30%	Up to $50,000	30% of cost
Tier 2	Homeowners 81-120% AMI	20%	Up to $30,000	30% of cost
Tier 3	Homeowners 121-150% AMI	20%	Up to $15,000 requires 50% co-pay	30% of cost
Tier 4	In-home care business	20%	Up to $15,000 requires 50% co-pay	30% of cost
Tier 5	Renters <80% AMI	15%	Up to $15,000	30% of cost

Tiers 1 and 2 focus on providing no-cost retrofits for low-income homeowners, who typically face the highest energy burden and are unable to participate in traditional incentive programs that do not cover the full cost of installations. Tier 2 homeowners are also typically not served by state or regional low-income programs that have a requirement of being below 80% AMI and simultaneously do not have capital to implement energy efficiency upgrades where only a percentage of the cost is offset by utility incentives. The program intentionally removes any requirement for matching to help fill this gap.

Tier 3 allows for moderate-income homeowners to participate but requires a dollar-for-dollar match up to the $15,000. This unique mechanism can support homeowners that have been unable to pursue energy upgrades by providing a higher percentage of the installation cost than typical incentive programs. Additionally, the program allows local utility incentives and other energy rebates to qualify as match funding for these projects.

Tier 4 is a unique offering that will support upgrades for in-home care businesses. These businesses are typically child daycare providers or not-for-profit assisted living facilities in residential construction. By focusing on this specific demographic, the program can serve businesses that are primarily providing services within the communities we are trying to reach, including older adults and multicultural childcare providers who operate out of their home.

Tier 5 will be an offering for renters to directly support installations that offset the utility burden for renters. This tier will help reach tenants who are often not served through traditional incentive programs that primarily focus on outreach and engagement with property owners or managers. Up to $15,000 will be invested in each rental unit, focusing on measures that will not directly increase property value.

Culturally Responsive Outreach

Research on community trust and program uptake consistently finds that institutional mistrust, rooted in lived experience of discriminatory enforcement, is a meaningful predictor of non-participation in government programs, even among households that would benefit (Drehobl, Ross, and Ayala 2020). Language access alone is insufficient; households that have experienced adverse interactions with government agencies require sustained, culturally grounded relationships before they will engage with programs associated with municipal or utility institutions.

An important part of the program is making sure outreach is culturally specific and designed for the priority populations the program serves. This means sharing information and services in ways that respect the cultural backgrounds, values, and communication preferences of different communities. Because priority populations are diverse and have different needs, culturally responsive outreach helps reduce barriers and builds trust. The Client Navigators play a key role and implementing this practice. They will partner with the CBO Steering Committee to host outreach events that are warm, inclusive and supportive gatherings with wraparound services such as translation, interpretation, food, kid-friendly activities, and accessible spaces that are conveniently located near parking or public transit.

Transparent Feedback Loop

To increase transparency, the program created a feedback loop, maintaining varied and frequent touchpoints with clients and contractors, recognizing that traditional programs normally perform impact or process evaluations two- or three-years during implementation (US DOE 2012). Energy Friendly Homes approach is continuous and enables the team to identify issues early, make real-time adjustments, and improve equity and accessibility for both clients and contractors. In the table below, are the strategies used for clients for their home energy retrofits and contractors for program participation and workforce development strategies.

Table 2: Embedded Evaluation Engagement Strategies

Clients	Contractors
• **Fast feedback polls** immediately after project completion to quickly surface issues. • **Pulse surveys** every six months to understand satisfaction across the full process. • **Conduct focus groups** to allow deeper discussion of experiences and needs surfaced from the pulse surveys.	• **Contractor interviews** to identify challenges and propose process improvements. • **Listening sessions** to discuss themes from interviews and co-create solutions.

Inclusive Workforce Development and Contractor Engagement Strategies

Based on early workforce data from PCEF-funded activities, contractor participation from under-represented groups continues to grow, but a gap of how many contractors who are credentialed and have the capacity to deliver these initiatives still remains[6]. These results suggest that combining certification pathways, financial support, and direct project opportunities can expand and diversify the contractor base, while also extending program ramp-up timelines. PCEF-funded workforce programs have also supported contractors from Latino, Black, Native, and other underrepresented communities to enter the clean energy construction sector through training, apprenticeship pathways, and business development support.

[6] PCEF program dashboard | Portland.gov

Table 3: PCEF Workforce and Contractor Diversity

By Race	**% Hours Worked**	**% Wages Earned**
Black or African American	5%	4%
Latino/a/e/x or Hispanic	27%	24%
White	27%	31%
Prefer not to answer	35%	35%
By Gender	**% Hours Worked**	**% Wages Earned**
Woman	14%	13%
Man	52%	52%
Non-binary or Prefer not to answer	32%	33%

Recognizing that program outcomes depend on who delivers the work and that culturally grounded relationships are important in not just outreach, but also implementation, the Energy Friendly Homes Program follows the PCEF model and embeds equitable workforce and contractor development into its core design. The workforce development and contractor support services are designed to support contractors from the community who have not traditionally engaged with local energy efficiency programs, including small businesses, communities of color and women with the specific skills, credentials, and business capacity to perform energy retrofit work. Energy Friendly Homes also hosts ad hoc trainings and provides on-the-job training grants, mentorship, and equipment support to develop the inclusive teams that will implement the program's projects.

To support the goal of connecting clients with contractors from their own communities, contractor and workforce development initiatives, grants and support are integrated throughout the program. To reduce barriers to entry and support contractor success, the program includes four integrated design components:

- **Recruitment and onboarding:** Contractors are connected to a consistent pipeline of client projects while receiving hands-on support to meet program requirements, including no-cost certification, mentoring, and training on modeling tools and program processes.
- **Certification and training pathways:** The program partners with a Building Performance Institute (BPI) training provider using a cohort-based model that combines hands-on training, mentoring, and test preparation. This approach has achieved near-complete certification rates, demonstrating its effectiveness in building contractor capacity.
- **Equipment access and capital support:** Contractors can access equipment grants (up to $20,000) and a lending library for diagnostic and installation tools. These supports reduce upfront capital barriers that often limit participation in energy retrofit markets.
- **On-the-job training (OJT):** The program funds paid training placements with participating contractors, supporting skill development in building science, energy modeling, and project delivery. Workers are recruited from pre-apprenticeship and workforce development programs serving priority population communities. Structured training pathways align with participants' experience levels and include language support and mentorship.

BPI certification cohorts and professional pathway

The Energy Friendly Homes Program contracts with a BPI training partner that uses an inclusive model to help break down barriers for participants from underserved communities. In this program, most instructors are women or people of color. They use a cohort model that builds relationships and community between participants, provide group and individual mentoring, hands on training approaches, and test-taking skill building. The partner aims to provide an accessible learning environment for all participants, especially those least comfortable with formal education and those for whom English is not their primary language. This model has shown great success so far, and 100% of participants have passed their certification tests.

Program Impact and Outcomes

While the Energy Friendly Homes program is still in its early implementation phase, preliminary data provide strong evidence that a community-centered, whole-home delivery model can achieve meaningful energy savings while significantly expanding participation among historically underserved households.

Energy Efficiency Outcomes

For this analysis, we are using the first 406 program client interactions (n=406), defined as making it into the intake process and/or engaged with our intake specialists, while subset analyses use smaller samples representing projects that completed income verification (n=178) or fully completed retrofit projects (n=23).

The first set of completed projects (n=23) modeled annual savings are estimated at approximately 15,500 kWh and 14,000 therms, average cost coverage of $44,500 and average co-funding of $4,500. Average per-home energy savings range from 15% to 30%, depending on housing conditions and income tier, with Tier 1 households typically achieving the highest percentage reductions due to higher baseline inefficiency.

To reflect a conservative and defensible estimate of program performance, reported savings are aligned with program design targets of 15–30% reductions in energy use per home, consistent with whole-home retrofit expectations. Initial energy modeling conducted using Snugg Pro indicated even higher average modeled savings (over the 15-30% needed across approved and completed projects). However, prior research and practitioner experience suggest that modeled savings can be optimistic relative to realized performance. As a result, the program uses a conservative savings range for reporting and planning purposes while additional evaluation efforts are underway.

Across projects, core measures consistently include air sealing and insulation, which are required to ensure baseline building performance improvements. Where project scope and budget allow, electrification measures, particularly heat pumps and heat pump water heaters, are also incorporated. This combination of envelope upgrades and electrification aligns with best practices for achieving durable energy savings and managing utility bill impacts (NREL 2020).

Participation Equity Outcomes

About 65% of participating households fall into Tier 1, 80% or less of area median income (AMI), and a significant proportion of participants represent communities historically underrepresented in energy efficiency programs and culturally specific populations engaged through community-based organizations.

Table 4: Income Eligibility Data *(n=178)*

Projects	# of clients	%
Tier 1	118	65%
Tier 2	48	27%
Tier 3	15	8%

** Note that Tier 4 and 5 have not launched*

Table 5: Client Race Data *(n=406)*

Race	# of clients	%
White	209	51%
Black or African American	69	17%
I prefer not to answer or blank	37	9%
Multiracial	36	9%
Latino/a/e/x or Hispanic	30	7%
Asian	25	6%

Referral-based enrollment through word-of-mouth accounts for a majority of program intake (~57% of the 406 projects), indicating that our client journey, equity, and program design are supporting happy clients to share with their neighbors and community members. The upfront design with culturally responsive outreach, client navigation, and trusted community partners are critical drivers to that early participation. Community-based organizations (including the CBO SC) contribute 17% of client referrals to the program.

Table 6: Program referrals *(n=406)*

Referral	# of projects	%
Word of Mouth	232	57%
Contractor Referral	42	10%
Community-Based Organizations (CBO)	45	11%
Other (fill)	34	8%
CBO Steering Committee	23	6%
Energy Friendly Homes Website	16	4%
In-Person Event	7	2%
(blank)	4	1%
Online Source - Google, social media, etc.	3	1%

Early program data show higher conversion rates from application to completed project compared to typical programs serving similar populations, which often experience significant participant drop-off due to administrative complexity, upfront costs, and challenges sustaining engagement throughout the retrofit process, even after initial assessments or audits are completed (Amann, Tolentino, and York 2023; McKenna et al. 2025). Out of the 406 client interactions, there have been 17 (4.2%) dropouts and 28 (6.9%) ineligible projects. Major reason for dropouts has been clients not responding after initial interest or clients deciding to not move forward for

personal reasons. Primary reason for ineligibility is the home is located outside of Portland city limits.

Workforce and Economic Outcomes

The program's integrated workforce development approach has generated measurable economic benefits through the launch of the BPI cohorts and trainings. Over 20 contractors with wages at or above 180% of the area minimum wage have enrolled and supported participating projects so far. The program has also issued 13 equipment grants totaling almost $120,000 and began lending tools to contractors with fulfilling nine requests. Training and certification programs, including Building Performance Institute (BPI) cohorts, have achieved high success rates, with near-complete certification attainment among all participants. These results suggest that structured, cohort-based training combined with financial and technical support can effectively expand the contractor base capable of delivering whole-home retrofits. The program to date has conducted six BPI trainings and one heat pump training for a total of 79 trainees in attendance.

Table 7: Contractor trainee race demographics *(n=79)*

	# of Registration	%
Latino/a/e/x or Hispanic	25	32%
White	20	25%
Black or African American	12	15%
Asian	7	9%
American Indian, Alaska Native, Indigenous Peoples of the Americas	5	6%
I prefer not to answer	4	5%
American Indian, Alaska Native, Indigenous Peoples of the Americas; Latino/a/e/x or Hispanic	2	3%
Not listed above, please describe	2	3%
Latino/a/e/x or Hispanic; Native Hawaiian or Pacific Islander	1	1%
(blank)	1	1%

Table 8: Contractor trainee gender demographics *(n=79)*

	# of Registration	**%**
Man	59	75%
Woman	15	19%
I prefer not to answer	3	4%
Non-binary; Transgender	1	1%
(blank)	1	1%

Co-Funding and Partnerships

Even with the relatively high per-home funding and a 30% allowance for critical repairs, the Energy Friendly Homes program can be constrained in fully meeting household needs. Many homes require investments beyond program caps, highlighting the limits of even well-funded, whole-home approaches.

To address this gap, the program relies on co-funding and resource braiding across multiple programs. While effective in expanding project scope, this approach requires significant coordination, administrative effort, and flexibility to align program requirements. Even with these efforts, funding limitations remain a barrier for some households.

An important partnership is with the Energy Trust of Oregon[7], which layers utility incentives on top of program funding. Collaboration between programs has streamlined application processes and reduced documentation requirements, creating a more efficient pathway for joint project delivery. However, integrating multiple funding sources requires additional quality assurance to ensure all measures meet partner requirements and maintain cost-effectiveness.

Program Lessons Learned

Early implementation of the Energy Friendly Homes program provides several evidence-based insights into the design and delivery of community-centered residential energy efficiency programs. These findings highlight both the advantages of the model and the structural tradeoffs required to achieve equitable outcomes.

The program faces several challenges that impact how quickly and equitably it can reach households. Coordinating staff, contractors, and community partners takes longer than standard programs, and it is especially difficult to reach priority populations because many traditional programs have not yet connected with these households or have tried and unintentionally created misunderstandings or miscommunications that have led to mistrust or impacts.

The 30% per home critical repair cap and overall project budget caps based on income-tier can be inadequate to address the deferred maintenance and energy needs required to provide a comprehensive energy upgrade for the client. Some homes needing expensive repairs, such as roof replacements, knob and tube wiring replacement, or asbestos mitigation that fall outside the project budget cap, may require partnering with other programs. From our early launch stages, we have created resources to share with homeowners who need more financial support and are forming partnerships to bridge the gap we have identified. However, the resource braiding required due to program budget limits has required significant time commitments for both Energy Friendly Homes and the PCEF Community Grants program staff. Even with these efforts, the program still has had to defer households from the programs.

The program has seen projects for clients who fall into higher income-tiers with lower cost caps that require prioritization decisions, and sometimes important energy upgrade opportunities are left off the table because of funding restrictions. Braiding funds with other partners for these projects are rarely possible, as Energy Friendly Homes is unique in its ability to serve clients in moderate income tiers.

For a program of this size, scaling up has taken time, and reaching full capacity required a year-long ramp up period. Once established, it helped direct more resources into the community through retrofits and workforce development strategies. For policymakers and implementers, it is important to plan for higher costs, anticipate repair needs exceeding the budget, invest early in coordination, and allow enough time for the program to scale so it can effectively reach households that traditional models have missed.

There are a variety of local programs seeking to support these same underserved homeowners, making coordination and sequencing of services a critical consideration. An

[7] For more information Energy Trust and their programs, https://www.energytrust.org/.

important principle guiding cross-program referrals is to avoid implementing measures that could unintentionally reduce a household's eligibility for other programs. For example, completing partial upgrades through one program may prevent a home from meeting savings-to-investment ratio (SIR) requirements for low-income weatherization programs, effectively limiting access to additional resources. In some cases, it is therefore more appropriate to refer clients to partner programs first, particularly those with stricter eligibility or cost-effectiveness criteria, while ensuring clients understand they may still be eligible for Energy Friendly Homes at a later stage. Because this program uses a flexible minimum savings threshold of 10%, it can often serve clients after other programs have completed initial work. This sequencing approach reflects a broader "do no harm" commitment of the program to maximize total benefits available to the household.

The aim for this program and, where possible, other funding partners, is to find solutions to holistically support our community's most vulnerable homeowners, to intentionally engage each funding mechanism to be able to provide the max benefit to the household and not negatively impact the homeowner by unintentionally increasing their utility bills.

Table 9: Summary of Energy Friendly Homes' Lessons Learned

Category	Lesson Learned
Challenges in coordination	• Coordinating staff, contractors, subcontractors, and community partners consistently take more time than traditional programs. • Alignment across partners requires ongoing communication, shared expectations, and flexibility as program processes evolve.
Barriers in reaching priority populations	• Many priority households have limited prior engagement with traditional programs, requiring additional time to build trust and strengthen referral pathways (word of mouth or with community-based organizations). • Mistrust and past negative experiences with other programs can slow enrollment and require a more personalized outreach approach with Client Navigators and CBO support. • Homes often have significant underlying repair needs (e.g., foundations, roofs, structural issues) that can fall outside the program's scope, delaying service and increasing costs.
Higher costs	• Repair needs and the added coordination required mean that total costs are higher than early estimates. • Additional funding sources are often required to fully address household needs.
Repair needs exceed resources	• Some homes may need major repairs before upgrades can happen, and these repairs often go beyond available funding. • New partnerships have been established to help bridge the funding gap for households needing support beyond the program scope.
Scalability	• Scaling a program of this size requires a long ramp-up period. Once staffing, contractor capacity, and operational processes are in place, the program can rapidly increase throughput and community impact. • Workforce development efforts and contractor onboarding are essential components of long-term scalability.

Category	Lesson Learned
Cross-program coordination risks	• Multiple local programs are serving the same underserved homeowners, making coordination critical to avoid unintentionally limiting a homeowner's eligibility for other services.
Holistic solutions for homeowners	• Aligning with local programs is important, so homeowners receive maximum benefit without unintentionally increasing utility bills or narrowing future options. • Intentional sequencing of funding sources and coordinated project design can help ensure vulnerable households receive comprehensive and equitable support.
Recommendations for policymakers and implementers	• Plan for higher costs, expect repair needs to exceed the budget • Allow time for the program to scale. These steps help reach households traditional models have missed. • Invest early and heavily in partner coordination, contractor capacity development, and community engagement. • Build flexibility into program timelines to allow a ramp-up period for staffing, training, and outreach systems. • Ensure policies support collaboration across programs to prevent eligibility conflicts and enable holistic home upgrades.

Conclusion

The Energy Friendly Homes program demonstrates that a priority community-centered, equity-driven approach to residential energy efficiency can fundamentally reshape program participation, delivery, and outcomes. By integrating whole-home retrofit strategies with local partnerships, culturally responsive outreach, client navigation, workforce development, and funding for critical repairs, the program addresses structural barriers that have historically limited access to energy efficiency services.

Preliminary results indicate that this model can achieve substantial energy savings while significantly increasing participation among low- and moderate-income households and communities traditionally underserved by utility-administered programs. At the same time, the program generates broader co-benefits, including improved housing conditions, workforce development, and local economic opportunity. These outcomes are not achieved without tradeoffs. The findings highlight that this type of priority community-centered delivery models require greater investment per home, longer implementation timelines, and intensive coordination across partners. Deferred maintenance needs can exceed available resources, and effective program delivery depends on strong partnerships and flexible funding structures capable of supporting comprehensive solutions.

One of the most important insights from this work is that program success is not solely a function of incentive levels or technology deployment, but of delivery design. By reducing administrative burden, building trust through community-based organizations, and providing sustained client support with Client Navigators, the program can reach households that conventional models have consistently failed to engage.

For policymakers, utilities, and program administrators, these results suggest that achieving equitable energy savings at scale will require a shift away from purely cost-effectiveness-driven program frameworks toward models that explicitly incorporate equity,

housing stability, and workforce development as core objectives. While such approaches may involve higher upfront costs, they offer the potential for deeper, more durable energy savings and more inclusive participation.

The Energy Friendly Homes model provides a replicable framework for advancing these goals. Future research should focus on long-term bill impacts, realized versus modeled savings, and cost-effectiveness comparisons across program types to further refine and validate this approach. Ultimately, the program demonstrates that equity-centered design is not in tension with energy efficiency goals, it is a necessary condition for achieving them at scale.

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