Renter-Ready Solutions: Addressing the Split Incentive Challenge with New Technologies

G Teeter, San Francisco Public Utilities Commission
Tim Minezaki, San Francisco Public Utilities Commission

ABSTRACT

Renters make up nearly half of households in U.S. metro areas, and a significant share of most utility ratepayers, yet most energy-efficiency and electrification programs continue to prioritize single-family homeowners. These programs often rely on property control and long-term investment—barriers that exclude renters, despite their financial contributions to the utility rate payer pool.

Electric bikes, plug-in heat pumps, and emerging plug-in solar systems represent a new class of electrification technologies that can help move beyond traditional property-based program models. These technologies provide low-emission solutions for mobility, comfort, and energy supply while requiring minimal building modifications because they are adopted directly by occupants rather than property owners. Electric bikes can replace short car trips, plug-in heat pumps provide an efficient alternative to electric resistance space heaters common in rental housing, and plug-in "balcony solar" systems allow residents to generate electricity without installing rooftop panels. The San Francisco Public Utilities Commission has been studying each of these and is currently supporting e-bike deployment through a voucher system and launching a plug-in heat pump pilot later this year.

By designing for flexibility and ease of participation, these programs serve as models for inclusive electrification. They align with real-world living conditions while reducing carbon emissions and increasing program accessibility. This paper explores how utilities and local governments can rethink assumptions about property ownership, technology deployment, and customer engagement. It examines the potential for scalable, renter-ready programs that deliver environmental and social benefits across our communities.

Introduction: Past Paradigms and the Split-Incentive

The "split-incentive" has long confounded the utility programs industry. Simply put, the split-incentive occurs when the costs of an investment are unaligned with the primary benefits of that investment. The traditional example of this challenge for utility programs is in a residential landlord-tenant relationship where the landlord owns and maintains key equipment like a furnace or air conditioner and the tenant pays for the ongoing energy costs. The landlord is not incentivized to make investments in equipment even when program funding is available because they obtain minimal benefits to participate. As a result, these tenant/utility customers are rarely able to participate, and apartment tenants and future tenants end up using less efficient

equipment. Meanwhile in the case of homeowners who pay the capital and energy costs, these benefits are well aligned.

The dynamics of this split-incentive form the foundation for much of the inequities regarding utility program participation. Across much of the U.S., renters are a large portion of utility ratepayer pools, which remain difficult to serve with traditional owner-driven utility program models. In San Francisco in particular, renters make up most of our residential customers, with 62 percent of renter households, according to estimates from the U.S. Census American Community Survey (U.S. Census 2024a). Figure 1 below shows a comparison of San Francisco County compared to the State of California and the United States.

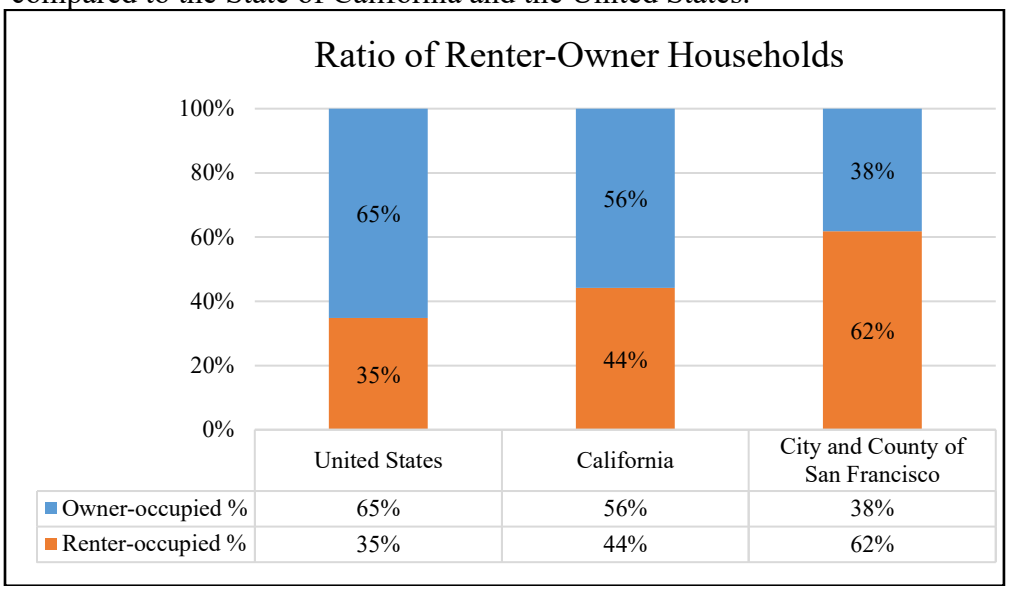
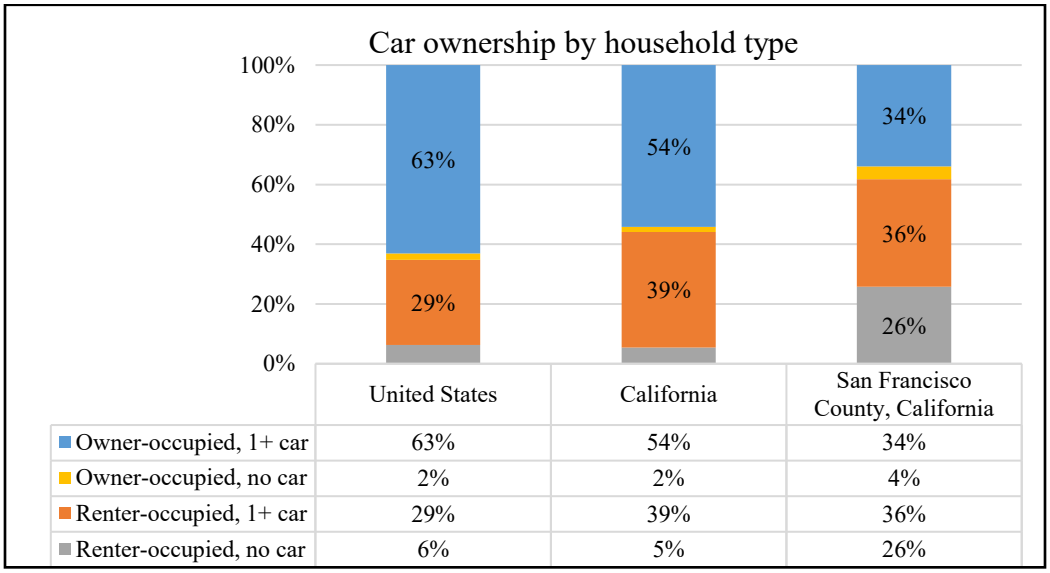


Figure 1. Stacked chart of home ownership and jurisdiction showing a high renter population in San Francisco. Source: U.S. Census 2024a

This dynamic can also be seen for car ownership, where some urban residents do not have a car but still face daily mobility challenges associated with connecting to transit networks. Program solutions to date have largely focused on getting them access to an electric vehicle and charging infrastructure which can fall on deaf ears to renters who may not even have their own parking spot. Figure 2 below shows a comparison of San Francisco County's car ownership by household type compared to the State of California and the United States.



	United States	California	San Francisco County, California
Owner-occupied, 1+ car	63%	54%	34%
Owner-occupied, no car	2%	2%	4%
Renter-occupied, 1+ car	29%	39%	36%
Renter-occupied, no car	6%	5%	26%

Figure 2. Stacked chart of car ownership by household and jurisdiction showing limited access to vehicles for renters. Source: U.S. Census 2024b.

Evolving Technology is Increasing Access

San Francisco's lower rate of home ownership and car ownership shapes utility needs to serve our customers. Luckily, a variety of new plug-in consumer products show potential to upend our past utility paradigm. These new products have the potential to be rapidly deployable and affordable alternatives that can provide renewable generation, electrified mobility, or efficiency electrified heating and cooling at a fraction of the cost. We discuss each in additional detail below.

E-bikes: Electrified Mobility for Urban Environments

Electric bicycles represent a rapidly growing electrification technology with the potential to reduce transportation emissions while expanding access to low-carbon mobility. Unlike many electrification technologies that require building upgrades or property ownership, e-bikes are portable consumer assets that individuals can adopt directly. This characteristic makes them particularly accessible to renters, who often face barriers to participating in electrification programs tied to building infrastructure. These barriers are widely documented in the energy efficiency literature. Research from ACEEE highlights that many utility programs fail to reach underserved households due to structural barriers, including complex program participation requirements, housing tenure, and program design that assume customers have control over property upgrades. The ACEEE toolkit *Adapting Energy Efficiency Programs to Reach Underserved Residents* emphasizes that renters, multifamily residents, and low-income households are consistently underrepresented in energy efficiency program participation and recommends designing programs that better reflect the circumstances of underserved customers

(ACEEE 2023). Housing tenure is a particularly significant barrier to electrification participation. As Ross et al. (2021) note, renters often face the well-documented landlord-tenant split incentive, in which landlords control building investments while tenants pay energy bills and receive the benefits of efficiency improvements. Because building upgrades typically require owner approval, renters frequently lack the ability to adopt technologies such as HVAC heat pumps, electric vehicle charging infrastructure, or building weatherization improvements.

As mentioned in the introduction above, in urban settings, renters often do not have access to dedicated parking and charging or may have a number of other barriers that make a large electric vehicle a poor fit for their needs.

Figure 3: Electric vehicle charging in private garage
Source: Enphase.com

Figure 4: e-bike charging
Source: shutterstock.com

Heat Pumps: Central Units or Plug-In Heat Pumps?

Adding heat pumps to households in San Francisco offers multiple benefits for both electric utilities and customers. For customers, heat pumps help customers adapt to increasingly frequent extreme heat events by providing cooling. The same heat pump can also efficiently replace gas heating with electricity, growing utility revenues while reducing emissions. While converting gas heating to clean electrified heat is a key priority for the City of San Francisco, legacy building infrastructure makes this challenging. According to U.S. Census data from the 2023 American Housing Survey (AHS), just 50 percent of Bay Area households have air conditioning of any type, and only 37 percent of Bay Area households have central air conditioning (U.S. Census 2023). At the same time, AHS data indicate that Bay Area households have a high reliance on electric resistance heating, with portable electric heaters identified for 18 percent of households, suggesting widespread use of inefficient heating technology, likely by renters (U.S. Census 2023). Together, this means that the ease of simply switching out a central air conditioner with a central heat pump unit is not a simple process for Bay Area households.

Figure 5. Outdoor unit, Central HP
Image Source: California HP Partnership

Figure 6. Plug-in space heaters.
Image Source: NYTimes/Wirecutter

These result in high upfront costs for traditional heat pumps. Based on California's electrification program Technology and Equipment for Clean Heating (TECH) Clean California, the median cost of a traditional heat pump installation in San Francisco County exceeds $22,000 (TECH Clean CA 2026). This cost represents a huge barrier making the upgrade untenable for many and impossible for those in our community who rent.

Fortunately, a new class of plug-in window heat pumps is emerging that can bring the benefits of traditional heat pumps at a fraction of the cost, nearly changing the owner-investment dynamics. These products were the topic of much consideration at ACEEE's 2024 Summer Study with multiple studies documenting their ability to provide efficient performance below 5°F and efforts to develop rating systems for these products (Beaini S. 2024; Coakley K. 2024; March E. 2024). Below are in Figure 7 to 9 show a few examples of these plug-in window heat pumps.

Figure 7 to 9. Emerging 110V, Window Heat Pumps (left to right: Gradient, Midea, GE)
Source: EnergyStar(2024)

Since 2024, additional products continue to be developed with the potential to address remaining barriers with regards to new dimensions, product weight, and importantly further reducing cost into a range affordable for renters[1]. These advancements could mean a future where renters are

[1] For example, GE's AWGP08WWF has can be purchased for less than $1,000

empowered to bring their own heating and cooling equipment and installing it themselves rather relying on the landlord to navigate a costly upgrade that would inevitably be passed on to them.

Plug-In Solar

Recent policy developments suggest that plug-in solar systems may represent the next frontier in renter accessible electrification. Often referred to as balcony solar, these systems consist of small photovoltaic panels paired with a microinverter that can be connected directly to a home's electrical outlet, allowing electricity generated on a balcony, patio, or similar outdoor space to supply power to a home without permanent installation (Canary Media 2024a; Solar United Neighbors 2023).

While rooftop solar has historically been limited to homeowners with suitable roofs and access to financing, plug-in solar technologies reduce these barriers by functioning more like consumer appliances than building infrastructure. Legislative proposals emerging across the United States aim to formalize this distinction. For example, recent California legislation proposes to classify small portable solar generation devices in a way that exempts them from traditional interconnection requirements and utility permitting process, significantly lowering barriers to adoption for renters and multifamily building occupants (California Legislature 2025a; California Legislature 2025b). These policy discussions are occurring alongside a broader wave of legislative activity across the United States. Lawmakers in numerous states have introduced legislation designed to enable small plug-in solar systems that connect directly to a home's electrical outlets, reflecting growing interest in distributed consumer-scale solar technologies (Canary Media 2024b).

Rethinking Programs for Renters

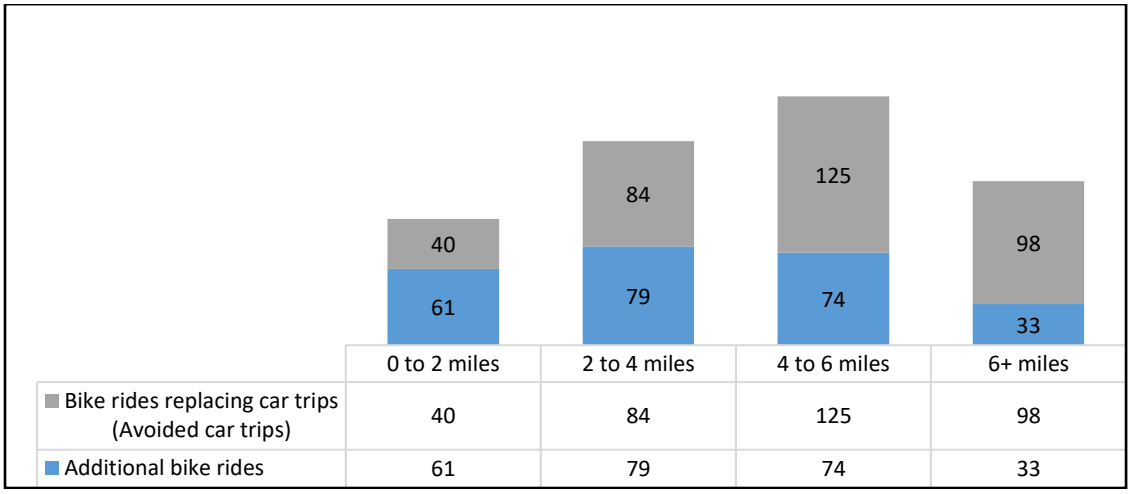
San Francisco Public Utilities Commission's Electrify-My-Ride

The Electrify My Ride program, administered by the San Francisco Public Utilities Commission, provides an example of how program design can address the structural barriers described above. The program offered $1,000 point-of-sale vouchers toward the purchase of an electric bicycle at participating local bike retailers. Eligibility was limited to income-qualified utility customers living in designated equity priority communities and enrolled in qualifying assistance programs, ensuring that program benefits were directed toward households historically underserved by transportation and energy programs.

Program design emphasized accessibility and ease of participation. Rather than requiring customers to navigate complex rebate processes, Electrify My Ride provided vouchers redeemable directly at local bike shops, reducing upfront costs and simplifying the purchasing process. Outreach efforts included multilingual marketing materials, community partnerships, and targeted engagement in priority neighborhoods to increase awareness among eligible residents. These design choices align with strategies recommended in the ACEEE toolkit for

reaching underserved residents, including simplifying enrollment, reducing administrative barriers, and delivering incentives at the point of purchase (ACEEE 2023). Unlike many electrification measures that require building modifications or landlord approval, e-bikes can be adopted directly by individual customers. This feature makes them particularly well-suited to renters and multifamily residents who may lack the authority to make property-level upgrades.

Survey results, as outlined in Figure 10, from Electrify My Ride participants suggest that the program produced measurable transportation impacts. Participants reported 347 car trips replaced by e-bike travel in the previous week, with the largest reductions occurring for trips between 2 and 6 miles. In this distance range alone, respondents reported 209 avoided car trips, including 84 trips between 2 and 4 miles and 125 trips between 4 and 6 miles. These results are consistent with research showing that many urban car trips occur within this distance range and may be particularly well suited to substitution with electric micromobility. For example, data from the U.S. National Household Travel Survey indicate that nearly 60 percent of all vehicle trips in the United States are less than six miles, highlighting the potential for short trips to shift to alternative modes such as cycling or micromobility.



	0 to 2 miles	2 to 4 miles	4 to 6 miles	6+ miles
Bike rides replacing car trips (Avoided car trips)	40	84	125	98
Additional bike rides	61	79	74	33

Figure 10. Reported reductions in car trips among Electrify My Ride participants.
Source: Electrify My Ride Travel Habits survey data.

These findings illustrate how occupant-level electrification technologies can expand participation in utility programs. By shifting program participation from property owners to individual customers, portable technologies such as e-bikes can bypass the landlord–tenant split incentive that often limits adoption of building electrification measures. Participation disparities in energy programs are also linked to broader equity challenges in program design and outreach. Sunter et al. (2019) find that higher-income and homeowner households disproportionately benefit from distributed energy and efficiency programs, while lower-income households and renters face structural barriers that limit access to program incentives. These findings highlight the

importance of program models that expand participation pathways beyond property-based upgrades.

A recent retrospective of Electrify My Ride participants found concentration in poorly served transit corridors, outside of the transit core of San Francisco's light rail Muni lines. Figure 11 outlines the geographic concentration offering complimentary story, that e-bike access targeted at low-income populations is improving mobility and connection from past neglected portions of the city.

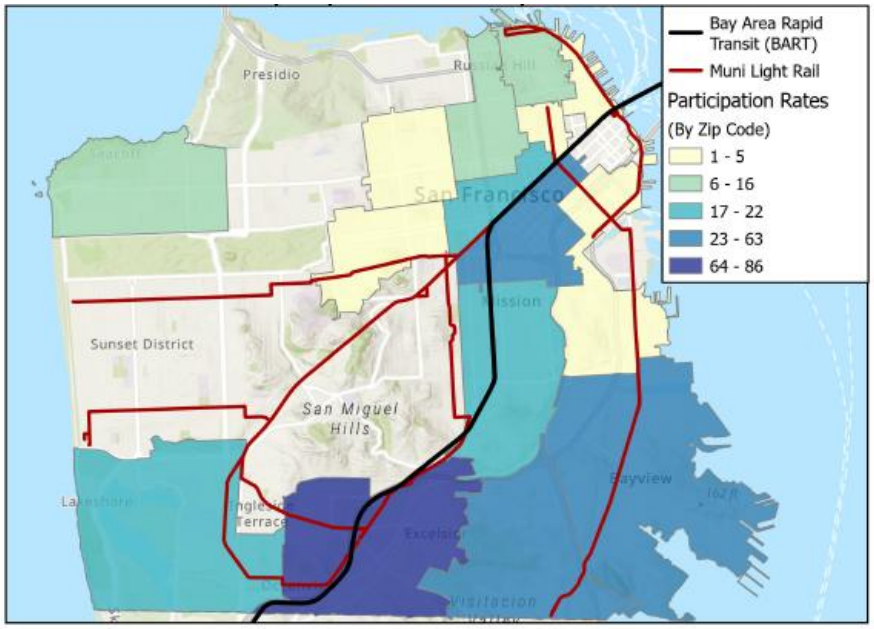


Figure 11. Heat map of Electrify My Ride participation by zip code with light rail infrastructure (red & black).
Source: Electrify My Ride program data.

For utilities and policymakers, this approach suggests an additional pathway for expanding equitable electrification. While building electrification programs remain essential for long-term decarbonization, complementary programs that support renter-accessible technologies may help utilities reach customers who are otherwise excluded from property-based upgrades. Incorporating portable, customer-controlled technologies into electrification portfolios may therefore provide a practical strategy for improving program equity, increasing participation among underserved households, and accelerating near-term emissions reductions.

Plug-in Heat Pump Pilots

Recent innovation in plug-in heat pump technologies have the potential to expand access to efficient heating and cooling in buildings where traditional heat pump projects are difficult or costly. These technologies may be particularly relevant in San Francisco, where residential air-conditioning penetration remains very low and much of the housing stock consists of older multifamily buildings without Central HVAC systems. Window air conditioners are uncommon across the city, reflecting both the historically mild coastal climate and building characteristics that have limited the adoption of mechanical cooling equipment. As a result, plug-in heat pump technologies represent a relatively new concept for many San Franciscans.

Limited familiarity with room-based conditioning equipment may influence customer perceptions, installation preferences, and willingness to adopt these technologies. At the same time, the absence of entrenched equipment types may create an opportunity for alternative solutions to gain traction if they can demonstrate strong performance, ease of installation, and positive user experiences.

Beginning in 2026, the San Francisco Public Utilities Commission will pilot plug-in heat pumps in partnership with both building owners and renters across the city. The purpose of our dual pilot approach will be to test uptake and barriers by working with these two very different markets. By working directly with landlords and property managers we will be able to test uptake, measure performance, and uncover installation challenges at the building level and allow coordinated deployment across multiple housing units that will allow us to test these products for their ability to provide space heating electrification to a whole building. This approach will test multiple plug-in heat pump technologies across a range of building contexts, including both market-rate housing and deed-restricted affordable housing.

Meanwhile, testing uptake with a direct-to-renter deployment will address different questions, as we seek to understand how well renters can install these units, which are not common in the San Francisco market, and how well they are understood as replacements for inefficient electric resistance space heaters.

These pilots are designed to evaluate both technical performance and customer experience in real-world conditions. Field monitoring will assess quantitative outcomes, including energy performance during the heating and cooling seasons and bill impacts. At the same time, surveys and interviews with residents will explore qualitative dimensions of product performance, including perceived comfort, usability, noise, aesthetics, and overall satisfaction.

Together, these insights will help the San Francisco Public Utilities Commission understand how customers interact with, understand, and value plug-in heat pump technologies in a market where air conditioning equipment has historically been uncommon. Findings from this work will inform multiple program design challenges with the goal of developing novel electrification

approaches to reduce reliance on both gas heating systems and inefficient electric resistance devices while avoiding the cost and disruption of traditional Central HVAC retrofits.

Plug-In Solar: Emergence of Occupant-Level Distributed Generation

International experience provides an indication of the potential scale of plug-in solar technologies. In Germany, where regulations allow simplified interconnection of small plug-in solar systems – referred to as "balcony solar" – more than 500,000 systems have been installed on apartment balconies and other small residential spaces. These systems are small, between 300 and 800 watts, but can offset a meaningful portion of household electricity consumption, particularly for daytime loads such as a refrigerator (Canary Media 2024a; Bundesnetzagentur 2024). Similar policies are emerging in several European countries as regulators adapt interconnection rules to accommodate small plug-in solar systems.

Within the broader context of electrification policy, plug-in solar represents a growing category of renter accessible portable electrification technologies. Similar to electric micromobility and plug-in heat pumps, these systems can be adopted directly by occupants without requiring building retrofits or landlord approval. By shifting adoption from property owners to residents, these technologies may help address the landlord-tenant split incentive that has historically limited participation in energy efficiency and electrification programs (Bird and Hernández 2012; Ross et al. 2021).

Policy discussions in the United States suggest that similar market opportunities may emerge as regulators clarify the treatment of small plug-in solar devices and simplify interconnection requirements (Canary Media 2024b). While individual systems are small, their low cost, portability, and ease of installation could expand distributed generation in multifamily housing and rental markets that have historically been excluded from rooftop solar programs. Plug-in solar complements other renter accessible technologies, such as e-bikes and plug-in heat pumps, that allow individuals to adopt low-carbon technologies without requiring property-level upgrades.

Figure 12. Example of a balcony solar system installed on an apartment.
Source: Canary Media

Conclusion

Traditional electrification programs have focused on technologies that require property ownership or building-level infrastructure, such as rooftop solar, HVAC heat pumps, or electric vehicle charging equipment. While these technologies are long-term solutions for decarbonization, their reliance on property control and capital investment can limit participation among renters and residents of multifamily housing. As a result, a significant segment of utility customers – despite contributing to program funding via their utility bills – often face structural barriers to accessing electrification incentives.

This paper highlights the potential for a complementary approach centered on renter-ready electrification technologies. Electric micromobility, plug-in window heat pumps, and emerging plug-in solar systems demonstrate how low-carbon technologies can be designed for direct adoption by occupants rather than property owners. Because these renter-ready solutions require minimal building modifications and can often be installed or operated without landlord approval, they provide new opportunities to address the landlord-tenant spit incentive.
The case study of the Electrify My Ride program illustrates how utilities can operationalize the renter-ready concept through program design. By providing point-of-sale incentives, partnering with local retailers, and targeting outreach toward underserved communities, the program lowers barriers to participation and supports electrification technology that customers can adopt directly. Survey results suggest that these approaches can produce measurable transportation impacts

while expanding program accessibility. As electrification policies continue to evolve, utilities and policymakers may benefit from expanding program portfolios to include technologies that align with the realities of rental housing and multifamily living. Renter-ready solutions will not replace whole-building electrification; the two are complementary by providing near-term emissions reductions and expanded access.

More broadly, the emergence of portable technologies such as e-bikes, plug-in heat pumps, and balcony solar suggest that electrification is moving beyond traditional infrastructure. Recognizing and supporting renter-ready solutions may enable utilities to reach a larger share of their customers, quickly reduce emissions in the near term, and design programs that reflect the diversity found in modern cities.

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