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# Building Decarbonization Policy Brief

Financing a Climate-Safe Future: Low- and Moderate-  
Income Residential Building Decarbonization



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# Building Decarbonization Policy Brief

## Financing a Climate-Safe Future: Low- and Moderate-Income Residential Building Decarbonization

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### Abstract

California needs a comprehensive financial and regulatory strategy to support a transition to residential building decarbonization that prioritizes low-income communities. This approach should leverage existing funding streams, establish new funding programs, and should tap into third party capital to help finance the cost of electrification while using public funds in a targeted way to bring down the cost of electric appliances and incentivize early retirement of existing gas appliances. **Tariffed on-bill financing (TOBF)** can enable more equitable adoption by providing homeowners and landlords a cost-effective way to finance a portion of the cost of home electrification. Investor-owned utilities (IOUs) already have the ability under California law to implement TOBF programs with approval from the California Public Utilities Commission (CPUC). TOBF is a critical and underutilized tool, and the state and local governments can facilitate the equitable use of TOBF by deploying targeted incentives and adopting legislative and regulatory changes aimed at reducing the lifecycle costs of heat pumps and electric appliances and phasing out fossil fueled appliances.

## Introduction

Decarbonizing existing residential buildings is a critical component of meeting state and global climate goals. Buildings in California are responsible for almost 44 million metric tons (MMT) of CO<sub>2</sub>e (California Air Resources Board 2021a) per year. When electricity use in buildings is included, the building stock contributes 25 percent of California's total measured greenhouse gas emissions annually, with residences contributing 12 percent and commercial buildings 13 percent (Hopkins et al. 2018; Energy and Environmental Economics 2019). Recent research by Kammen et al. (2021) shows that, to keep pace with the latest climate science and stay below 1.5°C of warming, total building emissions in California must fall by almost 70 percent by 2030.

Electrification of appliances, including cook stoves, space heating and cooling, and water heating throughout California, would offer significant climate benefits. Under the current grid electricity mix, complete home electrification would reduce each building's emissions by up to 60 percent (Energy and Environmental Economics 2019). Under a decarbonized grid, building emissions would drop by 90 percent (Ibid). Electrification of residential appliances would also help reduce indoor air pollution caused by gas stoves and other appliances — which has been causally linked to asthma, cancer, and premature mortality (US Environmental Protection Agency 2016; Lebel et al. 2022). These health conditions are most likely to be experienced by low-income households and Black, Brown, Asian, and Indigenous communities in California (Bueno, Meng, and Pickett 2012). Any effort to reduce building emissions must ensure that low-income and disadvantaged households have access to all-electric, climate-safe homes.

### On-Bill Tariffed Financing (TOBF): Definition

Utilities invest in residential building electrification measures that are proven to lower utility bills by improving efficiency. Utilities then charge ratepayers over time to recoup the initial capital investment, at a rate that still allows ratepayers to receive some cost savings. This mechanism taps private capital while lowering utility bills for households or building owners, and is also sometimes known as "inclusive utility investment." (Energy Star, 2022)

For new housing, all-electric construction generally has a lower capital cost compared to building a mixed-fuel home with gas and electric appliances. There is growing momentum toward regulation that mandates the electrification of new homes (see text box on the following page). However, in any given year, newly built housing accounts for less than 1 percent of California's total housing stock.<sup>1</sup> Electrifying the state's existing housing stock is a major challenge requiring substantial investment. In today's market, the installation of electric appliances is generally more expensive compared to gas equivalents. Electrical upgrades, new wiring to locations that didn't have electrical service, the price of equipment on the market, unfamiliarity with technology, and contractors' "pricing adverse" practices and panel changeouts are all major upgrade costs. These higher costs can be due to home improvements that are typically not covered by existing utility incentives, leaving high out-of-pocket requirements for

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<sup>1</sup> Since 2016, about 100,000 permits have been issued per year, compared to an existing total housing stock of more than 14 million units (H. Johnson, Cuellar Mejia, and Lafortune 2021).

those interested in making the investment. This places clean, all-electric homes out of reach for many low- and moderate-income (LMI) households. Electrification of rental housing presents a particular challenge, since landlords may not have a financial incentive to invest in electrification upgrades when the bill savings accrue to the renter. Even when landlords may be willing to make this investment, tenants sometimes face rent increases or potential displacement when existing tenant protections are not robust.

According to a recent estimate by the Building Decarbonization Coalition, fully decarbonizing low-income multifamily housing through grants alone would require a commitment of public funds between \$72 and \$150 billion over 25 years (Mast, Hummel, and Clinton 2020).<sup>2</sup> TOBF can help reduce the need for public investment by leveraging private capital, while expanding access to electric appliances both to renters and LMI homeowners. Some important features of TOBF are that (a) the investor is the utility rather than the occupant or building owner, and (b) the utility's investment is recovered via a tariff tied to the location, not the occupant. These innovations increase access to funding for those who are left behind in consumer lending, provide a pathway for improvements in renter-occupied properties, enable cost recovery over the life of the improvements, and align costs and benefits for both current and future building occupants (particularly when local governments support TOBF investments with tenant protections to avoid bill or rent increases or displacement).

TOBF alone will not be enough to address the significant cost of upgrading our existing built environment. Substantial public funding for complementary incentive programs will still be required and regulatory reform is needed to address high electricity rates and other disincentives to electrification investments. Nevertheless, when paired with targeted incentives and regulatory reform, TOBF can play an important role in enabling LMI households to access the benefits of building electrification. In the process, it can stretch scarce public dollars and accelerate the overall pace of clean energy investments.

The remainder of this white paper is organized as follows:

- **Existing State Programs and Funding Sources:** Describes existing state programs, policies, and funding sources, as well as related strategies and research, that support each of the action areas.
- **Challenges to Funding and Financing:** Summarizes major challenges for achieving net zero emissions from our built environment.
- **Recommended Funding Pathway:** Discusses the range of potential incentive and regulatory mechanisms evaluated and the recommended pathways selected for further analysis.

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<sup>2</sup> Note that this estimate only includes the gross up-front cost of electrification and does not account for the ongoing cost savings that are expected to be realized by households over time.

- **Funding Gap Analysis:** Provides an estimate of the funding needs for achieving necessary greenhouse gas reduction goals<sup>3</sup> as well as the potential of the recommended funding pathways to fill the funding needs.
- **Additional Considerations and Next Steps:** Key considerations and next steps for implementing each funding pathway.

## Existing State Programs and Funding Sources

California currently has a patchwork of programs to assist homeowners and landlords with decarbonization. Many programs are offered by investor-owned utilities (IOUs) and are not available statewide. Table 1 shows the range of existing programs that are available. As shown, the current approach to facilitating residential building decarbonization falls into four general categories:

- 1. Household-level rebates and incentives for electric appliances:** The first set of programs provides rebates and incentives, either directly to households that install electric appliances or to the contractors that provide installation services. These programs are typically administered by utilities and local governments, one of the state's four investor-owned utilities (IOUs), through four regional energy networks (RENs) in the Bay Area and Southern California,<sup>4</sup> and by Community Choice Aggregators (CCAs). IOU programs are funded by a surcharge on electricity and gas rates included in customer bills, which provides more than \$1 billion per year to fund energy efficiency programs (California Public Utilities Commission 2016). These programs do not effectively serve low-income households even when program eligibility rules do not categorically exclude them for the simple reason that they require the building owner or occupant to provide the bulk of the project funding.
- 2. Low-income programs targeted for single-family and multifamily housing:** These programs provide direct consultations and subsidies for low-income households and owners of affordable multifamily housing to make energy upgrades. Many of these programs — offered throughout most of the state by IOUs — target assistance either to building owners whose tenants meet income eligibility criteria or buildings located in disadvantaged communities as defined by state law for the purposes of distributing cap and trade funding. Affordable housing developers can also secure tax credits for their projects, but must undergo a competitive process through the Tax Credit Allocation Committee, which provides preference for projects with significant energy efficiency investment. This has been a significant driver in energy efficiency improvements in affordable housing in California. Market impacts are constrained both by the volume of tax credit funding available and by affordable housing finance regulations that limit major facilities rehabilitation to 15-year resyndication cycles.

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<sup>3</sup> <https://arxiv.org/abs/2103.07801>

<sup>4</sup> I-REN, CCC REN, BayREN, Rural REN.



- 3. Lending and credit enhancement programs:** The third set includes credit measures in the form of either low-cost lending to landlords and homeowners, or “credit enhancement” for participating lenders. In a credit enhancement program, the utility or CCA sets money aside to cover potential losses to lenders that agree to offer better loan terms, making financing for energy-efficiency upgrades more affordable to property owners. An example of this mechanism on a statewide level is the GoGreen Home program, administered by the California Alternative Energy and Advanced Transportation Finance Authority (CAEATFA) with funding from the IOUs under the regulatory authority of the CPUC.<sup>5</sup> These programs do not effectively serve low-income households even when program eligibility rules do not categorically exclude them for the simple reason that they require the building owner or occupant to have the financial wherewithal to take on debt.
- 4. Non-financial interventions:** These policies focus on direct intervention in markets, not always financial in nature. This includes programs and policies that aim to educate contractors on best practices in electrification and energy efficiency upgrades and build out supply chains for efficient appliances and materials. These sets of interventions can also focus on local reach codes, streamlined permitting, workforce development, and direct engagement with manufacturers to promote development of new technologies such as smart panels.

The four categories of existing residential building decarbonization programs in California address the market from both the supply and demand side, with greater assistance dedicated to housing serving low-income households. However, critics have noted that the patchwork of state- and utility-led programs do not amount to a comprehensive, statewide framework for electrification. There are also challenges associated with program designs not working to serve LMI customers appropriately. Rebate and incentive programs require upfront investment, time, and energy to navigate programs. TOBF can help overcome these challenges. Funding for these programs — which generally comes from either the state’s cap and trade program or IOU ratepayer funds, and more recently from federal Inflation Reduction Act (IRA) funds — remains limited, assisting nowhere near the number of households needed to meet the state’s decarbonization goals.

## Challenges to Financing Decarbonization of the Existing Residential Building Stock

While funding sources and financing options exist throughout the state, there are significant challenges associated with achieving the speed and scale of transition required to decarbonize the building stock by 2030. Some of the major challenges for accelerating the pace of residential building decarbonization are described below.

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<sup>5</sup> See <https://gogreenfinancing.com/residential>

- **High upfront capital costs are the major economic barrier to electrifying existing buildings.** While costs vary across buildings and regions, in today’s market, electric appliances can be more expensive compared to gas equivalents. For example, a study of Berkeley’s older housing stock found that the gross cost of full electrification to achieve a net zero emissions target would range from \$20,000 to nearly \$40,000 per unit (including labor and other required housing improvements) depending on whether economy or mid-tier appliances are used and whether solar is included in the package (City of Berkeley 2021). In general, older homes are more expensive to electrify and make energy efficient than newer homes because they tend to be poorly insulated and often require additional electrical work to accommodate the new appliances. For example, some homes — particularly those that do not currently have air conditioning or electric heating — may need a new electrical panel, which can add approximately \$2,000 to \$4,000 to the total cost of electrification (Brooks 2021; Energy and Environmental Economics 2019). Over the longer term, increased demand is expected to result in a market transformation that may reduce costs and make appliances and labor more affordable. However, high prices constrain electrification efforts at this stage.
- **Rate reform is needed to ensure the affordability of all-electric buildings.** California’s existing rate structures are not aligned with state policy to decarbonize the built environment. California uses volumetric rates to pay for numerous programs and costs, including infrastructure, wildfire damages, energy efficiency programs, low-income subsidies, and rooftop solar. The Energy Institute at the Haas School of Business and Next 10 found that this practice has led to a large and growing gap between actual retail electricity prices and the utilities’ social marginal costs of providing power. This pricing distortion erodes bill savings from electrification and disincentivizes investment.<sup>6</sup> Electric appliances are typically more efficient compared to gas, but the bill savings are generally insufficient to cover the full investment cost.<sup>7</sup> The CPUC is currently exploring rate reform options to improve affordability, including a possible income-based, fixed charge, which could improve the operational savings of all-electric buildings for low-income households.<sup>8</sup>
- **LMI households, credit-constrained households, and renters are the least likely to be able to access electrification improvements without proper policies and planning.** LMI homeowners often lack access to the capital and/or credit required to finance significant energy improvements. Even where robust rebates and incentives exist, these incentives may not cover the costs of the electric appliances, much less any electric wiring, service panel upgrades, or efficiency improvements that improve the safety and affordability of all-electric homes. Existing financing instruments, such as consumer lending or home equity lines of credit, are not accessible to many of California’s low- and middle-income residents.<sup>9</sup>

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<sup>6</sup> Next 10 (2022), *Paying for Electricity in California: How Residential Rate Design Impacts Equity and Electrification*, <https://www.next10.org/publications/electricity-rates-2>

For a summary of the report findings, see the Energy Institute blog post *Equitable Decarbonization Requires Rate Reform* at <https://energyathaas.wordpress.com/2022/09/26/equitable-decarbonization-requires-rate-reform/>

<sup>7</sup> Energy and Environmental Economics 2019; Hopkins et al. 2018; Brooks 2021

<sup>8</sup> CPUC rulemaking. <https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/electric-costs/demand-response-dr/demand-flexibility-rulemaking>

<sup>9</sup> <https://eta-publications.lbl.gov/sites/default/files/report-lbnl-5244e.pdf>

Renters typically rely on landlords to make investments in energy upgrades. LMI households don't normally have adequate capital to float a few months while incentives are finalized and distributed in a project. TOBF can be the bridge loan in that regard. However, in many cases, the costs of electrification upgrades are borne by the owner while any bill savings accrue to the renter.<sup>10</sup> This “split incentive” disincentivizes investments in electrification by building owners. This is a particular challenge for an equitable electrification strategy given that 45 percent of Californians are renters, of which 56 percent are low-income and 24 percent are very low-income households.<sup>11</sup> Electrification of appliances along with smart controls and rate alignment with carbon-free power can streamline the transition to the clean power future.

- **If building decarbonization becomes available first and foremost to those who already have the financial means to pay for electrification, the cost of maintaining the gas distribution infrastructure may shift disproportionately to those who can least afford it.** Low-income households already spend a higher portion of their income on energy than wealthier households (Borenstein, Fowlie, and Sallee 2021). As more homes reduce their reliance on gas, utilities will have a smaller pool of customers from which to recover fixed costs, resulting in increased rates for households who remain on the gas grid (Ibid).
- **A shortage of experienced, well-trained workers contributes to high costs and creates a challenge for scaling up the pace of electrification.** Many contractors are inexperienced in electrification skills and electric appliance installation and/or do not consider themselves energy efficiency technicians (Brooks 2021). Labor costs tend to be the most expensive portion of an electrification retrofit bill, though labor costs may decline as contractors gain more experience in electrification projects (Ibid). A larger, skilled workforce representing quality, high road jobs is needed to meet current and future demand.
- **A lack of awareness and familiarity among contractors and consumers around the health, comfort, and climate benefits of electrification also hinders faster adoption.** Lack of awareness — combined with higher prices and limited availability of many electric appliances compared to gas alternatives — is a particular challenge because households and property owners often purchase new appliances only when old ones fail.
- **Emergency replacement with electric appliances typically can't be completed in a matter of hours or even days, even if the customer and contractor are aware of the long-term benefits.** To the extent that new appliances are emergency purchases, buyers are more likely to buy products that are readily available, low-cost, familiar, and recommended by a contractor, who often sells as well as installs new appliances such as water heaters and furnaces (Bartholomy 2022). This problem can be compounded when retrofit projects cross trades. For example, many water heater replacement projects are currently handled by plumbers, whereas a heat pump installation may require an electrician.

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<sup>10</sup> This is particularly true for homes that are renter-occupied and have direct metering (i.e., where each unit has an individual meter and receives a bill directly from the utility).

<sup>11</sup> The Greenlining Institute 2019; National Low Income Housing Coalition 2021



Helping to build bridges between trades to pair electricians with plumbers may be necessary to facilitate more gas to heat pump conversions.

- **“Soft” costs and transaction costs are increasing the costs of installation and discouraging adoption.** Even where the incremental cost of the electric equipment is comparable, the soft costs associated with a gas to electric appliance transition can increase the cost and “hassle factor” of a project, discouraging customers and contractors from embracing the transition. These soft costs include a lack of availability of electric appliances, lack of familiarity by building officials or inspectors, and increased timelines to accommodate the potential for electrical work that may be required as part of a broader project.

Table 1. Existing Residential Building Decarbonization Programs in California

| Program Name  | Administering Entity                                    | Regions Available  | Eligible Property Types | Incentives Available   | Low-Income Set-Asides |
|---|---|--------------------|-------------------------|--|-----------------------|
| <b>Type 1: Household-Level Rebates and Incentives for Electric Appliances</b>                                     |   |                    |                         |  |                       |
| Description: Household-level rebates and incentives for the purchase of electric appliances at a household level. |   |                    |                         |  |                       |
| Residential Rebates   | Pacific Gas & Electric (PG&E) - IOU                     | PG&E Service Area  | Residential             | Smart thermostat: \$50/unit; Electric heat pump storage water heater: \$300/unit; Backup power generator: \$300-\$1,000/unit; Portable battery: \$300-\$1,000/unit | None                  |
| Rebates and Incentives Program  | Southern California Edison (SCE) - IOU                  | SCE Service Area   | Residential             | Electric portable power stations: \$75/unit; Smart thermostat: \$75/unit; Portable power generator: \$200/unit   | None                  |
| Home Rebates  | Sacramento Municipal Utility District (SMUD) - POU      | SMUD Service Area  | Residential             | Induction cooktop: \$100 - \$750/unit; Heat pump water heater upgrade: \$2,500; Smart thermostats: \$50/unit   | None                  |
| Appliance Rebate Programs   | Los Angeles Department of Water and Power (LADWP) - POU | LADWP Service Area | Residential             | Refrigerator: \$50-\$75/unit; Clothes washer: \$400/unit   | None                  |
| Rebates and Incentives  | Alameda Municipal Power (AMP) - POU                     | AMP Service Area   | Residential             | Heat pump water heater: \$1,500/unit; Electric clothes dryer: \$100/unit; LED lighting: \$20-\$50/unit   | None                  |

| <b>Program Name</b>                              | <b>Administering Entity</b>                     | <b>Regions Available</b> | <b>Eligible Property Types</b> | <b>Incentives Available</b>   | <b>Low-Income Set-Asides</b> |
|--|---|--------------------------|--------------------------------|---|------------------------------|
| Residential Equipment Rebates                    | City of Lompoc Utilities - POU                  | CLU Service Area         | Residential                    | Clothes washer: \$300/unit; Dishwasher: \$50/unit; Refrigerator: \$75-\$100/unit; Variable-speed pool pump: \$250/unit  | None                         |
| Appliance Rebates                                | Turlock Irrigation District - POU               | TID Service Area         | Residential                    | Refrigerator: \$35/unit; Clothes washer: \$35/unit; Induction stovetop: \$100/unit; Heat pump water heater: \$350/unit; Electric water heater: \$75/unit          | None                         |
| Rebates and Financing (Single-Family Homeowners) | Bay Area Regional Energy Network (BayREN) - REN | Nine-County Bay Area     | Single-Family Residential      | Heat pump water heater: \$1,000/unit; Induction cooktop: \$300/unit; Heat pump dryer: \$300/unit; Air conditioning: \$800/unit; Tankless water heater: \$400/unit | None                         |

Note: Rebates and incentives listed as Type 1 above are not comprehensive of all programs offered statewide (especially among publicly-owned utilities), but may be representative of the types of programs available. These programs are subject to change.

Sources: Programs information sourced from individual agency websites.

**Type 2: Consultation and Direct Subsidies Targeted to Low-Income, Single-Family, and Multifamily Housing**

Description: Consultations with multifamily property owners to assess potential energy efficiency upgrades, followed by direct subsidies for select upgrades and repairs.

| <b>Program Name</b>   | <b>Administering Entity</b>                                    | <b>Regions Available</b>           | <b>Eligible Property Types</b>                        | <b>Incentives Available</b>  | <b>Low-Income Set-Asides</b>   |
|---|--|------------------------------------|---|--|--|
| Building Initiative for Low-Emissions Development Program (BUILD) | California Energy Commission                                   | Gas IOU Service Area               | New multifamily properties                            | Incentives to be determined for each building type and climate zone by IOUs, with the aim of covering the incremental cost between traditional and electric options. | 75% of funding must go to low-income communities; must meet Disadvantaged Community or other income criteria |
| Energy Savings Assistance (ESA) Program                           | California Public Utilities Commission                         | IOU Service Area                   | IOU customers who qualify for CARE                    | No-cost, direct installation of energy efficiency improvements in the homes of customers who qualify for or are currently on the subsidized CARE rate.               | Program is dedicated to customers at or below 200% of the Federal Poverty Level.                             |
| Weatherization Assistance Program                                 | Community Services & Development (via US Department of Energy) | Statewide, administered regionally | Customers at or below 80% of Area Median Income (AMI) | No-cost, direct installation of health and safety and energy efficiency improvements for both single-family and multi-family buildings.                              | Program is dedicated to customers at or below 80% of AMI.  |

|   |   |  |                                |   |  |
|---|---|--|--------------------------------|---|--|
| Low-Income Weatherization Program for Multifamily Properties) (LIWP-MF) | Community Services & development (CSD) (via Association for Energy Affordability, Inc.)   | Disadvantaged Communities                        | 5+ unit multifamily properties | Agreed upon between AEA and property owner.   | Property must be in a Disadvantaged Community  |
| BayREN - Multifamily Building Enhancements                              | BayREN  | Ventura, Santa Barbara, San Luis Obispo counties | 5+ unit multifamily properties | \$3,350/unit  | Priority given to small properties, those in Disadvantaged Communities, those meeting income cutoffs |
| SMUD Go Electric  | SMUD (via Association for Energy Affordability Inc, Frontier Energy, and Brighton Energy) | SMUD Service Area                                | 5+ unit multifamily properties | HPWH: \$2,000; HVAC: \$1,800; Dryer: \$400; EV charging station: \$6,500                  | Higher incentive rates for those participating in SMUD's Energy Assistance Program                   |
| South Coast AQMD Multifamily Affordable Housing Electrification Program | South Coast Air Quality Management District (via Association for Energy Affordability)    | South Coast Air Quality Management District      | 5+ unit multifamily properties | HPWH: \$3,500; Space heater: \$4,000; Dryer: \$250; Induction cooking appliances: \$2,000 | 66% of tenants are <80% of Area Median Income  |
| Marin Clean Energy - Low-Income Families and Tenants (LIFT) program     | MCE   | MCE Service Area                                 | 4+ unit multifamily properties | \$1,200/unit  | Income cutoffs based on household size   |



|  |  |  |                                |                           |   |
|--|--|--|--------------------------------|---------------------------|---|
| Marin Clean Energy - Energy Savings for Multifamily Properties | MCE and BayREN                         | MCE Service Area   | 4+ unit multifamily properties | \$1,000/unit              | None  |
| Solar on Multifamily Affordable Housing (SOMAH)                | California Public Utilities Commission | Utility or CCA customer in PGE, SCE, SDGE, PC, or LU territories | 5+ unit multifamily properties | \$3.20/AC watt            | Property must be in a Disadvantaged Community or 80% of residents make <60% of Area Median Income |
| 3C-REN - Direct Install  | 3C-REN                                 | Ventura, Santa Barbara, San Luis Obispo counties                 | Single-family properties       | \$1,445 average incentive | None, though explicit emphasis on "hard to reach" communities                                     |

### Type 3: Lending and Credit Enhancement

Description: This type of program lends to property owners making energy efficiency upgrades to their homes or multifamily buildings.

| Program Name                                    | Administering Entity      | Regions Available    | Eligible Property Types   | Incentives Available   | Low-Income Set-Asides   |
|---|---------------------------|----------------------|---|--|---|
| GoGreen Home Energy Financing                   | Lending partners          | Gas IOU Service Area | 1-4 unit residential properties   | Loans and retail installment contracts up to \$50,000.                                       | 1/3 of credit enhancement must go to LMI borrowers; additional credit enhancement rates for LMI communities |
| GoGreen Affordable Multifamily Energy Financing | Lending partners          | Gas IOU Service Area | Multifamily (5+ units) where at least 50% of units are restricted to LMI households | Loans, leases, energy service agreements, equipment financing agreements up to \$10 million. | 1/3 of credit enhancement must go to LMI borrowers; additional credit enhancement rates for LMI communities |
| thirdACT  | thirdACT (Private Lender) | Statewide            | Residential   | N/A  | N/A   |

#### Type 4: Upstream or Midstream Programs

Description: This set of programs aims to build out the supply-side of the market for electrification. This includes educational trainings and workshops, as well as direct subsidies to contractors and suppliers.

| Program Name  | Administering Entity | Regions Available                                | Eligible Property Types | Incentives Available   | Low-Income Set-Asides                                    |
|---|----------------------|--|-------------------------|--|--|
| Technology and Equipment for Clean Heating (TECH) Initiative  | CPUC                 | Gas IOU Service Area                             | Contractors             | Contractor education and training, consumer inspiration campaign, quick-start grants and innovative pilots, and financial incentives to contractors. | At least 40% to low-income and disadvantaged communities |
| Marin Clean Energy - Workforce Education and Training Program | MCE                  | MCE Service Area                                 | Contractors             | Contractor education and training.   | N/A  |
| 3C-REN - Workforce, Education, and Training                   | 3C-REN               | Ventura, Santa Barbara, San Luis Obispo counties | Contractors             | Contractor education and training.   | N/A  |

## Financing Our Future

Expanded use of tariffed on-bill financing (TOBF) can help enable more equitable adoption of building electrification by providing homeowners and landlords an easy, cost-effective way to pay for new electric appliances and other energy efficiency measures. The State of California and local governments can facilitate the equitable use of TOBF by deploying targeted incentives and adopting legislative and regulatory changes aimed at reducing the lifecycle costs of electrical appliances. TOBF is described in more detail below, followed by a discussion of actions that the state, local governments, and utilities can take to expand its use.

As noted above, TOBF alone is not sufficient to facilitate the transition to a decarbonized building sector. For TOBF to work for Californians, especially low- to moderate-income Californians, it should be paired with robust incentives, electricity rates that support our climate targets, and regulatory policies that address the high soft costs and transactional costs that keep electrification out of reach for many.

## Tariffed On-Bill Financing

TOBF works directly through customers' utility bills to finance energy efficiency and electrification upgrades within units and/or common areas. Utilities make an upfront investment in upgrades like heat pump water heaters, recovering the cost over time through a tariff charge attached to the unit's monthly utility bills. Upgrades are limited to improvements that yield lifecycle net savings to ensure customers' annual utility costs do not increase. The tariff charge remains attached to the meter for the unit where the improvements were made, regardless of who occupies the property, until the utility recovers its full cost.

The TOBF model differs from on-bill loans and repayment models in that investments are not tied to a customer loan, but rather a utility investment for which cost recovery is tied to the utility meter according to terms set forth in a utility tariff. The tariff charge remains attached to the meter at the improved home, regardless of who occupies the property, until utility cost recovery is complete. This investment model thus enables the utility to offer nearly universal access to capital to its customers, including those customers that are typically disqualified due to high debt-to-income ratios, poor credit, low home equity, or renter status.

TOBF programs based on the Pay As You Save<sup>®</sup> (PAYS<sup>®</sup>) system have been successfully implemented during the past 20 years in nine states by 20 utilities from Hawaii to New Hampshire, including investor-owned, cooperative, and municipal utilities. Utilities and customers have invested more than \$50 million in energy efficiency and renewable

upgrades at more than 5,800 locations.<sup>12</sup> In California, the PAYS<sup>®</sup> system has been deployed through a handful of water districts but has not yet been adopted by any energy utilities.

TOBF offers several benefits compared to existing public grant and private lending programs. TOBF:

- **Expands access to renters and borrowers who might otherwise not have the credit to take out loans for home upgrades.** TOBF is backed by future streams of utility payments, so households can qualify regardless of their credit worthiness, discretionary income, or savings. While many other programs are limited to homeowners, TOBF investments are treated as utility investments; thus, payments are attached to meters, not occupants, so the original participants (whether renters or owners) can move without paying off an outstanding loan.
- **Alleviates the “split incentive problem”** whereby property owners pay up-front for electrification upgrades but tenants enjoy the benefits (Bird and Hernandez 2012). Instead, the investor-owned utility bears the initial cost and then recovers that cost over time through electricity rates. Landlords must permit the utility to install the upgrades and agree to maintain them. However, they benefit from access to low-cost financing for the new appliance and therefore have a financial incentive to participate.
- **Provides an opportunity to deploy significant third-party capital at relatively low cost.** Reported losses for utilities in tariffed on-bill repayment programs have been very low, making TOBF potentially much safer than traditional consumer lending (Lachman and Hummel 2018). This means that utilities may be able to access private capital from financial institutions (banks) and the corporate bond market at a relatively low cost of capital (Mast, Hummel, and Clinton 2020). As Inflation Reduction Act funding becomes available, TOBF will set California up to capture federal investment and enhance TOBF offerings for Californians.

Best practice TOBF programs are characterized by the following features, as described in a recent paper commissioned by the Building Decarbonization Coalition (Mast, Hummel, and Clinton 2020):

- **Open to all customers regardless of income, credit score, or renter status.** In contrast to traditional consumer loans, an TOBF investment is qualified by an assessment of the improvement’s cost effectiveness at a particular site (rather than by an individual’s credit score).
- **Limit to financing proven technologies that have been shown to result in significant energy cost savings.** To ensure cost savings, a site-specific savings analysis should be conducted. Not all upgrades will result in cost savings; for instance, a recent study estimates that existing homes without air conditioning may incur

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<sup>12</sup> See [http://www.eeivt.com/wp-content/uploads/2021/12/2021-PAYS-Status-Update\\_12.30.21rev.pdf](http://www.eeivt.com/wp-content/uploads/2021/12/2021-PAYS-Status-Update_12.30.21rev.pdf)



additional costs of \$200 per year by switching to an HVAC heat pump (Energy and Environmental Economics 2019). In such cases, it may be possible to use TOBF to finance the portion of a project that can be cost effective with bill savings, while the rest is paid for by homeowners, property owners, or — particularly for affordable housing units and low-income households — direct subsidies.

- **Provide cost savings for consumers, but also allow for cost recovery by the utility.** As a best practice, the monthly cost recovery charge to households should be limited to 80 percent of the estimated savings from the upgrades so that the consumer can benefit from the remaining savings. Once the utility's cost recovery is completed, the upgrades belong to the building owner.
- **Apply the tariff terms automatically to successor customers.** The cost recovery charge should be treated the same as the charge for other utility services and be tied to the meter, regardless of who occupies the property. Automatically applying the terms of the tariff to successor customers both enables the utility to recover costs over the life of the upgrades and frees occupants from any debt obligations when they move out of the upgraded home.
- **Provide consumer protections.** These include requirements to notify future occupants of the improvements, associated obligations, and caps on cost recovery to ensure that consumers share in bill savings. Given the ability of TOBF investments — and payments — to transfer from one building occupant to another, consumer protections are a key aspect of a well-designed TOBF program.

## Funding Gap Analysis

An analysis of TOBF was conducted to understand its potential to help finance the cost of LMI building decarbonization, focusing on HVAC heat pumps and heat pump water heaters (HPWH). TOBF is most likely to be an effective financing tool for HVAC heat pumps because this technology has been shown to generate bill savings compared to gas furnaces in most climates and building types in California (Energy and Environmental Economics 2019).

There are approximately 4 million housing units in California that are occupied by LMI households and currently have non-electric heat, including 2.6 million single-family units and 1.4 million multifamily units.<sup>13</sup>

The cost of upgrading to a HVAC heat pump and the resulting bill savings can vary significantly depending on building type, age, and location within the state. Based on an analysis of the distribution of LMI units across California, the average cost (including labor) was assumed to be \$16,500 for single-family homes and \$10,000 for multifamily

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<sup>13</sup> Based on AECOM analysis of ACS 5-Year Estimates – Public Use Microdata Sample. For the purposes of this analysis, LMI housing was defined as units occupied by households earning at or below California's median household income in 2019 (\$75,235).

units. As a conservative approximation, average annual bill savings were estimated at \$300 per unit for single-family and \$100 per unit for multifamily units.<sup>14</sup> Like other appliances, heat pump costs will increase slowly over time with inflation reflecting historic trends, while bill savings escalate more quickly with projected increases in energy costs.<sup>15</sup> However, these increased costs will also be offset by incentives, IRA funding, and tax credits. This is likely to create a declining cost curve over time similar to LED and solar PV markets. In keeping with best practices, TOBF programs are assumed to capture 80 percent of consumer bill savings and to recover costs over ten to 15 years (or approximately 80 percent of a heat pump's 12 to 18-year lifespan). All costs and revenues are discounted to present value.<sup>16</sup>

Based on these assumptions, installing new electric heat pumps in 70 percent of California's LMI units could cost approximately \$32 billion through 2030. TOBF could recover approximately \$6.4 billion of this cost, or enough to finance roughly 20 percent of the total cost of HVAC heat pump upgrades. Note that these estimates are intended to demonstrate the potential contribution of TOBF statewide. For individual units, TOBF could account for a lower or higher share of the total cost.

These estimates suggest that while TOBF is not sufficient to finance LMI building decarbonization on its own, the tool can play a significant role in facilitating the transition. HVAC heat pumps are already generally cost-competitive with gas furnaces, especially after accounting for existing rebates and other incentives available in much of California, and result in consumer savings. While it is not unreasonable for property owners to contribute to the cost, this is frequently not possible for the LMI households that may benefit the most from TOBF. The state and utilities should play a continued role in requiring and subsidizing building electrification, particularly for LMI households, given the substantial environmental and public health benefits. Recommendations for targeting public sector investments are discussed in more detail below.

## Additional Considerations and Next Steps

IOUs and POUs already have the ability under California law to implement TOBF programs with approval from the CPUC in the case of IOUs or their governing board in the case of POUs (Mast, Hummel, and Clinton 2020). These programs are, however, not available to most Californians and the high lifecycle cost of electrification makes them more difficult to implement at scale in California compared to other places. State

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<sup>14</sup> Costs and savings data estimated based on the analysis in Energy and Environmental Economics (2019).

<sup>15</sup> The cost of heat pumps is projected to increase with inflation at an annual average rate of 2.5 percent a year as improvements in technology are assumed to result in improved performance rather than significant decreases in costs. Bill savings are anticipated to increase annually with the cost of energy at a rate of 4 percent a year, based on recent projections for customer rates between 2020 and 2030 for California's three major IOUs (California Public Utilities Commission 2021). This may be conservative, as improved technology (and rate reform) could result in higher bill savings in the future.

<sup>16</sup> Using a 7.5 percent discount rate, reflecting the approximate weighted average cost of capital (WACC) for California's major energy utilities (California Public Utilities Commission 2019).

agencies, local jurisdictions, utilities, and private investors can take the following actions to facilitate the use of TOBF and accelerate the speed and scale of building decarbonization, especially for LMI households:

- 1. Establish new platforms and programs to make TOBF available to more Californians.** The state, local governments, utilities, and private investors should work together to create programs that make TOBF available throughout California. These may be most easily implemented at the level of individual IOUs and POU — similar to the model recently pioneered by the City of Ithaca, New York — given that tariffs are tied to utility bills. However, the state should also explore the feasibility of creating a comprehensive statewide program or platform through which consumers and property owners can easily access all electrification and energy efficiency programs.
- 2. Reduce the upfront costs of electrification with targeted incentives.** TOBF is effective when electric appliances provide lifecycle cost savings compared to gas equivalents. In order to make TOBF more widely applicable, the state should rapidly expand incentives aimed at reducing the upfront cost of purchasing electric appliances so that electric becomes the easier, lower-cost option when a household or landlord faces the need to replace a failing appliance. For expanded incentives to have an impact, they also need to be complementary and stackable. Examples of how this can be achieved include establishing compatible eligibility requirements, contractor requirements, and equipment standards. As it stands, combining multiple incentives on a single project is not a trivial exercise. Local governments could also help reduce upfront costs by streamlining the permitting process for installing new electric appliances and by considering creative solutions such as bulk purchasing of heat pump space and water heaters (Bartholomy 2022). Public sector spending could also be well-targeted towards subsidizing new electrical panels for LMI households.
- 3. Lower the cost of operating electric appliances through electricity rate reform.** Reducing volumetric electricity rates would also help make electric appliances more cost competitive and feasible to finance with on-bill tariffs. California's electricity rates are among the highest in the nation in part because IOUs recover many fixed costs in electricity rates, resulting in rates that are two to three times higher than the marginal cost of providing electricity to consumers. Rate reform is required to lower electricity costs and move California toward a more equitable energy transition (Borenstein, Fowle, and Sallee 2021). Building electrification can also be helpful in aligning energy use with times when the grid has an abundance of low- or zero-carbon resources available. Rates that pair cost to the carbon intensity of the electricity mix will provide the price signals necessary to help all-electric buildings use the lowest carbon content electricity available.
- 4. Authorize the use of public funds to leverage private investments in TOBF.** For example, federal funding, a state bond issuance, green bank, or the Climate Catalyst Fund could help capitalize a reserve fund to mitigate the risk of default by TOBF participants. These sources could also provide utilities with low-cost loans to help pay

for upfront investments in residential energy improvements. An initial round of investment funded by taxpayer money could help prove the concept and attract additional private investment (Mast, Hummel, and Clinton 2020). Public funds can also be used to provide consumer protections, such as bill guarantees that keep the cost of the program affordable for low- and moderate-income consumers.

- 5. Consider additional incentives or requirements to phase out the sale of new fossil-fueled appliances and encourage households and property owners to retire their appliances before they break.** Even with robust incentives and widely available TOBF, the pace of building electrification is likely to be slowed by the fact that many homeowners and landlords wait until their existing appliances fail before replacing them. Ideas for incentivizing the early retirement of gas appliances include direct “cash for clunkers” programs, time-of-sale electrification requirements, building performance standards for multifamily buildings, and neighborhood-scale electrification programs (City of Berkeley 2021). The state and two air districts — BAAQMD and SCAQMD — have all expressed the intention to phase out the sale of new fossil-fueled appliances. These new regulations, when they arrive, could bolster interest in, and the need for, more concerted and meaningful incentives.
- 6. Promote programs and policies geared toward reducing the soft costs associated with building electrification projects.** Programs that aim to streamline building permitting, provide greater education for both building inspectors and plan checkers as well as contractors, and programs that aim to reduce the timeline associated with service panel upgrades could all help to reduce the soft costs associated with building electrification projects.

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