How to Pay for Low- and Moderate-Income Home Energy Retrofits
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Key Findings

- Energy efficiency upgrades can lower household energy costs significantly. However, many low- and moderate-income (LMI) households cannot afford the full cost of upgrades, even with assistance from federal, state, and utility financial incentives.
- To reduce the upfront costs of energy efficiency upgrades for LMI households, program administrators should first enroll eligible households in no- or low-cost weatherization programs.
- Next, program administrators can offer rebates and other financial incentives to facilitate the purchase of energy-efficient equipment.
- When these resources are not enough to cover the full cost, program administrators should explore financing solutions such as low-interest loans from mission-driven lenders or on-bill repayment options. These are better suited to moderate-income households than low-income households.
- Throughout, program administrators should braid and stack funding sources to maximize impact, while ensuring that all financing is paired with strong consumer protections.

Introduction

As part of the broad market transformation to clean energy, utilities are increasing investments in energy efficiency programs available to low-income customers (Morales and Nadel 2022). Additionally, several states have launched federally funded Home Energy Rebate programs to help Americans pay for home energy upgrades and electrification projects.[1] These residential rebate programs are structured so that the highest rebates are available for low-income customers.[2] Although states and utilities are working diligently to scale these programs and distribute more funding, most energy efficiency programs lack the funding and the capacity to provide no-cost services to all income-eligible households. As a result, the upfront costs of home energy upgrades generally remain unaffordable for most low- and moderate-income (LMI) households.

Although frequently grouped together, there are some notable distinctions between low-income and moderate-income customers. Many federal financial assistance programs define “low-income” as 200%

[1] At the time of this writing, the Department of Energy (DOE) is reviewing rebate programs established through the Inflation Reduction Act (IRA). Currently, programs continue to operate in some states while other states await application approval from DOE.

[2] Low-income is defined as at or below 80% of area median income (AMI) for Inflation Reduction Act (IRA) rebates.

or below the federal poverty level (U.S. DOE 2025b).[3] Due to their very limited incomes and low access to credit, such households have great difficulty qualifying for loans. Moderate-income households, on the other hand, fall short of income thresholds for many financial assistance programs. However, their marginally higher incomes and financial health could improve their chances of receiving loans. Figure 1 shows the differences and commonalities between low-income customers and moderate-income customers.

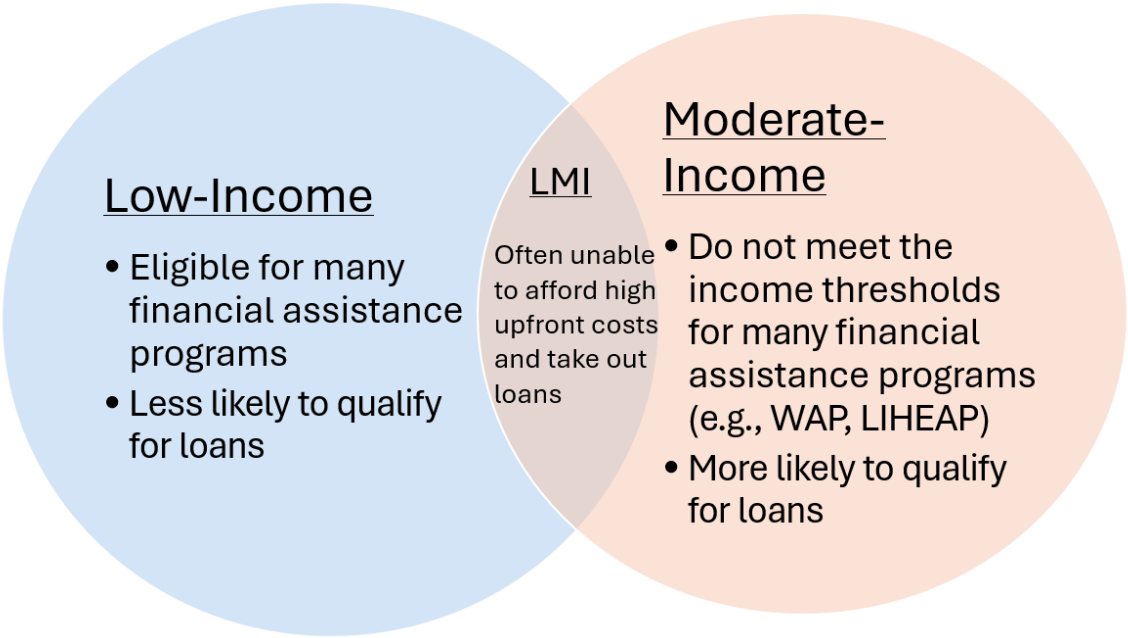

Figure 1. Venn diagram of the differences between low-income customers and moderate-income customers, plus shared traits of low-and-moderate-income (LMI) customers

Generally, both groups lack the cash reserves needed to finance home energy retrofits,[4] and have limited access to credit at reasonable terms or affordable payments like low-cost, sustainable loan options. As a result, LMI households cannot access rebates if they cannot even afford the remaining upfront costs of new energy upgrades (Forrester and Reames 2020). However, retrofits are beneficial for reducing high utility bills which burden many LMI households who live in older, inefficient homes. Thus, households that would most benefit from energy upgrades are often unable to obtain them.

LMI households seeking to improve energy efficiency in their homes must navigate a fragmented and potentially confusing landscape of programs with different offerings and eligibility requirements. In this brief, we propose a pathway for program administrators looking to bridge financing gaps that prevent

[3] The Department of Energy's Weatherization Assistance Program uses this threshold. States can also apply the Low-Income Home Energy Assistance Program's threshold of 60% below area median income. See https://www.energy.gov/scep/wap/how-apply-weatherization-assistance.

[4] We use the term "LMI" to generally refer to households that struggle to afford high upfront costs of energy upgrades. We distinguish between low-income customers and moderate-income customers when speaking of struggles unique to either group. We use the term "retrofit" throughout to describe a general package of energy upgrades. In other instances, we draw attention to specific measures.

LMI customers from receiving home energy upgrades. We note several lending options, and include details on offerings, income eligibility, benefits and risks to LMI customers, and how these options can be scaled up. Doing so increases the opportunities for LMI households to have a fair chance at accessing energy efficiency services and reducing their energy burdens.[5] Our aim is to assist utilities and program administrators who want to better serve LMI households and help them reduce their cost burdens.

The High Cost of Energy Upgrades

The high upfront costs of home energy upgrades are a persistent barrier to LMI households. Energy efficiency programs typically offer higher financial incentives to help LMI households afford upgrades, but rebates usually do not cover the full cost of comprehensive home energy retrofits, which can include envelope, equipment, and electrification measures. For example, households at or below 80% of area median income (AMI) are eligible for a central heat pump rebate up to $8,000 through the federal Home Electrification and Appliances Rebate (HEAR) program (in states where the HEAR program is available) (U.S. DOE 2025a).[6] However, installation costs for whole-home heat pumps can range from $7,180–9,089 at the lower end,[7] and $17,000–23,000 at the higher end[8] (U.S. EIA 2023; Rewiring America 2024). In other words, the maximum HEAR rebate may not fully cover the more expensive end of projects. In Massachusetts, Mass Save offers more generous maximum rebates ranging from $10,000–16,000 for replacing oil, propane, and electric-resistance heating systems with a heat pump (Mass Save 2025b). However, an average heat pump installation in Massachusetts costs about $22,000, highlighting the need for additional financing tools.

Other analysis has shown that Inflation Reduction Act (IRA) rebates do not typically cover full project costs. Specifically, Elevate Energy analyzed potential costs of combined electrification and solar photovoltaic (PV) retrofit packages for single-family homes. Elevate found that project costs before incentives ranged from $38,000–58,000, and concluded that even with all potentially available IRA rebates applied, funding gaps of $6,000–26,000 remain (Klug and Greco 2025). The U.S. Environmental Protection Agency (EPA) provides another retrofit project scenario where IRA rebates could reduce the cost of a $26,000 retrofit project (which includes a heat pump, heat pump water heater, electrical upgrades, and attic/ceiling insulation) to $10,250 (U.S. EPA 2024).

These discrepancies between available rebates and typical project costs are unfolding in an economic context where low-income households have very limited discretionary income available to make these investments. For example, nearly half (47%) of Americans say that monthly expenses are too high for them to save for emergencies, and 37% cannot afford emergency expenses greater than $400 (Empower 2024). In a national survey conducted in 2024, ACEEE concluded that about half of respondents with annual incomes of $50,000 or below were unable or unwilling to invest $1,000 for an energy upgrade (Sussman, Lewallen, and Conrad 2024). As it is, a quarter of low-income households in the United States

[5] Energy burden refers to the percentage of annual income that a household spends on their energy bills.

[6] All states but South Dakota have applied to participate in this program. However, as of this writing only some state programs have been fully approved, and some of the programs that have been approved have not yet begun operations. See here for status as of January 2025: https://climateprogramportal.org/wp-content/uploads/2025/01/A_50121f.pdf.

[7] Values are expressed in 2024 dollars, with original values coming from the Energy Information Administration's (EIA's) *Updated Buildings Sector Appliance and Equipment Costs and Efficiencies* (May 2023).

[8] Estimate is based on a whole-home heat pump for a home of 1,500 to 2,500 square feet. Data are derived from California and Massachusetts sources; the high cost of living in these states may explain the high installation costs. See https://www.rewiringamerica.org/research/home-electrification-cost-estimates.

have energy burdens above 15%, which indicates that a high percentage of their already limited incomes goes toward energy costs (Ayala and Dewey 2024).[9]

To bring energy upgrades to LMI residents, we recommend program administrators follow multiple steps to minimize high costs. First, program administrators should enroll LMI households in no- or low-cost weatherization programs. Next, they should offer rebates and other financial incentives to facilitate the purchase of energy-efficient equipment. If these options cannot sufficiently cover the full costs of upgrades, then program administrators should connect moderate-income households to loans and other financing solutions. Low-income households, however, should primarily be offered solutions that do not generate debt. Although these options can help households afford upgrades, they should come with strong consumer protections to mitigate consequences for vulnerable households. Figure 2 shows the sequence of recommended actions.

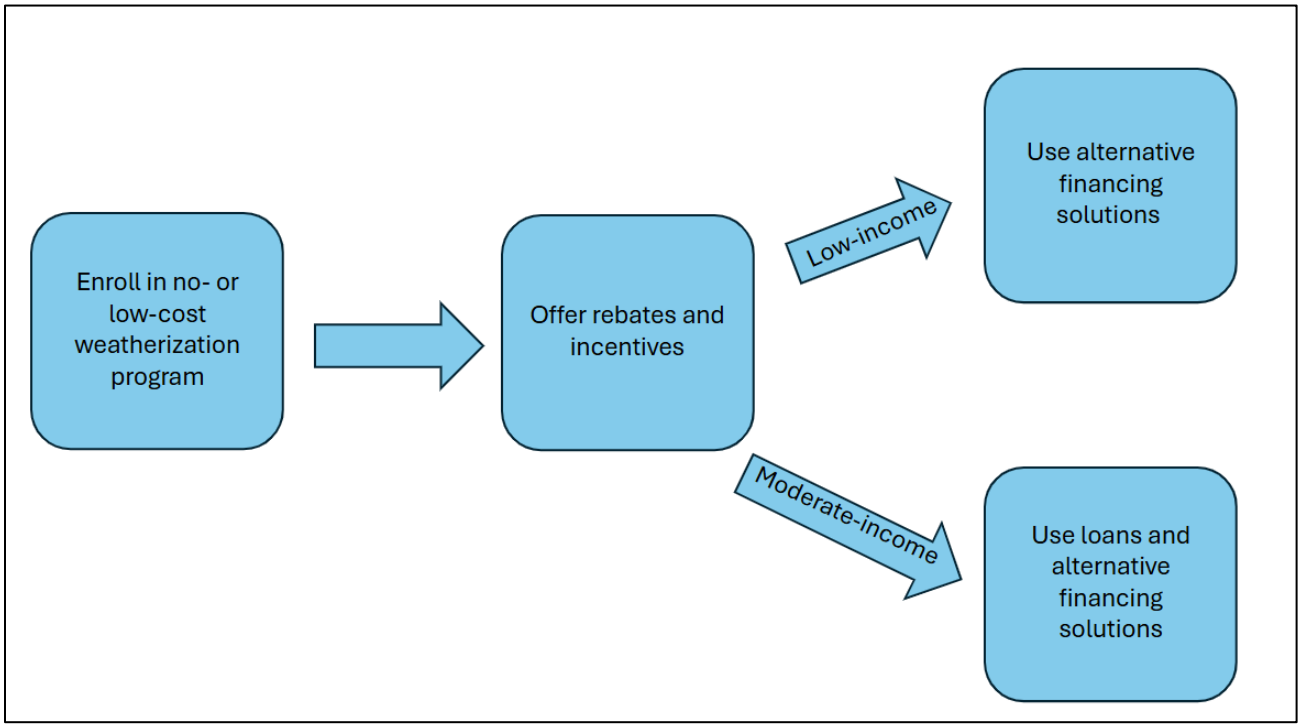

Figure 2. Recommended pathway for program administrators to bring energy upgrades for LMI households

No- or Low-Cost Weatherization

The first option for avoiding a funding gap and delivering energy efficiency benefits to LMI households is offering home retrofits at no cost to the consumer. Such programs allow households to receive services without paying out-of-pocket costs or taking on debt. For example, the Department of Energy's Weatherization Assistance Program (WAP) offers no-cost services (such as insulation and air-sealing) to

[9] Six percent is the threshold for high energy burdens while 10% is the threshold for severe burdens. See ACEEE Policy Brief: "Data Update—City Energy Burdens," 2024 https://www.aceee.org/policy-brief/2024/09/data-update-city-energy-burdens.

households at or below 200% of the federal poverty level.[10] Utilities and program administrators can help low-income households verify their eligibility for WAP and identify weatherization providers. WAP participants benefit from reduced energy costs and improved comfort and safety in the home. Although WAP serves tens of thousands of homes each year, limitations in funding mean the program serves a small percentage of low-income households each year nationally. Thus, there is a great need for additional federal funding to support WAP along with complementary programs run by states and utilities.

Some utilities offer whole home retrofit programs that cover the full cost of projects for LMI customers. These programs can vary widely in their offerings, income eligibility, and structure. Utilities looking to start their own no-cost programs can look to CPS Energy's Casa Verde program in San Antonio as an example to follow (CPS Energy 2025). The Casa Verde program not only provides no-cost services to qualifying customers but specifically targets households whose energy costs exceed 9.9% of annual income, allowing moderate-income customers to participate alongside low-income customers. Eligible customers can receive weatherization, light-emitting diode (LED) lighting, and other services to reduce their energy burdens. Similarly, Efficiency Vermont's Targeted High Use Program provides retrofits for households who make less than 80% of AMI and have electric energy burdens greater than 3% (Wentz et al. 2021). Energy burdens are a notable indicator of how high energy costs and inefficient housing can strain LMI households' resources, so serving heavily burdened customers can ensure that they enjoy immediate benefits of lower energy bills and more comfortable homes.

Households with incomes above income limits for WAP or low-income utility programs may have significant difficulty financing the total costs of retrofits (Forrester and Reames 2020). Although they may be above income limits for free or low-cost services, these households may still experience high housing and energy cost burdens. Thus, utilities and program administrators must make additional investments and refer customers to financial incentives to minimize costs, especially for moderate-income households.

Rebates and Incentives

This section discusses financing options that program administrators can leverage to help LMI households pay for energy retrofits. We recommend that program administrators first use conventional financial incentives like rebates to offset the costs of new equipment. If funding gaps remain after accessing incentives, then program administrators can explore no-to-low-interest loans or, where proper underwriting indicates genuine affordability, newer innovations like on-bill financing programs and green banks. Rebates are preferred to tax credits, as explained below.

Rebates

One partial solution for LMI households is the federal Home Energy Rebates. Although rebates can apply to all households, they are especially beneficial for moderate-income[11] residents who do not qualify for WAP or utility-income-qualified programs. Rebates can support whole-home energy retrofits and electric appliance purchases, decreasing or covering the remaining balance that a household needs to

[10] WAP income eligibility varies by state, with two general pathways: households with annual incomes at or below 200% of federal poverty level, or household at or below 60% of state median income. These levels vary according to household size.

[11] Moderate income is defined as between 80% and 150% of AMI for purposes of the federal rebate programs.

finance a project. Therefore, program administrators should consider this group as they develop programs that offer financing assistance for energy efficiency or electrification projects.

Tax Credits

Tax credits are another important primary mechanism for the federal government (and some states) to support purchase of energy efficiency upgrades and renewable energy systems (solar photovoltaic) (SEIA 2025). Tax credits, however, may not be effective as an incentive for LMI households who may not owe enough income taxes and thus may not be able to benefit from tax credits. Also, the financial benefits of tax credits may be delayed until after purchase and installation and after income taxes are filed, and thus the homeowner needs to front the cash until they get their tax refund many months later, although in many cases purchasers can obtain the tax credit at point of sale. Furthermore, the federal 25C Energy Efficiency Home Improvement credit will be unavailable after 2025, so all homeowners (regardless of income) have limited time to take advantage of this funding source. Although tax credits have broadly supported residential energy efficiency, we do not recommend them as a primary financial incentive for LMI households.

Regardless of which financing tools program administrators choose, they can further offset costs of retrofits through combining different program funds and financial incentives. *Braiding* funding is the practice of simultaneously accessing different individual funding sources and tracking each one separately. *Stacking* funding is a similar practice, but it involves using separate funds in a specific sequence (U.S. DOE 2024). Program administrators need to know each funding source's eligibility requirements and ensure that the target households meet such requirements (R2E2 2025). The most common eligibility requirement is an income threshold, often expressed as a percentage of AMI or as a percentage of the federal poverty level. For example, WAP is typically open to households with incomes at or below 200% of the federal poverty level. Meanwhile, the highest IRA rebates are open to households who make 80% or below AMI, and some rebates are only available to households who make below 150% of AMI. Some households may qualify for both WAP and the IRA rebates. Program administrators can help such households enroll in WAP, complementing services with a federal rebate to support further energy upgrades.

Programs that combine separate sources of funds and optimize energy savings on behalf of low-income customers are particularly helpful. For example, the Massachusetts Low-Income Energy Action Network (LEAN) program is a long-standing example of a statewide program that provides coordination between WAP providers and utility programs so low-income customers can get the most benefit from available services and rebates and reduce energy costs (Mass LEAN 2025b).

Loans, Financing, and Repayment Plans

Banks can offer loans to homeowners to pay upfront costs of energy upgrades—to be repaid with interest monthly. However, households' likelihood to be approved for loans varies by income—as income decreases, likelihood of approval decreases as well. Lower incomes are correlated with lower credit scores as well as a lower likelihood of having a credit history, owning a home, and knowing how to improve credit scores or build credit (Beer, Ionescu, and Li 2018; Brevoort, Grimm, and Kambara 2016; Goodman, Tozer, and Zhu 2025; Consumer Federation of America 2020). Moreover, loans with lower credit requirements tend to have higher interest rates and, thus, cost consumers more. This is particularly problematic for low-income households, given they are more at risk of incurring "problem debt" than others with higher incomes (i.e., having a high debt-to-income ratio and falling behind on

payments) (Consumer Federation of America 2020). Indeed, low-income households should take on additional debt or repayment obligations only as a last resort. No-cost weatherization programs and stacked/combined rebates that bring upgrade costs to zero should take precedence for this group. They should not be displaced in favor of programs that require repayment for upgrades.

Some moderate-income households may be candidates for loans or financing. After taking advantage of low- or no-cost programs and all available rebates and incentives, loans may be the best solution for any remaining gap between rebates and actual installed costs for this group. Broadly speaking, three interconnected issues define the problem: Households with lower incomes are less likely to qualify for loans, they are less likely to receive favorable or affordable loan terms, and they are more likely to need strong consumer protections. As a result, households with lower incomes are also more reluctant to take on loans than those with higher incomes (Deason, Leventis, and Murphy 2022). Thus, loans and financing for this group should generally be provided by mission-driven lenders with the goal of helping this particular consumer segment.

LMI Loans with Low or No Interest

Although vulnerable households are not advised to take on additional debt, it could be an option for some, especially if the loan is from a reliable community development lender with experience making sustainable loans for these circumstances. An effective loan or financing program for moderate-income households is most beneficial if it has flexible eligibility for borrowers with lower credit scores and a low interest rate. Loans are governed by the Truth in Lending Act (TiLA) and come with critical consumer protections that are particularly important for this consumer segment. Given proper underwriting, these protections include the right of recission, the right to clear disclosure of loan/payment terms, and protections against predatory lending, among others. Notably, a consumer receiving a bank loan cannot be disconnected from their utility for nonpayment.

Mass Save provides a strong example of a two-part strategy for helping LMI households upgrade their homes. Income-qualified (low-income) households are eligible for no-cost upgrades through the LEAN program that braids and stacks benefits from weatherization and rebate programs to allow homes to upgrade without requiring additional financing (Mass LEAN 2025a). Moderate-income customers (just outside the threshold for low-income benefits) who are approved for a loan can get additional gap funding through a no-interest loan from the HEAT loan program. This program offers loans with 0% interest rates for energy upgrades costing up to $25,000 (Mass Save 2025a). They have very low default rates (less than 0.75% for HEAT loans) (Avers 2014). No-interest loans with no upfront costs can be effective for encouraging adoption of comprehensive energy upgrades (Sussman, Lewallen, and Conrad 2024).

When zero interest loans are not available or cannot be approved for some customers, program administrators can consider unsecured installment loan products offerings. The Solar and Energy Loan Fund (SELF), the green bank Michigan Saves, New York State Energy Research and Development Authority (NYSERDA) Green NY loans, and Maryland Department of Housing and Community Development's BESmart Loan are good examples of these products, each with low default rates (Andrade 2019; Deason, Leventis, and Murphy 2022).[12] Some of these products offer below-market

[12] For example, SELF had a default rate of 1% between 2014 and 2018, with 70% of loans going to LMI homeowners (https://solarenergyloanfund.org/site/wp-content/uploads/2019/11/SELF-Q1-2019-Impact-Report.pdf). A study of four green loan programs, including NYSERDA and Michigan Saves found combined 30-day delinquency rates of 1.57% (https://emp.lbl.gov/news/new-research-shows-energy-efficiency).

interest rates (which lenders and their partners facilitate through interest rate buydowns). NYSERDA's Smart Energy Loan offers a 4.5% rate with a monthly billing program, or 4.0% rate if a customer uses the autopay option (NYSERDA 2025). The Eco-Financing option from Enervee enables customers to access micro loans (up to $5,000) to purchase energy efficiency products and appliances from utilities in California or New York with a 9.99% APR (Enervee 2025).

Each of these products requires a loan application, with some requiring the applicant to be a homeowner. Nevertheless, with the possible exception of Mass Save,[13] they have a relatively low minimum credit score requirement (540 to 640) and allow a reasonably high debt-to-income ratio allowance (40% or 50%). The SELF loan application does not include a credit check.

Effective LMI lending programs for energy upgrades are made possible by credit-enhanced lending, a practice in which governments provide funding to encourage private lenders to offer attractive loans to select markets (U.S. EPA 2025). These funds mitigate risk to lenders by either providing a loan loss reserve, payback to lenders for a percentage of non-repaid loans (e.g., 10% of a total loan portfolio), or interest buy-down, making an upfront payment to the lender to give the borrower a lower interest rate. The program can be administered by the state or local government agency, or the private lender. Program administrators can pay for credit-enhanced lending through a mix of public funds (e.g., revolving loan funds or stimulus money), bonds, ratepayer funds, private lenders, or utility programs (NASEO 2017).

Low- or no-interest energy efficiency loans for LMI customers are helpful but generally serve moderate-income homeowners more effectively than low-income homeowners and renters. Moreover, mission-driven lenders cannot serve all of these customers (Carrillo et al. 2025).[14]

On-Bill Programs

On-bill programs refer to financing models in which the customer repays the costs of energy upgrades through an additional charge on their utility bill. The charge appears as a line item alongside other riders and fixed charges. This reduces risk of non-payment because customers tend to put a high priority on paying their utility bill and are unlikely to default (Zimring et al. 2014).

One class of on-bill programs involves either a utility or a third-party lending money to customers for energy efficiency upgrades (ACEEE 2017).[15] These are functionally similar to any other loan, except that the repayment mechanism is the utility bill. The individual who takes on the loan must be repay it even if they move away from a property they upgraded. On-bill programs involve an underwriting process and all the traditional consumer protections afforded to loan recipients. Although there is no guarantee of

[13] Loans are provided by a large number of independent credit providers, each with their own application form. This product may not always be available to those with poor credit scores or high debt-to-income ratios. It is only open to homeowners.

[14] For example, in a panel at the 2025 California Energy Commission Electrification Summit, Bert Hunter, long-serving chief investment officer at the Connecticut Green Bank (the oldest green bank in the United States), notes that because loans cannot reach everyone in the target market, "I'm convinced that [PAYS] is the way to go. That's what we've learned" (at 2:47:54 mark) https://energy.zoom.us/rec/play/VTzsE_gFOrKKMRC4xkWP6ItORB7168JXlp1np7jS3UFQ5D8PjbqLwKd6UtoOxm0wo_eSpie-kdjplh9_.st1x-EDn5D7EZmSw.

[15] Historically, on-bill repayment plans have been called "on-bill loans" in which the utility lends money for upgrades (sometimes called "on-bill financing"), "on-bill repayment" in which a third party lends money for upgrades, or "tariffed on bill financing" in which energy upgrades are made part of the energy bill and paid for as though they were an energy service.

cost savings from energy upgrades, these loans can have favorable terms and be geared toward moderate-income homeowners.

Tariffed On-Bill Financing

A second class of on-bill payment mechanism is tariffed on-bill (TOB, also known as inclusive utility investment). In this case, a utility makes a direct investment in a customer's home and the customer pays a monthly service charge until the utility's costs are recovered. Although regulators to date have ruled that these are not loans, the National Consumer Law Center (NCLC) and other groups have challenged this ruling and thus, this definition could change (Cohen and Wein 2024).[16] Regardless, TOB programs can pose significant risks to consumers if they are not accompanied by strong consumer protection measures.[17]

In a TOB model, the homeowner signs an agreement with the utility to pay for the cost of new upgrades through an additional service charge on their utility bill. However, the annual charge is modeled to be less than the predicted financial savings from the energy upgrades. The utility (or other low-cost capital provider such as government or non-profit financer) covers the upfront cost with their own capital, and the utility owns the equipment and is responsible for maintaining it during the payment period. If a resident leaves the home (e.g., a lease expires) then the next resident assumes the tariff as part of their bill. In a favorable scenario, the household thus saves money on their energy bill despite the additional tariff. The energy upgrades become part of the bill and, although there is always a risk that households fail to pay their energy bill, the risk should not be increased by the presence of the tariff.[18] However, energy savings may be smaller than predicted, and, thus, important program design elements and strong consumer protection measures should be included.

Advantages of TOB

If savings exceed the tariff and consumers save money while paying for energy upgrades, a TOB program can have a few advantages: A credit check and loan application is not required (instead utility bill-payment history is often used), there is no need to disclose income, it serves both renters and owners (helping address the split incentive problem), it is designed such that maintenance of upgrades is paid by the utility, and it could provide an alternative upgrade option when a local mission-driven lender or free program is not available.

Although no-cost upgrades are strongly preferred for LMI households over repayment-based programs and loans, many no-cost provision programs are oversubscribed. While administrators of no-cost programs work to increase their capacity, TOB options could be a promising alternative for households in urgent need of upgrading. Consumer advocates, such as NCLC, prefer mission-driven lenders,

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[16] NCLC explains their preference for loans in their letter to the Consumer Financial Protection Bureau. https://www.nclc.org/wp-content/uploads/2024/09/Final-letter-on-TOB.09092024-Alys-Cohen.pdf.

[17] If deemed a loan, these would be regulated by TiLA and would likely require a more thorough underwriting process (likely including a credit check), which could pose a barrier to upgrading. However, with this regulation and oversight recipients would be afforded the consumer protections associated with loans and thus TOB would be a potentially safer product. Other groups, such as Clean Energy Works, argue that guidelines already exist to make TOB products sufficiently safe, without having to be regulated by TiLA.

[18] Traditional energy assistance programs such as the Low-Income Home Energy Assistance Program (LIHEAP) would continue to assist customers who have trouble paying their bills, including customers participating in a TOB program.

especially for moderate-income households (Cohen and Wein 2024), but they are not available in all regions.

The program does not require a credit check, although some programs still use the ability to pay the utility bill as a check. A credit check or loan application can be a barrier for upgrading because lower incomes are associated with poorer credit, and some customers may prefer not to disclose their low-income status for personal reasons (this may also limit their ability to participate in free low-income programs).

The ability to serve both renters and owners also differentiates this program from others. Most programs disincentivize participation from rental housing because of the split incentive problem (i.e., the cost of the upgrades is borne by the landlord, but the financial benefits are often reaped by the tenants who save on their utility bills). Since the cost of the upgrades is paid on the utility bill, the tenants pay for the investment over time, while also seeing reduced energy bills. When a tenant leaves the unit, the next tenant paying the utility bill will continue paying for the upgrades until the utility's costs are recovered. With other financing options, even if a renter decided to get a loan and pay for upgrades, they could not guarantee staying in the residence long enough to repay it. Notably, however, tenants need a landlord's permission before initially entering into a TOB agreement.

Energy upgrades are owned and maintained by the utility during the payment period. As such, utilities are responsible for paying for maintenance and replacement of the upgrades. Moreover, well-designed TOB programs include a provision that tariff payment must be stopped if the upgrade fails. The mechanism by which maintenance is provided, and tariff payments are stopped should be clearly delineated in a TOB agreement, and a clear and simple dispute process should be put in place to protect consumers.

These are all potential advantages of TOB programs. The program can be useful under the right circumstances. However, challenges exist to achieving the benefits.

Potential Risks of TOB

TOB could be problematic for customers if savings do not outpace tariffs or if high copays are required to reduce tariffs. As shown in Appendix A, these challenges are a concern for programs lacking key elements (e.g., sufficient savings estimate buffer). Critics also note that contractors may push customers into upgrades they cannot afford, and savings estimates may not apply to new residents. These obstacles are discussed below, along with suggested remedies.

Tariffs are equal each month, but savings fluctuate depending on the season. Thus, even if annual energy savings exceed annual tariffs, customers will still see increased energy bills in some months (alongside lower bills in other months). Ensuring that the tariffs are smaller than the savings is vital to the success of TOB programs for LMI customers. Guaranteeing savings is not always possible because changes in behavior, weather, and energy costs are not completely predictable. That said, analytical tools are being developed to determine reasons for energy bill increases (Goldman, Theurer, and Bickel 2022). Although they have not yet been tested in TOB contexts, these new tools could be used to learn if energy bills would have gone up anyway, or if the energy modeling or upgrades' performance were predicted incorrectly. If the tariff increased the energy bill due to incorrect energy modeling or equipment failure (or if bills go up before an assessment of the reason can be performed), then steps should be taken by the utility to reduce the tariff and repair the upgrades. A loan-loss reserve could be used to offset these costs.

Nevertheless, some critics note that if energy bills go up, it is difficult to determine the reason, and it could lead to nonpayment and disconnection.[19] Strong energy modeling, a large buffer between savings and costs, and regular true-ups to ensure tariffs do not exceed savings (along with a contingency fund to pay for tariff reductions as needed) can help ensure bills do not increase because of the tariff and, thus, help protect customers. Indeed, some residential upgrade providers can use this type of contingency planning to go as far as guaranteeing savings for qualifying homes (Sealed 2025).

Some programs are allowed to incentivize contractors to promote TOB,[20] and this has the potential to encourage them to nudge homeowners into plans where tariffs exceed savings and bills go up (NCLC 2023). It could also encourage them to suggest loans to homeowners to cover copays. Contractors nudging homeowners into energy upgrades they could not afford is a key failure point for the residential property assessed clean energy program (R-PACE) (NCLC 2020).[21] Therefore, calculations of costs, savings, and copays should be conducted by program officers (or another party whose primary responsibility is to the consumer) rather than contractors. Further, contractors should be incentivized (or required) to direct customers to no-cost upgrades and weatherization programs when available. In general, although safeguards can be put in place to ensure TOB investments do not increase energy bills, these programs should not be marketed or pitched to customers as guaranteeing specific savings margins, given modeled savings may fall short of predicted savings even if bills do not increase (Opinion Dynamics 2023).[22]

A new resident in a TOB home may not save money like previous residents did. A new resident's energy use patterns may differ from the previous resident's (e.g., they may be a smaller household) and thus the modeled savings may no longer be accurate. To remedy this, a true-up of modeled savings should be performed for new residents and tariffs should be decreased if appropriate.

Implementing TOB with Consumer Protections

TOB can serve an essential role in the marketplace, but consumer protections are necessary. Several attempts have been made to codify critical consumer protections for TOB programs. Pay as You Save (PAYS®) is a common TOB model and is a registered trademark of the Energy Efficiency Institute (EEI) (EEI 2021).[23] EEI stipulates that PAYS® programs must include multiple consumer protections. EPA has

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[19] NCLC suggests that TOB is a form of loan and, as such, customers should be afforded protections for an inability to repay. Their proposed solution is to allow customers to pay just the energy portion of their bill without paying the tariff and thus avoid shutoff if they cannot repay their upgrades. However, separating line items on a utility bill and allowing payment for one part is technically difficult to implement.

[20] For example, NCLC points out that the Illinois Climate and Equitable Jobs Act provides for the possibility of shareholder incentives for promoting a TOB program.

[21] R-PACE is a tool that is similar to TOB, but it is a voluntary lien repaid through the property tax bill rather than a charge added to the utility bill. A major failure point of PACE programs in the past has been that they did not explicitly require that the monthly savings from energy upgrades outpace the monthly costs. Homeowners in California have been defrauded and duped by contractors into getting energy upgrades with no upfront costs only to find that they later can no longer afford their property taxes.

[22] For example, NCLC calculated realized savings from a program evaluation of one TOB program and found that although they were projected to be 20%, they were in fact closer to 8%. (Opinion Dynamics. 2023. "Ameren Missouri Program Year 2022 Annual EM&V Report Volume 2: Residential Portfolio Report." https://www.efis.psc.mo.gov/Document/Display/17592, Calculated from table 33, pp. 39–40).

[23] The PAYS program requirements are described on their website: www.eeivt.com/pays-essential-elements-minimum-program-requirements-2/.

created a non-trademarked set of requirements and best practices for TOB programs (called Inclusive Utility Investment) that are similar to PAYS but go slightly further (Deason, Murphy, and Leventis 2024).[24] We highlight several key protections and additional solutions below (ENERGY STAR 2025b):

- Programs should include at least a 20–25% buffer between modeled savings and tariffs.
- Programs should use industry-standard energy modeling practices that accurately estimate savings.
- After a year of payments, programs should do a true-up assessment to ensure that energy upgrades are saving more money than they cost. A similar procedure should be done for new residents at a TOB home. A loan-loss reserve fund should be set up to pay for tariff reductions when modeled savings are not achieved.
- Utilities should provide a clear and simple mechanism for customers to receive no-cost maintenance and repair of energy upgrades during the payment period, as well as a system for stopping tariff payments while upgrades are not operating correctly. Similarly, a dispute resolution process for customers is important.
- If tariffs outpace savings and thus customers cannot afford their energy bills, disconnection of service should not be allowed.[25]
- Contractors should be incentivized or required to channel customers toward no-cost programs and rebates before offering TOB. They should be explicitly instructed not to tell households that they will save a specific amount of energy under the TOB plan, and they should not encourage paying copays with additional loans.
- Copays should be reduced or eliminated through rebates and additional funding provided by low-cost sources such as utility funds, state programs, or other local lenders. Notably, the HOMES rebate (part of the IRA, which is currently only available in a few states), would cover roughly the amount needed for many copays (ENERGY STAR 2025a; Deason, Murphy, and Leventis 2024).[26]

High-Interest Loans

Energy upgrades can also be paid for through more traditional financial lending mechanisms, such as a Home Equity Line of Credit (HELOC; often available only to homeowners with good credit), credit cards, or payday loans. HELOC is less likely to be available to LMI households, and credit cards and payday loans are not recommended because of high interest rates. Mission-driven lenders, including credit unions, green banks, and Community Development Financial Institutions (CDFIs) can often provide loans with favorable terms and good consumer protections.

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[24] Notably, EEI allows programs to be called PAYS if they met the standard at the time the program was created. One program that was central to a report by Lawrence Berkeley National Laboratory (LBNL) was labeled PAYS because it conformed to an older version of the program, but it does not have newer requirements, such as a 20% of costs to savings. See https://emp.lbl.gov/publications/participant-outcomes-residential-pay.

[25] Analytical tools that differentiate between increased load and incorrect energy modeling should be used.

[26] HOMES can provide up to up to $2,000 for projects reducing energy consumption by 20–35% (https://www.energystar.gov/partner-resources/web_linking_policy/homes-program). Average savings of PAYS home upgrade projects fall within the required range, and this amount is more than enough to cover most project copays. See https://emp.lbl.gov/publications/participant-outcomes-residential-pay.

Consumer protections are critical for LMI (and especially low-income) consumers. Predatory lending practices often target individuals with lower incomes (Carr and Kolluri 2001). When it comes to energy upgrades or other home purchases, customers should be particularly wary of "buy now, pay later" credit providers. Contractors could offer these options when proposing upgrades and allow work to be completed immediately, but typically once a payment window has expired, creditors can demand high interest rates. NCLC notes that interest rates and clear disclosure of terms are now required by law for these products, but nevertheless buyers need to be cautious in using these programs (NCLC 2024).

Conclusions and Recommendations

Although privately and publicly funded programs for LMI customers have increased, program administrators must still find ways to close the gaps between high upfront costs for customers and available rebate amounts. It is especially important for program administrators to provide upgrades while minimizing expenses for these households, as high costs remain a persistent barrier for LMI households.

Paying for LMI home energy retrofits should follow this order: a robust no-cost energy upgrade (weatherization) offering, substantial rebates for LMI households that reduce upfront costs, and mission-driven lending or a TOB investment program that covers remaining costs.

The most impactful strategy for serving LMI households is scaling up residential energy efficiency programs that provide upgrades at no cost to the consumer. In the absence of such programs, ACEEE recommends program administrators provide substantial rebates or incentives for LMI households to upgrade their homes. In doing so, they should also help those customers navigate the complex eligibility requirements of multiple funding sources and combining funds. Braiding and stacking funding sources are good approaches to minimizing the total unpaid balances for energy efficiency projects or upgrades.

These traditional incentives often cannot fully finance upgrades for LMI households. Therefore, we recommend that utilities and their program administrators refer customers to energy-specific loan products from mission-driven lenders. LMI households should generally avoid taking on additional debt, but a lending program with low credit requirements and low interest rates could be effective, particularly for moderate-income homeowners. Program administrators can turn to credit unions, green banks, and CDFIs to provide such loans. We do not recommend that LMI households use high-interest short-term loans such as credit cards or payday loans to pay for energy upgrades. Any loan program must come with robust consumer protections to shield LMI customers from predatory lending practices.

Another strategy is to offer a well-designed TOB-program that saves money while protecting consumers. These programs address the split incentive problem, generally do not require credit checks, and take into account costs and savings to households (thus, they are more likely to be affordable to households without much disposable income). Moreover, while the energy upgrades are being paid over time through monthly service charges, the utility pays for equipment repairs and maintenance. It should be noted that modeled savings may not reflect actual savings, so TOB programs must ensure that customers do not get disconnected from service if tariffs outpace actual savings (because of inadequate energy modeling or underperforming upgrades). Despite the benefits of TOB, program administrators should only explore TOB or low-interest loans if no-cost programs and rebates are not enough to fully support retrofits.

From a public policy standpoint, questions of how to effectively scale residential retrofit activity remain. EPA estimates about 39.5 million households face challenges with paying high energy bills due to living in older, inefficient housing (U.S. EPA 2024). The traditional tools of no-cost programs and rebates are a good first step for reaching LMI households, but significantly more resources and better coordinated efforts are needed to reach underserved customers and finance home energy upgrades at the necessary scale.

Helpful Resources

- Fannie Mae offers a mobile-friendly Home Improvement Program Finder tool with reliable and regularly updated information about publicly funded (WAP and LIHEAP) and utility-sponsored programs potentially available to LMI households. No personally identifiable information is needed to search programs: https://yourhome.fanniemae.com/calculators-tools/energy-savings-program-finder.
- EPA provides a good resource on hiring an HVAC contractor here: https://www.energystar.gov/saveathome/heating-cooling/10-tips-hiring.
- The Database of State Incentives for Renewables & Efficiency® (DSIRE) provides a state-by-state breakdown of financial incentives for renewable energy and energy efficiency projects: https://www.dsireusa.org/.
- The Better Buildings Financing Navigator contains guides for financing energy efficiency in multiple sectors: https://betterbuildingssolutioncenter.energy.gov/financing-navigator/resources.
- Rewiring America—Home Electrification Calculator https://homes.rewiringamerica.org/calculator.

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Appendix A: TOB Program Study

A landmark study by Deason, Murphy, and Leventis (2024) reviewed five TOB programs; it concluded that such programs may not always save enough money to offset costs despite saving significant energy. Researchers found that participating households reduced their gas and electricity consumption by an average of 15% and 26%, respectively, but about half of the participating households were unable to cover their total monthly tariffed charges through utility savings. This was primarily because this program used a buffer between estimated savings and costs that was too small to account for variations in energy prices and energy consumption patterns (10% buffer). Energy models for that program were also not constructed by industry-standard modeling software and utility prices may have been overestimated. Properly calibrating energy models can greatly improve their predictiveness (Amann 2015). The authors of the study recommend savings buffers of at least 20–25%.

The study also acknowledged that TOB programs do not always eliminate upfront charges. If projected savings for a given upgrade are not expected to pay for themselves with monthly savings over the lifetime of the measure, then providers can suggest an upfront copay. Among the surveyed households, copays varied dramatically in frequency (15% to 75%) and amount ($1,700 to $2,700), often correlating to whether heating, ventilation, and air conditioning (HVAC) equipment was included and whether additional incentives (like rebates) were available. Copays reduce the total financed project cost so that the remaining costs, reflected in the monthly service charge, are below modeled savings annually, thus allowing these homes to qualify for the program. Copay requirements could remove TOB as an option for households that cannot afford them. Alternatively, it may lead to a project being scoped down and the household not receiving all the upgrades it could benefit from.