Affordability Benefits of Inclusive Utility Investment Paired With Bill Assistance

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ABSTRACT

Factors that affect affordability operate at both the system and the household level, requiring interventions to both lower the price of energy and provide pathways for households to seek energy-saving upgrades. As narratives today converge on system-level responses to rising utility rates that affect all households, acute and chronic affordability concerns for energy burdened households risk slipping from view. Approaches that combine bill assistance with home energy upgrades offer one way to close that gap. This paper examines one such strategy: pairing bill discounts with inclusive utility investments, which capitalizes money-saving home energy upgrades through the utility's cost-recovery authority.

We explore the customer and ratepayer impacts of inclusive utility investments when combined with two forms of energy bill assistance: percentage-of-income payment plans (PIPP) and low-income discount rates (LIDRs). Using a defined household profile in Missouri, we simulate the costs and savings of three upgrade packages, each layered with one of the two assistance mechanisms. We find that the integrated strategy can extend access to valuable energy efficiency upgrades while expanding the number of housing units that can be reached with ratepayer assistance. The results show when and how this layering improves outcomes for participating customers, and what it implies for delivering energy affordability at scale with these and other types of upgrades. We conclude by situating these findings within emerging utility and state initiatives, demonstrating the complementarity of inclusive utility investment as part of a broader portfolio of energy affordability solutions.

Introduction

Utilities are entering a period of capital deployment without recent precedent. Over the next five years, the industry is projected to invest roughly $1.4 trillion in grid infrastructure, double its spending in the previous decade combined (Utility Dive 2025). The costs to upgrade aging infrastructure while navigating high fuel prices alongside unprecedented energy demand are being passed onto customers, with residential electricity rates increasing nearly 40% since 2021 (PowerLines 2026). Gas utilities are on a similar trajectory, ramping up spending on distribution infrastructure and pipeline replacement. In 2025, the consumer price index for utility (piped) gas service rose over 10 percent — roughly 60 percent faster than electricity prices (BLS 2026). With the pace of investment outrunning the policy responses meant to contain its costs, energy affordability has become a moving target.

The strain on household budgets is already evident. The latest survey data from the U.S. Energy Information Administration (EIA) shows that one in three households experiences some form of energy insecurity, a 22% increase over 2020 (EIA 2026). Arrearages are climbing as well, particularly among customers already behind on their bills: between the start of 2024 and mid-2025, total household utility arrearages rose roughly 30%, from approximately $17.5 billion to $23 billion (NEADA 2025). For a growing share of customers, basic utility service has become a source of chronic financial burden and instability.

With already limited federal energy assistance funding under political threat, states are left to balance longer-term affordability solutions like free or subsidized home energy upgrades for a small percentage of the population per year against demands for immediate relief for everyone in the rate base (Yoder 2026). Utility efficiency spending has historically relied on rebates and customer incentives whose benefits are unevenly distributed, with low-income households receiving a disproportionately small share of residential program investment (Reames, Stacey, and Zimmerman 2019). Better deployment also pays off at the system level: improved utilization of existing investments can offset the expensive grid investments that are driving rate increases (Martucci 2026). No single instrument can close the affordability gap, but the most direct way to ensure investments benefit people is through home energy upgrades, and in turn, those upgrades can improve grid utilization factors and produce system-level benefits for all ratepayers. Affordability, in short, must be addressed at both the system and the household level: lowering the cost of energy while opening pathways for households to either reduce or increase their capacity to store or generate power.

Against this backdrop, this paper explores the role of inclusive utility investment as a financial solution that complements existing bill assistance and energy efficiency programs as well as new initiatives to expand demand flexibility and distributed generation and storage. Inclusive utility investment allows a utility to pay for site-specific upgrades and recover its costs through a monthly participant service charge that is less than the estimated bill savings from the upgrades (EPA 2021). Under the terms of a tariff approved by utility regulators, these site-specific investments are part of the utility's service at the location, applying to whomever is taking service at the site and benefitting from the upgrades until the utility's costs are recovered. Authorized investment potential at a site is based on the estimated savings of the upgrades, so eligibility does not depend on household income or credit score. This design makes inclusive utility investment particularly well suited to augment existing rebates, incentives, and program offerings; little work, however, has explored its intersection with energy bill assistance. We examine how inclusive utility investment performs when paired with energy assistance, asking where the two reinforce one another and where tradeoffs lie.

Inclusive Utility Investments

Inclusive utility investment, also known as tariffed on-bill investment, bridges the gap between the upfront cost of money-saving upgrades and the capital to pay for them, without requiring households to own their home, take on debt, or pass a credit check. A utility invests capital in upgrades at a customer's site and recovers its costs through a fixed monthly charge on the bill that is less than the estimated savings from the upgrades. In practice, utilities cap the charge at a set share of the estimated bill savings from the upgrades (typically 80%, though some programs, including Midwest Energy and Duke Energy, have used 90%) (Figure 1). Dollars invested through inclusive utility investment are utility capital or treated as regulatory assets until the utility's costs are recovered. This lets utilities deploy efficiency and other types of upgrades like flex capacity as a grid asset, accounting for the full local value an upgrade provides. EPA recognizes inclusive utility investment as a proven financial model grounded in three core tenets:

- No customer debt, no credit check. A site-specific utility tariff defines the terms of this utility service, including the cost recovery schedule. The charge applies to the meter at the site rather than the occupant, which lets renters participate without owning the home; the property owner must still authorize the upgrades.
- Site-specific savings estimates. Eligibility is grounded in building-level energy modeling to ensure estimated savings are based upon actual conditions at the property.
- Positive cash flow. The tariff requires that annual cost recovery charges (also referred to as the service charge) are lower than estimated energy cost savings, with multiple consumer protections to help ensure customers see net savings.

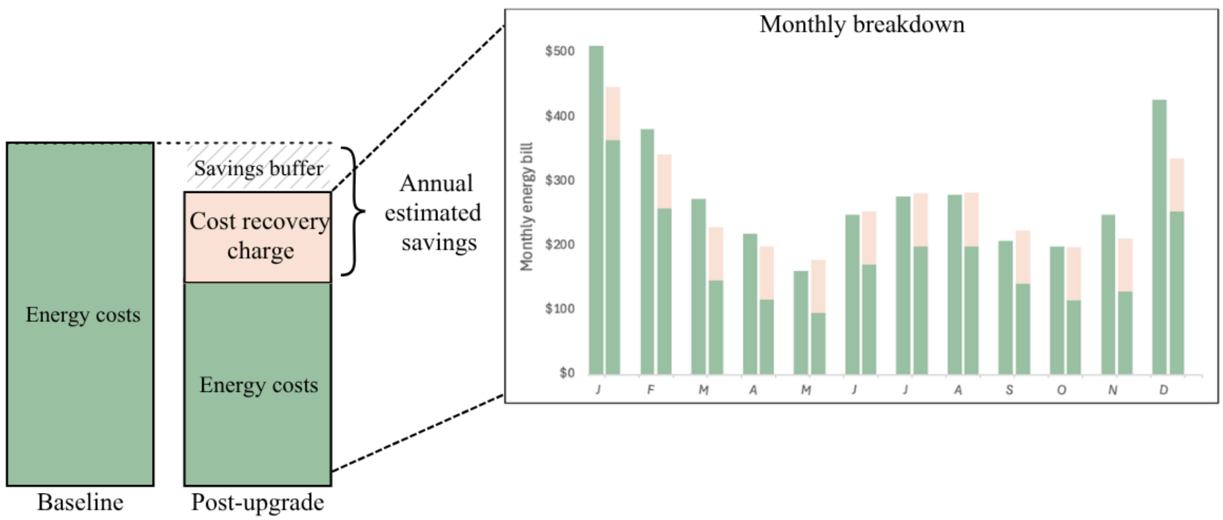

Figure 1. Illustrative billing mechanics of inclusive utility investment service charge. *Source*: Authors' illustration.

Rural electric cooperatives have led inclusive utility investment adoption through the Pay As You Save® (PAYS®) system, with examples generating consistent, measurable results:[1,2]

- Midwest Energy (Kansas) — How$mart: $19.2 million invested across 2,400-plus customers as of 2021 (Ferguson et al. 2022), with average reductions of 15% in electricity use and 26% in gas use (Deason, Murphy, and Leventis 2024).
- Ouachita Electric Cooperative Corporation (Arkansas) — HELP PAYS®: Over $3.4 million invested across nearly 400 homes, one factor in a 4.5% rate decrease by the utility (Ferguson et al. 2022).

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[1] In 1999 the Energy Efficiency Institute, Inc (EEI) created the first example of inclusive utility investment under the trademark Pay as You Save® (PAYS®). EEI has not charged royalties for use of the trademark but rather has sought to ensure programs satisfy minimum consumer protections and operational features.

[2] For details of past programs, please see: Hummel and Lachman (2018); Ferguson et al. (2022); and Deason, Murphy, and Leventis (2024).

- Roanoke Cooperative (North Carolina) — Upgrade to $ave: 465 member-owners served in its first year on a $6 million USDA Rural Utilities Service loan (Ferguson et al. 2022).

Adoption among investor-owned utilities is expanding, with offerings approved at three investor-owned utilities in Missouri, Duke Energy in North Carolina, and Evergy in Kansas. In addition, tariffs are under regulatory development in Illinois and California.[3] Ameren Missouri launched a $15 million PAYS program in 2021 for single-family residences, with regulators approving the investment to carry the same earnings potential as any other utility capital investment. Missouri requires PAYS of its investor-owned utilities through their Missouri Energy Efficiency Investment Act (MEEIA) filings, and Illinois's Climate and Equitable Jobs Act (CEJA) directs its electric investor-owned utilities statewide to offer inclusive utility investment. Massachusetts Governor Healey's proposed 2025 Energy Affordability, Independence, and Innovation Act would direct investor-owned electric utilities to develop and implement tariffs for inclusive utility investment.

Evidence From the Field

Upfront cost barriers and customer experience. Energy affordability is intrinsically tied to affordability writ large. For more than a decade, more than three in ten adults responding to the largest recurring federal survey of consumer finance have indicated that they lack sufficient savings to pay for an unexpected $400 expense with cash (Federal Reserve 2025). Scaling residential energy upgrades means addressing the upfront cost barrier for millions of households per year, especially those facing an unanticipated equipment breakdown and need for replacement. A survey of 10,000 U.S. households found upfront cost was the largest barrier to home modifications in every region, cited by roughly two-thirds of respondents, with broken equipment among the most common triggers for an upgrade (Antonopoulos et al. 2024). Even with the Inflation Reduction Act's Home Energy Rebates, incentives alone cannot cover the full upgrade cost (Jantz-Sell, Palmer-Dunning, and Brindel 2024). Like rebates, inclusive utility investment is one of several tools needed to scale upgrades.

In Missouri, EEtility, the implementer of the Pay As You Save (PAYS®) offering for the state's investor-owned utilities, launched a FastTrack PAYS® Pathway for HVAC replacements. In less than a year, the observed customer acceptance rate in response to the inclusive utility investment offer increased seven-fold (from 6% to over 43%), and across all participating utilities, the pace of enrollment is averaging over 390 households per month (T. Agard, EEtility, pers. comm., May 13, 2026). The turnaround in PAYS participation under FastTrack HVAC suggests that program design, not customer demand, was the binding constraint: when the upfront cost barrier is lowered and implementation is streamlined, participation follows.

Design limitations of inclusive utility investments. Inclusive utility investment complements existing programs; it should not displace program funding or participation in no-cost offerings, and the model tariff directs implementers to always ensure prospective participants are made

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[3] Illinois proceeding (Docket No. 25-0863) on the Equitable Energy Upgrade Program: www.icc.illinois.gov/docket/P2025-0863; California proceeding (R. 20-08-022) on Clean Energy Financing Options: www.apps.cpuc.ca.gov/apex/f?p=401:56

aware of direct-install and other no-cost options first. Applied together, the two can cover the cost of deeper upgrade packages. For example, Midwest Energy's How$mart PAYS program and the Kansas Weatherization Assistance Program were able to combine both services, with PAYS covering the appliance upgrades after weatherization funds were used (ENERGY STAR 2022).

Any financial solution that depends on estimated household energy savings is limited to sites where those estimated savings can be found for a given upgrade. Heating and cooling savings, for example, can be hard to establish for cost-constrained households that ration energy use to keep bills low (Cong et al. 2022). With bills already constrained, estimated savings will understate what the household would save if it were using enough energy to stay healthy at a comfortable temperature. Silicon Valley Clean Energy (SVCE)'s proposed tariffed on-bill investment pilot included additional risk mitigation protocols to ensure cost recovery charges best reflect the savings realized (SVCE 2022).

Lastly, cost savings alone may not be sufficient to capitalize upgrades with higher upfront cost. Since site-specific monthly service charges are a function of estimated savings, the amount that a utility can offer to invest has an upper limit. In cases where an upgrade is not estimated to produce annual savings, the participant is offered the choice to make a co-payment to bring down the upfront cost or to decline the utility investment in the energy upgrade. Higher copayments deter participation but ensure that the interest of future customers is regarded so that the utility investment is made within the bounds of the estimated annual savings from the upgrades.

Bill assistance and energy saving investments from the field. Energy bill assistance, whether through rate design or one-time bill credits, is a fundamental mechanism to make the energy affordability playing field more level. For energy vulnerable customers, such as medically dependent, elderly, or fixed-income households, access to affordable energy services is a necessity. As energy costs continue to rise, the need for energy assistance will only expand in response. From 2024 to 2025 alone, Maryland's Energy Assistance Program saw a 37% increase in customer enrollment (Overs 2026). Energy efficiency and distributed energy resources are the most durable tools to support households in need while containing the growing cost of delivering that relief: every kilowatt-hour an assisted household no longer needs frees a dollar of assistance to reach another household in need.

Despite a growing number of states establishing income-based assistance, only a limited number have customer-sided solutions that pair energy saving upgrades with assistance. A long-term evaluation of Pennsylvania's Low-Income Usage Reduction Program (LIURP), which provides ratepayer-funded weatherization to low-income customers, found that from 1989 through 2006, 40% of participating households reduced their arrears following weatherization upgrades (Shingler 2009). Washington shows the same effect at scale: a study of over 252,000 households found that weatherization cut bill assistance payments by 20% per household each year, and homes treated from 2017 to 2021 freed up more than $793,000 in assistance funding, enough to reach an estimated 1,505 additional households without new appropriations (Turek-Hankins et al. 2026). The need for energy savings is most evident where bill assistance faces fiscal realities at scale. A recent evaluation of California's 4-year bill assistance pilot echoes this same sentiment, calling for participation in energy efficiency programs to target households with high energy burdens (CPUC 2026).

Study Approach

Most research on energy upgrades paired with bill assistance comes from program evaluations focused on impacts and cost-effectiveness of using limited ratepayer funds for incentive payments and bill assistance. This study takes a more exploratory approach to the interactions between the two by adding inclusive utility investment. We model inclusive utility investment upgrade packages that incorporate available rebates and incentives, paired with the two bill assistance designs introduced above: a PIPP and a standard LIDR. Customers eligible for a discount rate are often also eligible for no-cost programs such as state weatherization, so we assume a larger upfront cost reduction that lets a whole-home retrofit proceed, and we test varying income levels to reflect participation by moderate-income households. The aim is to give utilities and states practical guidance on inclusive utility investment adoption and design—especially potential integration with bill assistance—and to clarify the tradeoffs among affordability strategies. The results that follow describe a single household scenario; the program-level case rests on aggregation, as each participating home contributes its own subsidy reduction to the shared assistance pool.

Baseline Energy Model

The analysis draws on public data representing a single-family home that accepted an offer of an inclusive utility investment from a utility in Missouri implementing PAYS. Missouri was selected given the investor-owned utilities have existing PAYS programs and a relatively limited number of rebates and incentives offered. Missouri also recently opened a utility working case considering utility assistance programs and low-income discount rates. The baseline energy model is derived from a participant of the Ameren PAYS® program, who provided energy audit details, estimated cost savings of proposed upgrade measures, as well as associated billing data (M. Corey, PAYS participant, pers. comm., May 15, 2026).

We matched these characteristics to the corresponding archetype in NREL's ResStock TMY3 2024 dataset (pre-1940 single-family detached, gas space and water heating, central air conditioning) to obtain a monthly end-use load profile reflecting the home's seasonal consumption pattern. The ResStock profile was then calibrated to the audit's billed annual consumption, scaling the modeled end uses so that aggregate electric and gas totals reconciled with the audit figures within 3–5%. Table 1 summarizes the model inputs and sources.

Table 1. Baseline model inputs and values

End-use and model input	Characteristics
Single-family detached home	Built 1892; 1,950 ft²; three stories + basement; gas and electric
Space heating & cooling	Natural gas furnace, 76% AFUE; central split-system AC, 12.6 SEER, 5-ton (whole-house)
Water heating	Electric tank water heater, UFAE: .867
Attic insulation; leakage rates	R-12; 12.7 ACH50; 14% leakage rate for ducts
ResStock Calibration	Bills within 3-5%; NREL ResStock TMY3 2024, matched MO archetype (pre-1940 SFD, gas heat/DHW, central AC)

End-use and model input	Characteristics
Utility rates Ameren MO Spire Gas MO	Electric: Fixed: $9; summer: $0.156/kwh; winter: $0.1062/kwh first 750 kwh, $.0714 after Gas (Spire MO): Fixed: $22; $1.1128 $/ccf (averaged)

Source: NREL ResStock TMY3 2024 dataset (NREL 2024); Ameren Missouri and Spire Missouri posted rate schedules; energy audit and billing data shared by the PAYS participant (M. Corey, pers. comm., May 15, 2026).

Upgrade Package Costs and Cost Recovery Terms

Three upgrade packages are analyzed based on the PAYS participant offer and electrification measures in ResStock. Each package corresponds to a ResStock model run, and the modeled savings are compared against the savings estimated in the participant's actual PAYS offer to confirm that the modeled results are consistent with the program operator's estimates. The monthly energy usage was compared to the load profile of similar buildings to further validate outputs.

- Package 1: Upgrade to heat pump water heater (HPWH).
- Package 2: Weatherization & envelope improvements. 20% air leakage reduction, R-40 attic insulation, duct wrapping.
- Package 3: Packages 1 and 2 and heat pump upgrade for heating and cooling.

Upgrade costs were set using the cost estimates in the PAYS offer and validated against local market data. For the heat pump water heater, we relied on online installation cost estimates posted by local HVAC companies. Rebate incentives were set using posted values on Ameren's website. Values are shown in Table 2 below, including the utility cost of capital rate associated with Ameren PAYS.

Table 2. Inclusive utility investment offer data for upgrade packages

	Package 1: Heat pump water heater	Package 2: Weatherization	Package 3: Package 1-2 & heat pump
Package cost	$ 3,500	$ 2,395	$ 23,895
Rebate	$ 500	$ 590	$ 3,090
Cost recovery	3% over 12-year period (up to 15 years allowed)[4]		

Source: Cost estimates shared by program administrator; Ameren & Spire rebate listings online. Package costs and rebates as modeled in a calculator developed for this analysis.

Energy Bill Assistance Offerings

This paper focuses on two forms of bill assistance: low-income discount rates (LIDR) and Percentage of Income Payment Plans (PIPP). A flat low-income discount rate is a fixed

[4] A utility finances the upgrade at its own cost of capital, which for an investor-owned utility may approach 7%. The 3% reflected here is the rate carried by the participant through the service charge; the difference is socialized across the broader ratebase, in the same way other utility capital costs are recovered.

percentage reduction of a bill, while PIPPs are designed so that customers pay no more than a certain percentage of their verified household income for utilities, typically 6%. Unless otherwise noted, PIPP results assume a household income at 60% of state median income (SMI). The results below were selected to illustrate the main ways inclusive utility investment and each type of assistance offering interact.

- Percentage of Income Payment Plan (PIPP): sets a monthly bill threshold based on spending, at most, 6% of monthly income on energy. The cap will vary by income.
- Low-income Discount Rate (LIDR): a 30% discount applied across the full bill.

Bill assistance design. In review of current and past PAYS investments, there is little documentation of how programs addressed customers receiving bill assistance other than Low Income Home Energy Assistance Program (LIHEAP) payments, which are federal funds applied directly to the bill. Recent low-income discount rate design dockets in California, Illinois, and Massachusetts approved discount rates that apply to the whole bill, arguing that this maintains the necessary price signal for customers to conserve energy (Colton 2023). Following that practice, this analysis applies each assistance offering across the whole bill and as the final billing step. For a site where the utility has invested in an upgrade package, the total bill includes the cost recovery charge for that package because the approved tariff assures the cost recovery charge is treated the same as other billed charges for energy services, and the bill assistance policy is applied to the total bill.

Results

We first present the financial details for each upgrade package, followed by the interaction of the inclusive utility investment with a PIPP and a LIDR. We then turn to ratepayer impacts, testing how the cross-subsidy benefits of the upgrades for PIPP and LIDR funds.

Monthly Energy Costs and Cost Recovery Terms

Table 3 reports the cost-recovery terms and modeled monthly bill impacts for each upgrade package under the inclusive utility investment tariff.

Table 3. Cost recovery terms and estimated bill impacts by upgrade package

	Package 1: HPWH	Package 2: Weatherization	Package 3: Full electrification
Estimated Annual savings (Percent savings)	$ 286 (8.3%)	$ 374 (10.9%)	$ 1,243 (36.2%)
Max. Monthly Cost Recovery Charge (80% of estimated annual savings ÷ 12)	$ 19.03	$ 14.94	$ 82.83
Net Monthly Bill Savings (Est. monthly savings – service charge)	$ 4.76	$ 16.21	$ 20.71
Total cost recovery charges	$2,741	$2,152	$ 11,928
Copayment	$ 701	$ 0	$ 10,798

(Upfront cost–total recovery payments)			
Cost recovery duration (years)	12	12	12
Portion of utility rate of return (ROR) borne by participant	$442	$347	$ 1,921

For package 2, the cost recovery period can be reduced to 7 years if the maximum recovery charge is used instead of the spreading cost recovery over the full-term period.

Bill savings from weatherization (Package 2) fully cover the utility's investment cost recovery charge, while the heat pump water heater (Package 1) requires $701 copayment and full electrification (Package 3) a $10,798 copayment to augment the $11,928 utility investment recovered through a monthly service charge. The cost recovery charges never exceed modeled energy savings annually; every package therefore preserves an estimated net savings position—from $4.76 per month for the heat pump water heater to $20.71 for full electrification, where estimated gross savings reach 36% of the baseline bill. Thus, the participating household comes out ahead from the first billing cycle, a key design feature of inclusive utility investment.

Comparing Assistance Mechanisms: LIDR vs. PIPP

With the package costs and savings estimated, we now layer on each assistance offering to test how the two interact. The comparison centers on the reduction in the ratepayer subsidy: the change in what the assistance fund must cover once an upgrade is in place. A lower bill shows the pairing benefits the participating household; a smaller subsidy shows it also benefits the ratepayers who pay for the bill assistance. The size of that reduction, in turn, indicates how far a fixed ratepayer funded assistance budget can stretch. The reported reductions are net of the utility's capital recovery as part of post-upgrade; they represent avoided outlays for the assistance fund rather than costs shifted onto it. Bill impacts capture the participant-side benefit of pairing the two mechanisms; subsidy reductions capture the ratepayer-side benefit and together, the value of co-delivering household-level upgrades alongside bill assistance.

Table 4. Annual customer bill, ratepayer subsidy, and reduction in subsidy by upgrade package under a LIDR (30% discount) and a PIPP

		LIDR (30% discount rate)		PIPP (6% cap)	
	Customer bill (no discount)	Customer bill with discount	Bill subsidy required	Customer bill with discount	Bill subsidy required
Baseline	$3,431	$2,402	$1,029	$2,932	$499
Package 1 HPWH	$3,374	$2,362	$1,012	$2,892	$481
Package 2 Weatherization	$3,237	$2,266	$971	$2,888	$349
Package 3 Electrification	$3,183	$2,228	$955	$2,870	$313

Subsidy reduction is the annual decrease in assistance funding per sample household relative to the baseline bill, shown for a 30% LIDR and a 6% PIPP (60% SMI).

A 6% energy burden cap for a household at 60% of the state median income (SMI) equates to an average monthly cap of $275.[5] Table 4 above presents the respective annual customer bill and required ratepayer-funded subsidy to cover the energy assistance offering. In our current baseline scenario, the PIPP cap only gets applied in high billing months. The estimated annual subsidy needed to cover the PIPP cap is around $500, about half as much as the subsidy needed to fund the 30% low-income discount rate for the simulated household.

Any monthly cost above the PIPP's income-based cap is covered through the ratepayer subsidy. The subsidy is modest in the current scenario because the cap sits near the household's average bill and binds only in the peak billing months; it would grow quickly at lower incomes, where a lower cap opens a gap in every month, or as rate increases push bills higher. Under a PIPP, the household's payment is fixed at its income-based cap, and the assistance fund covers the remainder of the bill, so in months when the cap binds, bill reductions accrue to the fund rather than the household. The LIDR subsidy, by contrast, is a flat rate for all households that meet the income qualification; as a fixed share of the bill, the subsidy level scales with the increased savings from each investment

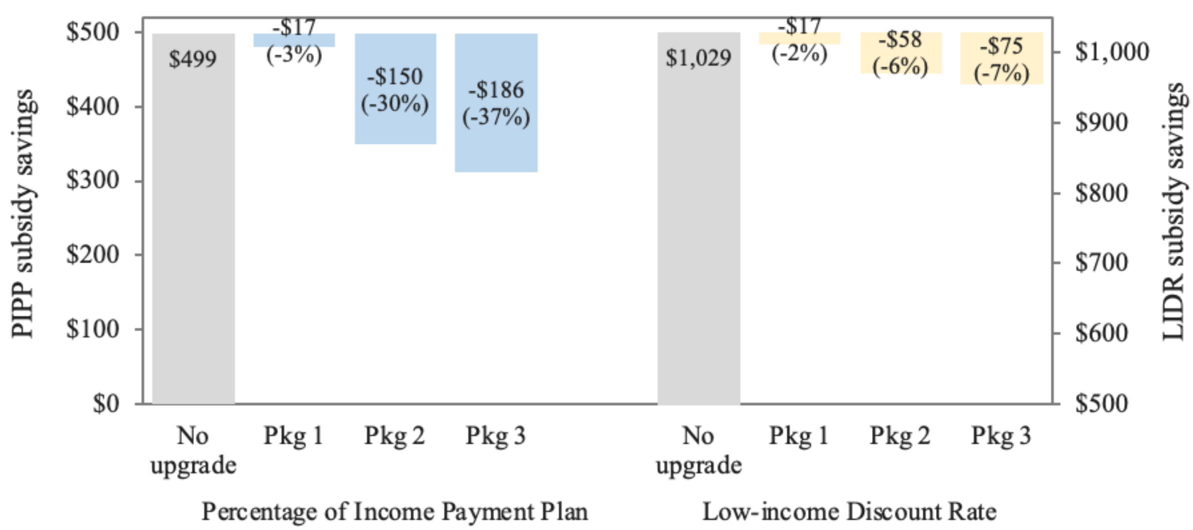

Figure 2. Annual bill assistance subsidy required, and its reduction, by upgrade package under a 30% LIDR and a 6% PIPP (60% SMI), relative to the baseline bill.

Under a LIDR, the subsidy is a fixed percentage of the bill, so the fund captures only that share of each dollar saved. At lower incomes the cap binds in more months of the year, widening the PIPP's advantage. In both cases, the savings delivered from the site-specific investment offset costs the bill assistance program would otherwise cover, showing how inclusive utility investment and bill assistance are complementary. To put the reductions in terms of reach, the $186 annual PIPP reduction under full electrification equals over a third of the $499 baseline PIPP subsidy for this household, so the savings from about three similarly upgraded houses would free additional ratepayer funding for bill assistance that extends coverage and impact.

[5] For a 3-person household in Missouri, the 2026 state median income is $55,051.

Bill stabilization effects mitigate high billing periods. Figure 3 breaks down annual energy costs, cost recovery charges, and assistance coverage by month to show the seasonal swing in customer bills.

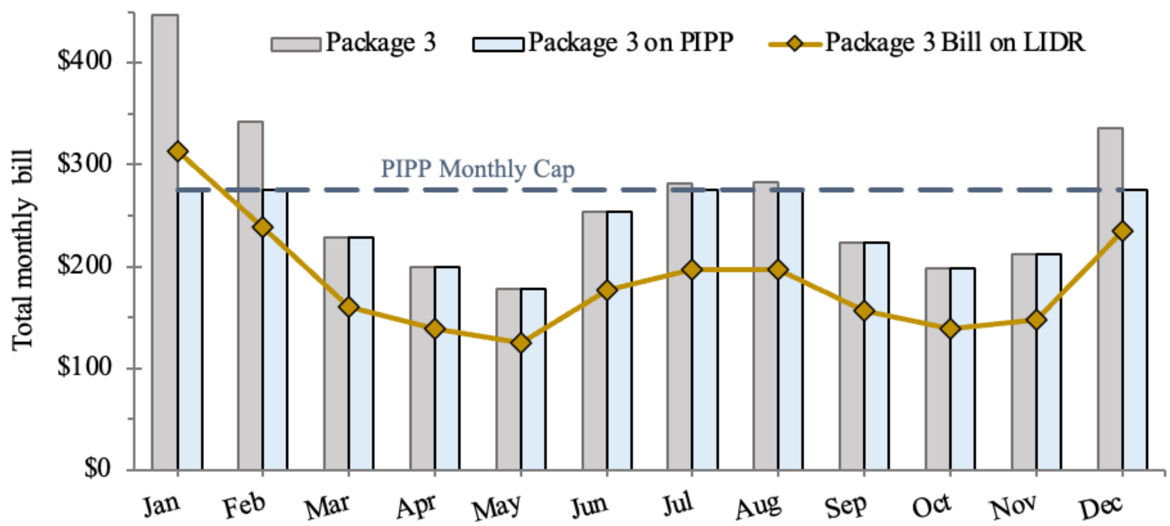

Figure 3. Monthly customer cost (bill plus service charge) under a PIPP and LIDR for the full electrification package (Package 3), compared with the baseline bill.

The fixed monthly service charge is 80% of the investment's annual savings, so it claims a larger share of the bill in the shoulder seasons; the deepest savings for the heating and cooling upgrade arrive in the peak summer and winter months, as reduced heating and cooling loads pull bills down. Savings therefore land where bills are highest, moderating monthly costs and narrowing the gap that any assistance fund must cover. That timing matters: energy assistance disbursements are cyclical—roughly half of federal LIHEAP dollars fund heating assistance and another fifth crisis aid (Perl 2018)—and reach only a fraction of the customers behind on their bills. As Figure 1 also illustrates, the net billing effect of inclusive utility investment is itself a form of bill stabilization. A PIPP is the design most exposed to those swings: its subsidy obligation moves with both income and high billing months, widening whenever the gap between the capped payment and the actual bill grows.

Ratepayer and participant costs are a function of household income. The maximum monthly cap a PIPP customer will pay is a function of their income: as incomes increase, so does the monthly cap. Conversely, the funds required to implement a low-income discount rate provide a subsidy that is a function of the total monthly bill. Intuitively, a PIPP concentrates relief on the lowest-income households, where the income-based cap sits well below the actual bill, whereas a flat discount delivers the same proportional reduction at every income level; the two therefore diverge as income rises. For the modeled household, the crossover falls near $38,000 of annual household income. In energy burden terms, the crossover household devotes roughly 9% of income to baseline energy costs—well above the 6% affordability standard embedded in the PIPP cap—and burdens climb past 10% as incomes fall toward $34,000.

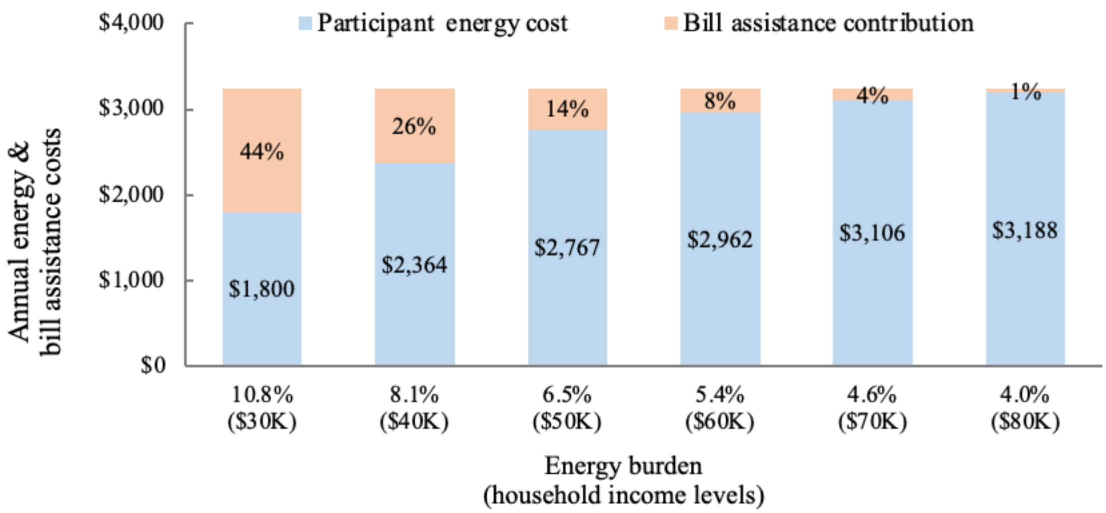

Figure 4. Annual cost of weatherization package (Package 2) with PIPP by energy burden and income.

Figure 4 depicts the effect of household income on annual PIPP funding needs and customer savings when applied with the weatherization upgrade (Package 2). The same trend exists if the PIPP cap is lowered to, say, 4%, or eligible household bills increase. Two patterns stand out in the modeled results. The subsidy shrinks quickly as income rises—from roughly 44% of annual energy costs at $30,000 of household income to about 15% at $50,000 and under 2% at $80,000—as the income-based cap climbs toward the actual bill. The upgrade, in turn, does progressively more work at higher incomes: with a smaller gap remaining between the capped payment and the bill, the same dollar of savings closes a larger share of the fund's obligation, with the remainder accruing to the participant.

Takeaways and Recommendations

Inclusive utility investment for monthly bill stabilization. A PIPP anchors the participant's payment to income rather than usage, so the assistance fund—not the household—absorbs the seasonal swing in the underlying bill (Colton 2023). Inclusive utility investment narrows the gap the fund must cover, delivering its deepest savings in the peak heating and cooling months that drive the spread between the capped payment and the actual bill. The stabilization runs both directions: the participant sees a more predictable bill, and the ratepayer pool that funds the assistance sees a smaller, more predictable subsidy obligation. Across all three packages modeled here, pairing an upgrade through inclusive utility investment with a LIDR or PIPP lowered the participant's bill and reduced the draw on the assistance fund—dollars that remain available to expand assistance opportunities.

Percentage of income payment and predictable bill savings. For high energy burden customers, a PIPP cap produces the greatest effect for customer affordability. Above the set threshold, costs accrue to the assistance fund, which leaves the PIPP design exposed to bill volatility. California's energy assistance pilot found that the average participant cost was twice that of their discount rate option, which raised concerns for utilities if implemented at scale

(CPUC 2026). Fuel switching warrants attention in this design: electrification can increase seasonal bill variation, widening the months in which the cap binds. Where a PIPP is designed for the high-burden tail of a customer base, the case for cross-subsidization between services is strongest; each dollar of efficiency directly offsets the subsidy required. These additional savings could be applied to justify socializing an even greater split in the investment's cost across the rate base. Ohio's practice of funding efficiency and its PIPP through the same rider reflects that connection. Its Electric Partnership Program targeted efficiency to high-consumption, high-arrears PIPP households and delivered $12.7 million in lifetime bill savings, over 90% of which offset PIPP program costs (Blasnik 2006).

A LIDR is best suited for households near the median income. A fixed discount rate scales a customer's credit based on their monthly energy bill—the higher the bill, the greater the discount. For households with higher energy burdens and low incomes, a 30% deduction does not bring their costs to a 6% affordability target (Colton 2023). The California pilot evaluation found that the state's California Alternate Rates for Energy (CARE) programs could be paired with a PIPP to cover the shortfall for the highest-burden households (CPUC 2026). A discount rate applied with inclusive utility investment is well suited for customers nearer the median income—above the roughly $38,000 crossover identified in the results—whose burdens are lower and energy bills more predictable. The energy savings from an upgrade are highest during peak months, when a discount rate alone may not leave a participant with enough bill savings. The discount is proportional, so the participant also retains a price signal to conserve, and the utility gains more predictable customer payments.

System benefits delivered through improved billing management: avoided arrearages, collections, and risk obligations. Efficiency investments and other money-saving energy upgrades stretch energy bill assistance budgets to serve more households and, in turn, reduce the costs of uncollectible accounts, utility-held debt, and collections that the broader ratepayer pool ultimately bears. These upgrades deliver their deepest savings during peak heating and cooling periods, so they also reduce load when the system is most constrained—a benefit shared by all ratepayers. That risk reduction was central to Pennsylvania's design: Low-Income Usage Reduction Program (LIURP) regulations frame usage reduction to lower the incidence and risk of payment delinquencies and the resulting utility costs, including uncollectible accounts, collection expenses, and arrearage carrying costs. The per-unit benefit is measurable: the program's 2021–2022 evaluation found that average net arrears fell by $25 per participating household statewide and by nearly $99 for PPL-customer participants, alongside declines in bad-debt write-offs (Rosenbach and Daniel 2025). The synergy LIURP documented should hold when inclusive utility investment is the mechanism capitalizing the upgrades. An inclusive utility investment strategy directed at households with high energy bills is a form of risk reduction, providing cross-subsidization for ratepayers against the recovered costs of unpaid bills.

Anchoring cost recovery to the metered location allows the utility to diversify site-level risk across a portfolio financed at utility cost of capital.

Closing Thoughts

This paper offers an initial exploration of how inclusive utility investments can pair with energy bill assistance to deliver deeper energy efficiency interventions alongside bill relief. For the example presented here in Missouri, this approach could help extend the limited ratepayer resources available for energy-insecure households, so that more households can benefit. The calculator and analysis developed for this study can support other use cases, particularly for states designing new programs for low-to-moderate income households.

Serving financially vulnerable households requires attention to needs that monthly bills alone may not capture. Home energy upgrades can provide benefits beyond bill reductions, including greater predictability for customers and lower costs for the broader system. Program implementers and providers generally find that customers want to pay their energy bills and benefit when multiple tools make that possible. Efficiency lowers the cost of service, assistance stabilizes the remaining bill, and each works best when designed with the other in mind.

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