CAN ELECTRICITY RATE SUBSIDIES BE REALLOCATED TO BOOST LOW-INCOME SOLAR?

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 Millions of Americans struggle to pay their energy bills, with low-income households spending an average of 7.2 percent of their household income on utilities, over three times more than higher income households.\(^1\)

Given the proven ability of residential solar systems to decrease monthly electric bills, rooftop solar could help relieve this disproportionate energy burden and become a source of ongoing wealth creation in lower-income communities.

Currently millions of low-income households rely on a variety of electricity rate subsidy programs to make their utility bills more affordable. We found that repurposing existing flat rate subsidy programs towards rooftop solar investments could, on average, reduce low-income homeowners electricity bills by 48 percent and save them almost $9,000 over the solar system’s lifetime.

Summary of Findings

- With residential solar slated to grow rapidly over the next few years, income-based residential solar adoption rate disparities will likely worsen.

- Lower-income households face a range of barriers to going solar, including being more likely to be renters or live in multi-tenant buildings, lacking access to financing, and owning property with deferred maintenance issues.
While lower-income households typically use a higher share of their income on energy, the conventional wisdom that they use less electricity than average is likely incorrect.

Using public and ratepayer resources to pay for low-income solar investments may provide greater and more targeted ratepayer and societal benefits than existing rate subsidy programs.

Reforming electric rate structures to reduce cross subsidization and incorporate and prioritize low-income solar could reduce adoption barriers.

Finding ways to enable lower-income Americans to benefit from solar will unlock huge new markets and is essential to reaching national energy goals.

**BARRIERS TO LOW-INCOME SOLAR ADOPTION**

While the price of residential solar systems declined about 70 percent since 2008, the resulting solar boom has not spread evenly across U.S. households. Despite being more vulnerable to energy costs, solar adoption rates amongst lower-income Americans are significantly lower than in more affluent households despite the technology’s economic benefits. In fact, less than five percent of domestic rooftop solar systems are installed on the 49 million households that earn less than $40,000 per year, despite this group making up 40 percent of all US households.² ³ ⁴

**Low-Income Households Face Many Unique Challenges**

There are a variety of challenges that prevent low-income families from going solar:⁵ ⁶ ⁷

- Lower-income households are less likely to own their roof due to higher rates of living in multi-family buildings and being renters (49.1 percent of lower-income households are renters versus 21.8 percent of households with incomes greater than $40,000).⁸

- Lower-income households have limited access to financing due to lower savings, less income to borrow against, and lower credit scores that further reduce access to affordable capital or third party leasing options. It can also be a challenge to monetize financial incentives like the federal Investment Tax Credit.

- Lower-income households are more likely to live in buildings with deferred maintenance that require other upgrades before solar investments make sense.

- Lower-income households are unable to realize the financial benefits of solar directly in cases where utility bills are not paid.
Low-Income Solar Penetration Stagnant
With residential solar expected to grow 35 percent over the next four years, income-based disparities will be exacerbated without a better understanding of the factors behind these trends and the public policy measures that could reverse them. In California, which recently announced that solar provided nearly ten percent of its electricity needs in 2015\(^9\) and accounted for nearly half of all residential solar installations nationwide,\(^{10}\) low-income solar penetration rates have barely increased despite having one of the most active and well-funded support programs in the country.\(^{11}\)

According to an analysis by Kevala Analytics, Golden State households with incomes of less than $70,000 make up 65 percent of residential installs, but only six percent of installs are on homes with median owner occupied incomes below $40,000. And while residential solar installations in Californian zip codes with a median household income of $40,000 to $70,000 have increased 59 percent since 2014, deployment in areas where household income is below $40,000 per year has remained essentially flat since solar penetration rates started growing rapidly in 2008.\(^{12}\)

![Figure 1](image_url)
WHAT ARE ELECTRICITY RATE SUBSIDIES?

There are over 67 electricity rate subsidy programs in 42 states that seek to reduce monthly electricity bills for lower-income ratepayers. While the mechanisms and scope of these programs vary considerably, they essentially all boil down to some form of cross-subsidization which impose somewhat higher rates on industrial, commercial, and wealthier residential ratepayers in order to provide lower-income families with reduced rates, sometimes at below the actual cost of electricity service. There is a broad range of entities regulating, paying, and implementing these programs including state and federal governments, public and private utilities, and state regulatory commissions.
Eligibility Criteria Varies
Eligibility criteria for electricity rate subsidy programs differ between states and sometimes even between utilities within a state. While most subsidy programs are pegged to the household Federal Poverty Level (FPL), which covers 14.8 percent of the population, implementing entities use these income brackets in a variety of ways. For example, one program in Kentucky focuses on households at or below 110 percent of FPL, while another program in Arizona restricts eligibility to those with incomes under 150 percent of the federal poverty level. Similarly, some programs may focus on age groups within the FPL, such as only seniors. Another structure in Alabama links utility discounts to households that receive other forms of government assistance.

The wide range of ERS programs make them difficult to compare and analyze. This analysis focuses on 9 states with Flat Rate Discounts (which provide a fixed rebate on monthly utility bills) because these programs were most suitable for comparison across states.

Efficacy of Electricity Rate Subsidies
Numerous studies have shown that electricity costs make up a much larger share of a low-income households’ budget compared to more affluent families. For example, data from a 2011 U.S. Department of Health and Human Services study found that electricity costs account for 5.7 percent of the median low-income family’s budget, while only accounting for 1.9 percent of other families’ budgets. Another recent study found a greater disparity, concluding that low-income households spend almost 10 percent of their income on electricity, a rate four times higher than higher earners. In addition, that study showed that electricity expenditures for lower-income ratepayers rose by a third over the last decade, even as they declined for higher-income households.

Lack of correlation between household income and electricity consumption
The conventional wisdom that lower-income households use less electricity than average is likely incorrect. For example, the U.S. Energy Information Administration found that low-income families use 22 percent of the electricity consumed in American homes while accounting for roughly 25 percent of all housing units. Program data from the federal Low Income Heating Assistance Program (LIHEAP) also showed only a marginal difference in energy consumption level, finding that a typical low-income family spends an average of $1,272 per year for roughly 10,060 kilowatt-hours of electricity, compared to more affluent families who spend $1,558 per year for roughly 11,720 kilowatt-hours of electricity.
Low-income households can be significant energy users
Some low-income households are actually relatively heavy electricity consumers. This is often because their dwellings, while on average smaller, are poorly weatherized, have antiquated appliances, or have higher household occupancy rates during more hours of the day. Under certain common rate subsidy programs like Increasing Block Pricing (which charge ratepayers less for the first tier of monthly usage and more for higher energy users), this dynamic means that some low-income families are actually penalized by programs that are meant to protect them. Moreover, the “baseline” or “lifeline” that defines the first tier of discounted electricity and is supposed to correspond to household essential needs rarely takes into account household size and age, the number of people living in a residence, or how much time they spent at home.

A recent analysis of data from a medium-sized utility in Oregon found electricity usage levels were distributed evenly across their customer base, regardless of income. Given that only 10 percent of the utility’s residential class customers were considered low-income, their block rate structure “was helping about nine times as many customers as intended.” Another interesting dynamic was documented in a 2014 American Economic Review article that found strong evidence that people respond to average prices rather than marginal prices because few ratepayers understand non-linear electricity pricing.

These findings imply that tiered rate structures are relatively ineffective in helping low-income households. Similarly, we found that flat rate discounts cover only about a quarter of an average low-income homeowner’s monthly electricity bill. A more targeted approach based on targeted rooftop solar investments could provide greater individual and societal benefits.

REALLOCATING RATE SUBSIDIES TOWARDS SOLAR

With leading empirical work showing that electricity rate subsidies doing a relatively poor job of transferring wealth to lower-income ratepayers, could funds dedicated these well-intentioned cross-subsidy programs be better used to break down barriers to lower-income solar penetration? A key dynamic to this calculation, which has only emerged as a factor in the last few years, is that in many states residential solar prices are below local utility rates, meaning access to solar power could significantly reduce the disproportionate energy burden borne by lower-income households.

Our analysis looked at data from nine states with flat rate discounts to estimate the economics and the relative merits of reallocating utility bill subsidies towards investment in low-income solar. We assumed that 25 years of future flat rate discounts could be bundled to buy down the upfront capital costs (after taking into account state and federal financial incentives) of a five-kilowatt solar system. We assumed, likely though an on-bill financing
program, that low-income households would be able to pay the remaining system installation costs with evenly distributed monthly payments over 25 years.

Three states with existing flat rate programs were excluded from our calculations, including Kentucky and Maine where the relatively low payback for a solar system\(^{24}\) did not justify moving away from existing rate subsidy programs. In addition, program data from Pennsylvania was insufficient to warrant inclusion.

Our analysis integrated state-specific data on factors ranging from average low-income household electric bills, to regional solar insolation rates, to local electricity prices. However, we did not account for inflation, panel degradation rates, electricity price volatility, potential increases in property values, or other ancillary benefits such as reduced local air pollution. Moreover, these calculations are based on the value of solar generation in and around each state’s capital, while in reality generation potential can differ considerably across some states.

We found that on average, households that installed a five-kilowatt solar system paid just $37.47 on their monthly electricity bills, an average savings of 48 percent, even after contributing an average of $19.77 per month to repay installation cost beyond what any one state’s existing flat rate rebate would cover. As the chart below indicates, there was considerable variation between states, with average monthly electricity bills ranging from $7.44 to $59.41 due to differential subsidy levels and other state-specific factors that were incorporated into this analysis.
Reallocating these funds towards low-income solar would also provide low-income households a significant net income gain. On average, a benefited household would save $8,891 over a 25-year period (the typical period used to amortize a residential solar system, although the panels themselves are likely to last much longer), with outcomes amongst states ranging from $3,940 to $15,423.
While these results are remarkable, it is important to note that reprioritizing resources towards solar installations over flat rate discounts could result in more concentrated benefits for some low-income households at the expense of lower but more dispersed subsidies for all eligible households. Low-income homeowners with suitable roofs may also be advantaged over renters, multifamily unit dwellers, and states without supportive solar policies like community solar, net-metering, or financial incentives.

Outcomes between states also differed substantially due to exogenous factors such as regional solar generation potential, seasonal demand variance, and retail electricity rates.

**CONCLUSION**

Rapid reductions in solar system costs provide new opportunities to address the disproportionate energy burden borne by lower-income households. Well-designed and implemented solar investment programs targeting low-income households could become a source of local, living-wage jobs and empower families with a tangible asset that delivers economic value for decades.

Strategically reallocating electricity rate subsidies to overcome financial barriers hindering lower-income solar adoption, such as lack of upfront capital or credit worthiness concerns, would provide better outcomes for targeted households.

There are also additional societal benefits for increasing low income solar installs such as strengthening low-income communities with local job creation, enhanced grid resiliency, and the potential for emergency backup power when combined with storage investments. It has also been noted that low-income communities are disproportionately vulnerable to climate change and the health effects of nearby fossil fuel plants, so the ability of solar generation to offset coal could also be important.

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8 See supra note 5.


14 Based on 2014 data from the U.S. Census Bureau, which estimated that 46.7 million Americans live in poverty.


Ibid.


The 9 states with flat rate electricity subsidies analyzed are Alabama, Arizona, Georgia, Illinois, Kansas, Maryland, Massachusetts, Montana, and Rhode Island.

Geographic specific payback rates were based on the National Renewable Energy Laboratory’s PVWatts Calculator, which estimates the energy production and cost of energy of grid-connected photovoltaic (PV) energy systems throughout the world, available at: http://pvwatts.nrel.gov

A 2012 report by the NAACP titled “Coal Blooded: Putting Profits before People” found that six million Americans living near coal plants have an average income of $18,400, compared with $21,857 nationwide, and 39% are people of color. Available at: http://www.naacp.org/page/-/Climate/CoalBlooded.pdf