Implementing Load Flexibility Programs To Help Alleviate Low-Income Energy Burden

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ABSTRACT

Grid-interactive utility programs, such as load control programs, almost always target higher-income households that can easily purchase intelligent devices like smart thermostats, smart water heaters, batteries, or an electric vehicle. Recent state and federal programs have prioritized deployment of smart, energy-efficient measures and electrified devices in low-income homes; however, load control for smart devices has not, to date, been a focus of these programs. When assessing typical energy burdens of low-income households (relative to average households) and comparing the reduction in energy burden from a typical demand response program participation incentive, low-income households see more benefits from the incentives—making it critical for these households to be prioritized. There is significant opportunity for getting thermostats into lower-income homes and achieving energy savings based on an analysis of smart thermostat adoption rates and typical temperature set points.

This paper will explore these challenges as well as look at the specific examples including a Mississippi Power Pilot Program as well as a precursor analysis from a proposed pilot program with Consumers Energy in Michigan. The paper will look at lessons learned, cost-benefit considerations, and explore how equity-focused load control programs could be integrated into federal and state initiatives (e.g., IRA HOMES and HEEHRA) to address the needs of low-income households while also addressing load growth.

Introduction

Electricity rates have been rising in the US over the past decade during a period of flat load growth. These rates are expected to continue to increase over time as retiring generation is replaced and transportation and heating are electrified. High electricity rates have a disproportionate impact on low-income households. When the share of annual household income that is used to pay annual energy bills is above 6%, it is defined as *high energy burden.* Levels above 10% are defined as *severe energy burden* (Drehobl, Ross, and Ayala 2020). Demand flexibility, where customer demand in homes and businesses are controlled in an aggregated, intelligent fashion, is a resource that can help keep rising electricity rates down through avoiding unnecessary peak generation and transmission and distribution build out. Demand flexibility programs offer customers incentives for participating. When a low-income customer participates, these incentives can have a measured impact on their overall energy burden. While both low-income energy efficiency programs and demand flexibility programs like smart thermostat demand response programs are common offerings, it is uncommon for utilities to incorporate both. By deploying low-income demand response programs, electric utilities can lower peak demand costs while also reducing the energy burden directly for low-income customers.

Background

Rising Electric Rates Across the US

Electricity rates in the US have risen over the past decade and have accelerated in recent years due to the COVID-19 pandemic and turmoil in global energy markets (e.g., due to the war in Ukraine). The average residential electricity price in the U.S. increased 23% from 2020 to 2023 from $.1315 per kWh in 2020 to $.1619 per kWh in November of 2023. (EIA 2023)

Acceleration of the Need for Demand Flexibility

With the shift toward a higher penetration of renewables on the system, a number of solutions can be brought forward in order to minimize intermittency impacts. One solution is large-scale battery energy storage, but this can be an expensive route to ensuring reliability. Another solution is demand flexibility where aggregated, behind-the-meter loads are shifted to align when the renewables are generating. This approach can both lower peak demand and ensure that a greater percentage of demand is fulfilled by renewable generation. Further, this will reduce the need for both the capacity of firm resources, such as natural gas, as well as lower the amount of fuel used by these resources further lowering total costs.

Also, the need for generating resource installations is going to increase not only because of existing plant retirements and the shift toward green energy, but also because of predicted load growth. Figure 1 below from DOE's Pathways to Commercial Liftoff: Virtual Power Plants Report shows that between now and 2030 there will be 140GW of generation retirements. Additionally, there will be 60GWs of peak load growth equating to a capacity need of 200GWs by 2030.

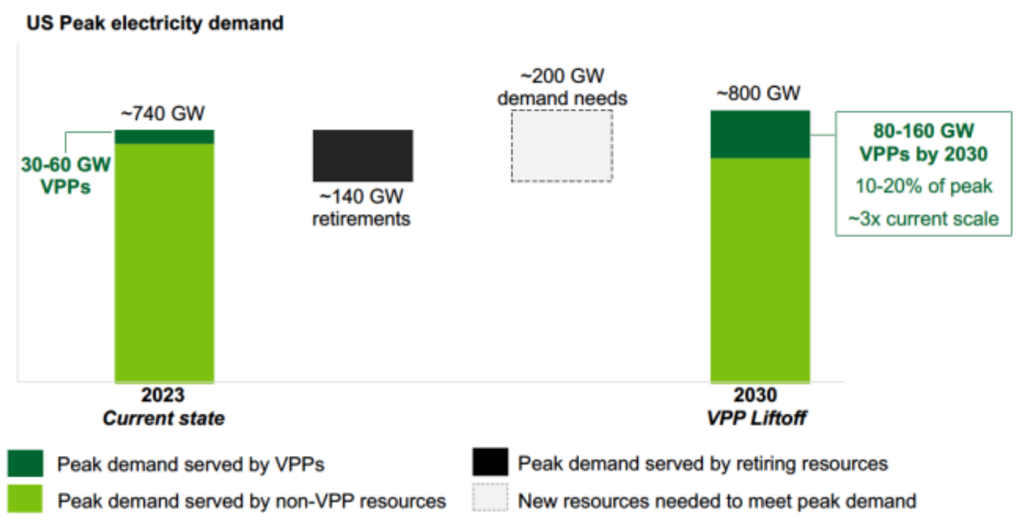

Figure 1. Generation needs and VPP potential. (Downing et al. 2023)

This load growth is primarily driven by three factors. The first is the rapid addition of data centers to the grid to accommodate the demand for increased computing power and artificial intelligence (AI) along with increases in industrial load. These are driven by the passage of the federal Bipartisan Infrastructure Law and the Inflation Reduction Act (Wilson and Zimmerman 2023). The second is the rapid growth of electric vehicles which will see over $500B in investment by 2030 in Figure 2 below. The third is the electrification of heating through air source heat pumps which grew about 11% in 2022, overtaking the sale of gas furnaces.(IEA 2024)

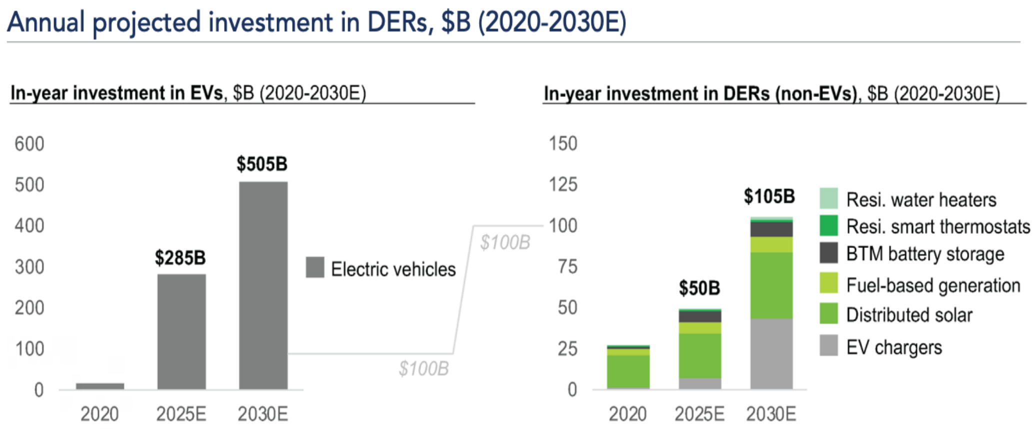

Figure 2. DER growth in the US through 2030. (Downing et al. 2023)

Existing Energy Burden

The average household in the US spends about 3.1% of their income on energy utility bills. This rises to 8.1% for low-income households which can be seen in blue on the left in Figure 3 below. Over 25% of households in the US experience high energy burden, defined as greater than 6% of income, and 67% of low-income households experience high energy burden. There are a number of drivers for high energy burden including leaky homes, old equipment, old equipment controls, lacking education on best practices to keep bills down, and other higher priority things to worry about in the home than energy usage. (Drehobl, Ross, and Ayala 2020). Both the Low-Income Home Energy Assistance Program (LIHEAP) and the Weatherization Assistance Program (WAP) are two programs specifically for low-income customers but are unable to address the entirety of the low-income problem. LIHEAP, for example, provides assistance to approximately 6 million households a year while over 30 million are facing a high energy burden.(Mariam 2024) Any program, utility, state, or federal that helps address high energy burden should be considered and adopted to help address this very large problem.

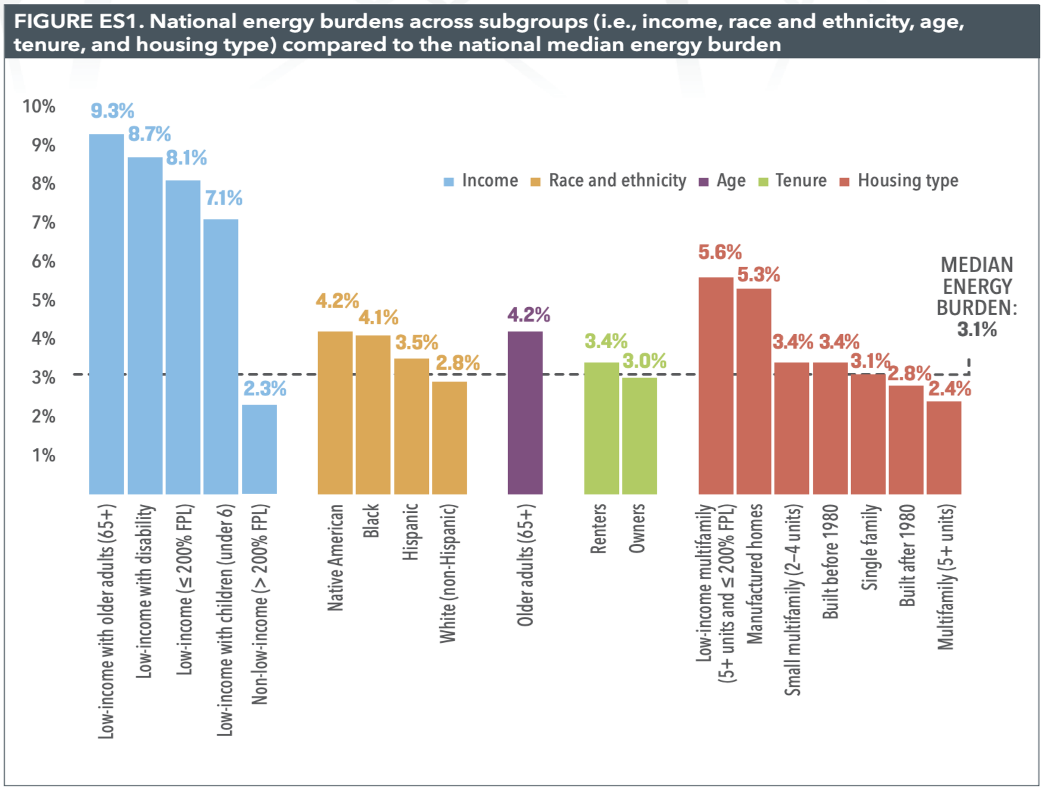

Figure 3. Energy burdens by subgroup. *Source:* (Drehobl, Ross, and Ayala 2020)

Trends on Utility Low-income Program Spending

The most recent data indicates that utilities on average spent $8.2M each on low-income programs in 2015 which grew to $9.6M in 2019, a 17% increase. (Morales and Nadel 2022). This is approximately 25% of federal LIHEAP funding which was approximately $3.7B in 2019.(LIHEAP 2019) Anecdotal evidence suggests that, in recent years, state utility commissions are directing their utilities to spend even more on low-income programs. For example, the low-income program minimum spend requirement for Consumers Energy in Michigan in 2022 to qualify for a financial incentive was $8.16M (Michigan Public Service Commission 2022). In 2025, it will rise to $9.35M (Michigan Public Service Commission 2024). The increased focus on utility spending in this segment is a good opportunity to also expand to low-income demand flexibility programs.

Smart Thermostat Demand Response Programs

Smart Thermostat Demand Response, where the smart thermostat is adjusted up or down automatically from utility DR program event triggers to turn on or off the central air conditioning unit or central heating system in the home, is one of the most common demand flexibility programs today in the market. These programs enroll customers typically one of two ways. One, by offering an enrollment incentive at the time of purchase of a smart thermostat, on a utility's online marketplace, for example. This is typically called Demand Response Pre-Enrollment (DRPE). Or two, if the customer already has the thermostat installed, a utility can offer an enrollment incentive through email outreach, on a program website, or through the Original

Equipment Manufacturer (OEM). This is typically called a Bring-Your-Own-Thermostat (BYOT) program. Additionally, at the end of a summer cooling or winter heating season, a participation incentive is given for participating in the program and not overriding too many demand response events. These incentive amounts typically total around $100 to $150 between the upfront enrollment incentive and the ongoing participation incentive which is typically received every season that a customer remains in the program. These demand response programs are usually run by electric utilities, though third-party models are starting to become more prevalent particularly in states like California. (McPhail 2022)

Marketing and outreach for enrollment in demand response programs typically target households that either already have a smart thermostat or would be likely to purchase one based on publicly available data such as income or home value. As such, those most likely to enroll in a demand response program fall in the $50,000 - $74,999 income bracket (Kaczmarski, Jones, and Chermak 2022). This study surveyed smart thermostat demand response participants and isolated determinants of participation. It is likely that this income bracket has sufficient funds to expend on non-primary household items instead of solely on food, housing costs, childcare, vehicle expenses, etc. Also, it is likely that higher income households don't view the incentive amount as worth the effort as they don't necessarily need it.

Scope

This paper first explores what the bill and energy burden reduction a household could see by incorporating the demand response program participation incentive to determine how much of an impact this could have on a low-income household. Second, the peak-load impact is compared across a typical household and that of a low-income household. Third, the prevalence of central cooling by income level is explored along with thermostats and finally, smart thermostats. Fourth, thermostat setpoints are analyzed by income level for the summer season and what the potential could be for energy and peak-demand savings. Fifth, home size is analyzed, and cooling and energy usage amounts are calculated to determine typical electricity costs by income level. Finally, utility cost tests are looked are discussed to determine where energy burden benefits would be accounted for.

Methodology

The foundation and conclusions of this paper are informed by analysis that utilizes several data sources and approaches to quantify impact. First, potential energy burden impact is analyzed looking at typical energy bills among median and low-income levels. Then a typical DR incentive is applied, comparing the percentage and total dollar impact across each segment. Second, peak-load impact is analyzed by creating a simple comparison between a low-income and a typical home. To quantify this, assumed typical AC hourly run-time is applied along with the typical AC unit size. Then DR event performance is assumed across each segment and the resulting kW amount is found. Event and non-event performance can then be compared across low-income and typical homes. Third, the EIA conducts a survey every five years of homes including a host of questions to gather information on housing type, home characteristics such as heating source, energy usage patterns, and household demographics. The microdata from the EIA Residential Energy Consumption Survey (RECS) 2020 survey is also published and was distilled down to discern the penetration levels of central AC units, thermostat, and smart thermostat prevalence by income level. Fourth, EIA RECS Microdata was also used and parsed down to discern summer temperature setpoints by income greater than and less than $40k per year. Fifth, The RECS Survey also has consumption and expenditure data broken down by end use including air conditioning. This data at the time of this analysis was not yet available with the 2020 survey so the 2015 data was used. By further analyzing this data we can determine the amount of cooling BTUs needed per square foot by income level. From this data set we also know the typical home size by income level and can then quantify the total cooling need, the corresponding kWhs needed for this cooling, and finally the total annual cooling cost. The total kWhs and resulting cooling costs can then be calculated.

Literature Review

In the Field Program Example and Program Design Considerations

One known low-income specific smart thermostat demand response program wasimplemented by Mississippi Power Company (MPC). It was a one-year pilot program that began in 2021 with 79 customers enrolled but continued into 2022 because of challenges with customer enrollments due to the COVID-19 pandemic and Hurricane Ida (Mississippi Public Service Commission 2021). In 2023 the Mississippi Public Service Commission issued Distributed Generation Rules, which required Mississippi Power Company to provide an incentive to residential customers for battery storage devices and to enroll them into a demand response program. MPC planned to launch a thermostat and battery demand response program in 2023 but did not include mention of a low-income demand response program in its 2023 Energy Delivery Plan (Mississippi Public Service Commission 2022) nor for 2024 (Mississippi Public Service Commission 2023). The reported program results are shown in Table 6 below. Due to enrollment challenges, the pilot never reached full implementation.

Table 6. Mississippi Power Company's Low-Income Smart Thermostat Demand Response Pilot Program Results

Year	Number of Participants	Annual kWh Savings	kW Savings	Program Expenses	kW Savings per Participant
2021	79	69,948	21	$25,997	.27
2022	19	22	7	$83,444	.37

(Year 2021 (Mississippi Public Service Commission. 2021))
(Year 2022 (Mississippi Public Service Commission 2022))

The MPC program was designed similarly to a standard smart thermostat DR program but there were a few important distinctions. The first was that qualification for enrollment in the program wasn't based off individual income but rather that of the census tract or zip code. The residential areas that qualified were based on the federal poverty guidelines and 200% of Area Median Income (AMI).

A second distinction from typical DR programs was that free, professional installation of the smart thermostat, which was also free, was provided if requested by the customer. Also, with the site visit, free LEDs were also given to the customer.

A third distinction, not necessary for low-income DR programs, was that on non-DR days an energy efficiency algorithm incorporating typical thermostat temperature setpoints and outdoor air temperature run to generate additional energy efficiency savings by turning up the temperature set point by small amounts at certain times during the day, which delivers additional energy savings above what a smart thermostat will deliver on its own.

Finally, this program offered a $25 incentive up front for enrolling in a program and $100 for every 12 months a customer stayed in the program and didn't override more than 20% of the events, disable connectivity, or move. This program ran across both summer cooling as well as winter heating seasons. The upfront incentive with this program was lower than typical upfront incentives for DR programs whereas the $100 incentive at the end of the year is higher than comparable programs.

A second known example is a low-income smart thermostat demand response pilot program proposed by Consumers Energy in Michigan. This program was slated to kick-off in the summer of 2022 (Michigan PSC 2022, U-21224*)* but no program information has been filed yet with the Michigan Public Service Commission on the results or findings from the program. However, the program was proposed in two phases, the first of which included an analysis on low-income customers participating in existing, non-low-income specific, demand response programs. They found that participating low-income customers in the smart thermostat DR program saved on average $6.45 (3.3%) on their monthly bills. Additionally, they found that these customers had between 60% and 75% of the peak load reductions as non-low-income customers. (Michigan PSC, U-21233)

Results

Analyzing Energy Burden Impacts of a Demand Response Incentive

The incentive amounts for demand response programs are typically of a size that they will have a measurable impact on the household's energy burden levels, particularly in a low-income household. As illustrated in Table 1 below, the typical electric bill in the US in 2022 over the course of a year was approximately $1,600. The median income in 2022 was $75,149 (U.S. Census 2024) while the Federal Poverty Level in 2023 for a family of 2 was $19,720. (HealthCare.gov 2024) By adjusting these numbers slightly for simplicity, we arrive at typical energy burden levels of low-income and non-low-income households of 8.1% and 2.1% respectively, we can then add on a typical DR incentive of $100. This reduces the energy burden of the low-income household by .4% to 7.6% while the non-low-income household drops .2% to 2.0%. This shows us that the $100 DR incentive amount can have a larger impact on energy burden for a low-income customer than a customer who earns more. While the impact is not massive, it can be a part of a group of measures that helps alleviate energy burden in this population segment. Additional benefits outside of the DR incentive are described later in this paper. Also, this paper did not focus on other quantifiable benefits but the free smart thermostat can further aid in lowering a household's energy by providing approximately 8% energy savings or approximately $50 per year on heating and cooling bills on its own. (EnergyStar 2024)

Table 1. Energy Burden Scenario

Effect of DR Incentive on Energy Burden	Low-income Household	Non-Low-Income Household
Typical Annual Bill Total	$1,600	$1,600
Typical Income per Year	$19,800	$75,000
Energy Burden - Normal	8.1%	2.1%
Typical DR Incentive per Season	$100	$100
Average Annual Bill - After DR Incentive	$1,500	$1,500
Energy Burden - After DR Incentive	7.6%	2.0%
Percent Difference	0.5%	0.1%

Analyzing Peak-Load Impact Across Typical and Low-Income Households

An additional reason why DR programs don't typically target low-income households is that the load shift performance achieved, measured in kilo-watts (kW), typically is lower than that of a non-low-income household. This can be due to a number of factors from the building's characteristics to measurement and verification approaches. Oftentimes low-income homes are older with more air leaks, have poorer insulation, and have inefficient, older AC units. (Drehobl, Ross, and Ayala 2020) All of these can result in the AC unit running much more in any given hour during the summer months.

Measurement and Verification can also present an issue particularly concerning baselines. There are a number of approaches to quantifying savings for DR programs, but one common practice is using a randomized control trial where a set number of customers participating in the DR program do not receive DR events. This is known as the control group. The customers who do receive the DR events are known as the treatment group. The data from the control group is then used to inform the kW baseline to compare event performance to for customers in the treatment group. However, if there is a low-income household in the treatment group, their savings will be compared to the baseline which is made up mostly of typical homes. Usually this won't be done individually but rather across the entire treatment group which in this case, the low-income household will drag down the average kW savings of the treatment group. This means from a program performance perspective, it's typically not beneficial to have low-income households in a non-low-income DR program particularly because participation by a low-income household is much more random and not guaranteed that there will also be an equivalent proportion in the control group.

However, if the low-income household was compared to a control group home that was also low-income and more similar, the kW savings resulting would be more accurate as well as higher. This is shown in the table below in a simple scenario looking at a low-income home that is poorly insulated with an older AC unit and comparing it to a typical home with a more typical AC unit.

- **HVAC Run Time:** HVAC run times can vary widely depending on temperature, humidity, and indoor temperature setpoint. We'll use a basic example where on a hot summer day, a typical home's AC unit runs for 40% (24 minutes) of one hour and compare it to a low-income home where the AC unit runs for 60% (36 minutes) of one hour.

- **AC Unit Size:** Typical AC unit sizes in the US averages about 3kW. (TCL Industries Holdings Co. 2024) We will keep this the same for simplicity as it's likely that the low-income household AC unit is sized larger due to the inefficiencies of the home and that the typical household's AC unit is sized smaller per square foot because the home is more efficient, but because their home size is typically larger (more on that to come) they'll roughly equal out in this simple example.
- **Amount of Load Shift:** For this analysis we will assume that a smart thermostat DR program can shift 80% of a customer's load outside of a DR event window, which tend to average about two hours in length but can extend from one to four hours on average. Because there are few low-income DR programs in existence it is difficult to say what the actual DR performance would be. From one known program (discussed in the Literature Review section) and generally expected poorer performance from a leaky home, 40% of load being shifted is a reasonable estimate to take here.
- **Typical kW Load:** This then shows us that a poorly insulated home uses on average 1.8kW (3kW multiplied by 60%) during a hot summer afternoon when a DR event is likely to occur. A typical home on the other hand uses 1.2kW (3kW multiplied by 1.2kW).
- **kW Load During DR Event:** If we apply the expected load shift expectations, average kW use during a DR event drops to 1.08kW for the poorly insulated home. The typical home drops to .24kW.
- **Results:** This is a .72kW load reduction for a poorly insulated home while it's a .96kW reduction for the typical home, a .24kW difference.
- **Results with Incorrect Control Group:** Also, if the low-income, poorly insulated home's kW reduction in this example is compared to the 1.2kW baseline of the typical home, we see that the load reduction drops to .12kW. This level of savings can be challenging to make work economically which shows the importance of having low-income households compared against other low-income households.

This simple scenario shows us that while less than a typical household, there is still a load reduction that can be achieved with a low-income demand response program.

Table 2. Sample Comparison of Peak Load Shift Potential

Summer kW Shift Comparison in Inefficient LMI Home vs. Efficient Non-LMI Home	Low-Income Home/Older AC Unit	Typical Home/AC Unit	Difference
Assumed Typical AC Run Time: Hot Day (% of hour)	60%	40%	20%
Assumed Typical AC Unit Size (kW)	3	3	None
Assumed Typical DR Program Performance (% of load shifted)	40%	80%	40%
Average kW Used: Non-Event, Same Home, Same Time Period	1.8	1.2	0.6
Average kW Used: DR Event, Same Home, Same Time Period	1.08	0.24	0.84
Average kW Reduction: DR Event, Same Home, Same Time Period	0.72	0.96	-0.24
Average kW Reduction of LMI HH in Non-LMI DR Program w/ Control Group	0.12	n/a	n/a

Analyzing Low-income Household Opportunity to Adopt a Smart Thermostat

The majority of households in the US have central AC units but that percentage climbs as income rises. This can be seen in Table 3 below from calculations from EIA RECS data. This trend extends to thermostats and is even more prominent with smart thermostats where less than 4% of homes with income levels below $40k per year have one. While other programs focus on equipping low-income households with new equipment such as a heat pump for both heating and cooling, there is a big market opportunity to enroll homes that already have a central cooling system but do not yet have a smart thermostat.

Table 3. Air conditioning in U.S. homes, by household income, 2020, Percent of Houses within Income Range

	<$5,000	$5,000–$9,999	$10,000–$19,999	$20,000–$39,999	$40,000–$59,999	$60,000–$99,999	$100,000–$149,999	$150,000 or more
All homes	4%	3%	8%	19%	16%	22%	13%	14%
Central AC (incl. heat pump)	44%	44%	49%	61%	67%	72%	77%	79%
Has thermostat	71%	73%	78%	85%	90%	92%	94%	95%
Smart or internet-connected thermostat	3%	2%	3%	4%	7%	11%	16%	26%

Analyzing Temperature Setpoints by Income Level

The EIA RECS data also includes a question on what temperature individuals normally set at various times such as when someone is home or away or what the nighttime temperature is set at. There is potentially bias in these survey responses but assuming the data is roughly accurate, by parsing the data down by incomes above and below $40k per year in Table 4 below, we can see that slightly lower-income households set their summer temperature at or below 73 degrees when someone is home. Further, even more low-income households leave their temperature set at or below 73 degrees during the summer when no one is home. This is counterintuitive to what we may expect a low-income household to have their temperature set at because a lower temperature set point equates to a higher energy bill. This could be because the AC unit is undersized and can't keep up with the cooling demands of the home, so the occupant turns the thermostat down even further hoping that it brings the temperature down faster. This also causes the AC unit to then run longer after the temperature cools in the evening hours and drops the temperature in the home below that originally desired—resulting in greater energy bills.

Coupling this with the fact that these homes are likely to be less well insulated means they are likely using substantially more energy than they would if their temperature was set higher. This means that these households are likely to benefit from a smart thermostat, particularly with the home and away capabilities and the energy efficiency impact. Further, given the right communication about what to expect with a DR event, the load shift potential could be higher than originally expected. For example, during a DR event, the thermostat will be set to 74 by the DR provider. If the thermostat is originally set to 68 degrees by the occupant, there are 6 degrees for the temperature to rise in the home. But if the thermostat is set originally to 72 degrees, there are only 2 degrees for the temperature to rise to 74 degrees before the AC turns back on so the occupant doesn't become too uncomfortable and opt-out of the program. This could mean that low-income households could achieve greater load reductions than originally expected because of the lower set points typically chosen.

Table 4. Temperature Set Points by Income Range Derived from EIA RECS Data

Percent of Homes within Income Range	Income <$40k	Income >=$40k
Summer indoor daytime temperature when someone is home: <=73 degrees	61%	59%
Summer indoor daytime temperature when someone is home: >73 degrees	39%	41%
Summer indoor daytime temperature when no one is home: <=73 degrees	52%	43%
Summer indoor daytime temperature when no one is home: >73 degrees	48%	57%
Summer indoor temperature at night: <=73 degrees	67%	67%
Summer indoor temperature at night: >73 degrees	33%	33%

Analyzing Cooling Costs by Income Level and Home Size

Further analyzing the EIA RECS Microdata we can quantify the cooling amount per square foot by income level. Next we can look at typical home size by income level and arrive at a total cooling amount needed by income level. From this we then can calculate a typical annual cooling cost by using the average cost of electricity in the U.S. Table 5 below shows that lower income homes tend to be smaller in size and use slightly more energy per square foot. However, because of the smaller, the total cooling amount and thus total cost is quite a bit less than higher income homes. This can be seen in Figure 4 which shows the decreasing usage per square foot by income and the increase in total annual cooling costs by income.

Table 5. Cooling Amounts by Home Square Footage and Income

2015 annual household income	Cooling Btu per Sq. Foot	Avg. Sq Feet	Total Cooling BTU	Total kWh	Total Annual Cooling Cost (using $.149/kWh)
Less than $20,000	4,019	1,319	5,300,000	1,553	$231
$20,000 to $39,999	3,723	1,692	6,300,000	1,846	$275
$40,000 to $59,999	3,838	1,902	7,300,000	2,139	$319
$60,000 to $79,999	3,178	2,171	6,900,000	2,022	$301
$80,000 to $99,999	3,424	2,278	7,800,000	2,286	$341
$100,000 to $119,999	2,990	2,642	7,900,000	2,315	$345
$120,000 to $139,999	3,370	2,759	9,300,000	2,726	$406
$140,000 or more	3,140	3,089	9,700,000	2,843	$424

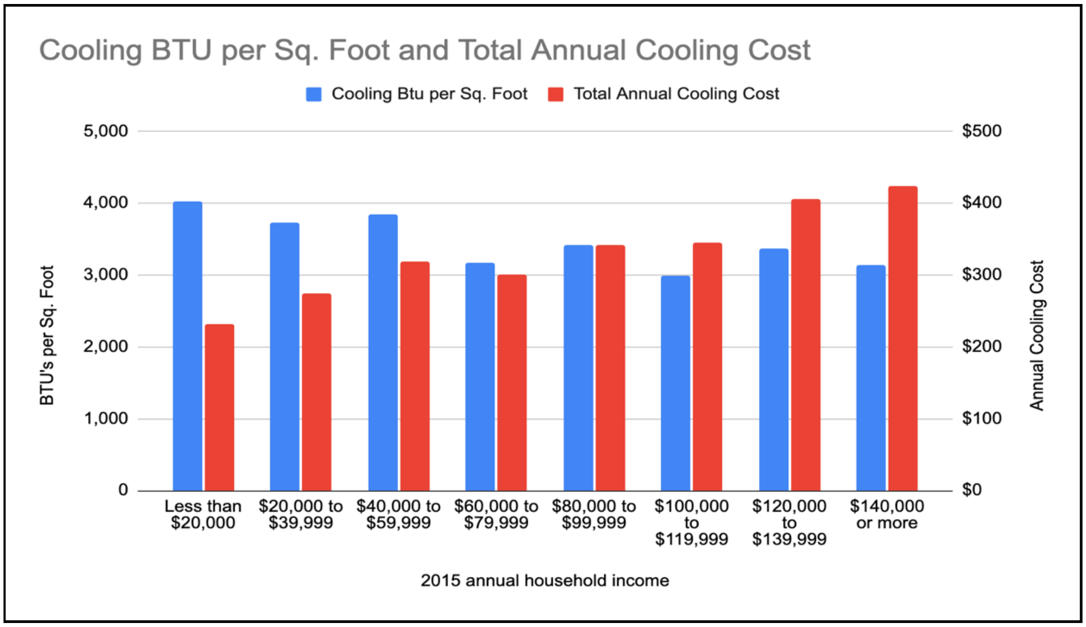

Figure 4: Total Cooling Use and Expenditures by Home Square Footage and Income

Discussion

Economic Considerations of Low-income Demand Response Programs

As discussed above, the kW shift amounts per household are likely to be smaller for low-income households than those of a typical household. This raises the question of whether the economics of a low-income DR program are worth the effort and does the program pass a cost/benefit test? If looked at purely from a $ per kW perspective, low-income DR programs should not be pursued because they will be more expensive. From a cost/benefit perspective the question then is what is included in the benefit side of the equation. Impacts on energy burden are included in the Participant Cost Test under Utility Incentives which are shown in Table 7 below.

Table 7. Cost test mapping by category and cost test. (Neme, Kushler 2010)

Table 1. Summary of Key Benefits and Costs Included in Different Tests

	Partic. Test	RIM Test	TRC Test	Societal Test	PACT Test
Benefits[4]					
Primary Fuel(s) Avoided Supply Costs		✓	✓	✓	✓
Secondary Fuel(s) Avoided Supply Costs			✓	✓	
Primary Fuel(s) Bill Savings (retail prices)	✓				
Secondary Fuel(s) Bill Savings (retail prices)	✓				
Other Resource Savings (e.g. water)	✓		✓	✓	
Environmental Benefits				✓	
Other Non-Energy Benefits			rarely[5]	in theory only	
Costs[6]					
Program Administration[7]		✓	✓	✓	✓
Measure Costs					
Program Financial Incentives		✓	✓	✓	✓
Customer Contributions	✓		✓	✓	
Utility Lost Revenues		✓			

Participant Cost Tests are not the primary measure in any state across the U.S. (NEEP 2024) as these are generally used to determine if a program is beneficial for an individual customer. This means that the impact on energy burden is not accounted for in the cost tests, typically the Total Resource Cost test or Utility/Program Administrator Cost test, that determine if a program should be implemented. This means that utilities should request to run low-income demand response programs under their low-income programs, not in their standard DR programs, because cost/benefit ratios greater than one typically don't apply. The costs and benefits however should be tracked to ensure efficient program delivery.

Integrating Low-Income Demand Flexibility Programs into the IRA Home Energy Rebate Program

The passage of the Inflation Reduction Act (IRA) in 2022 and the inclusion of the Home Energy Rebates Program, which includes the Home Efficiency Rebates and the High-Efficiency Electric Home Rebates, marked a major milestone for federal spending on home efficiency and electrification. These programs are going to accelerate the installation of building envelope measures such as air sealing and insulation as well as the installation of measures such as electric heat pumps. These will be driven by State Energy Offices (SEO) which are likely to hire implementation contractors to oversee the implementation of these programs opposed to utilities. These contractors will conduct energy efficiency upgrades and install new electric heat pumps (which include both heating and cooling).

These new electric heat pump loads will be unmanaged when they are installed meaning the local utility is going to have new electric loads that they don't have visibility into or load control signals for. Effectively managing these loads is going to be imperative as more and more homes electrify with more and more technologies both to maintain reliability at the distribution level but also at the system level. Low-income homes are no exception and should also be incorporated into demand flexibility programs. However, the data for what homes received what upgrades will live with the contractors, Home Rebate Program implementors, and potentially the SEOs but utilities likely won't have access to this data. To effectively leverage this federal spending and enroll customers who receive heat pump installations into demand response programs, programs or data need to be connected. Right now, as these measures are installed, utilities are blind to which customers have installed a heat pump. This means utilities will still have high education and marketing costs to reach and enroll customers into a DR program. In a perfectly connected world, during the sale process of the heat pump, the customer should also be offered enrollment into their utilities demand response program. If this offering can't be connected to the point-of-sale, the data on which customers purchased what needs to be shared with utilities so they can then directly market to and enroll these low-income households into demand response programs. Doing so will allow for substantially more low-income customers to receive load flexibility program incentives to further reduce their energy burden. This is a primary goal of the IRA, to lower costs for low-income households, and not providing easy pathways for low-income customer participation in load flexibility programs will be a missed opportunity to further reduce energy burden as well as will further drive increases in load growth and thus electricity prices.

Conclusion

Energy burden remains a significant challenge for utilities, government, and society more broadly and it will only become more important to address as energy costs continue to rise. We need to use all the tools and programs at our disposal to help customers reduce this burden including enrolling low-income customers into demand response programs as the incentive to participate can have a measurable impact on energy burden. All ratepayers are paying into these DR programs and while they do deliver savings across all ratepayers through avoided energy, capacity, transmission and distribution, and other costs, these avoided costs do take time to materialize on customer's bill. This is due to lengthy resource planning cycles, long construction timelines, and then lengthy rate cases where the savings in the end comes back to the customer. The participation incentive can be an additional way to have non-low-income customers pay to help reduce the energy burdens of low-income households directly through their participation in a demand response program. Some may view this as a role government should play and not utilities, but utilities in many states already have requirements placed on them by their state regulatory commissions to spend on low-income programs. However, these expenditures can also generate additional avoided costs through the load shift resulting from the DR program across all ratepayers.

Implementing demand response programs so they include low-income customers will be an additional tool to help lower energy burden in this customer class particularly as other programs and initiatives such as the IRA Home Rebate Program begin to expand and take off while also helping utilities manage this new load.

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