Addressing Energy Burden

Introduction

The U.S. Department of Energy (U.S. DOE) defines *energy burden* as "the percentage of gross household income spent on energy costs. In some areas, depending on location and income, energy burden can be as high as 30 percent. Of all U.S. households, 44 percent, or about 50 million, are defined as low-income."[1] Energy burden disproportionately affects low-income households and marginalized communities because members of these groups often live in older homes and buildings and don't have the same access to renewable energy and weatherization opportunities. The national average energy burden for low-income households is 8.6 percent, which is three times higher than the ~three percent energy burden for non-low-income households.[2] However,

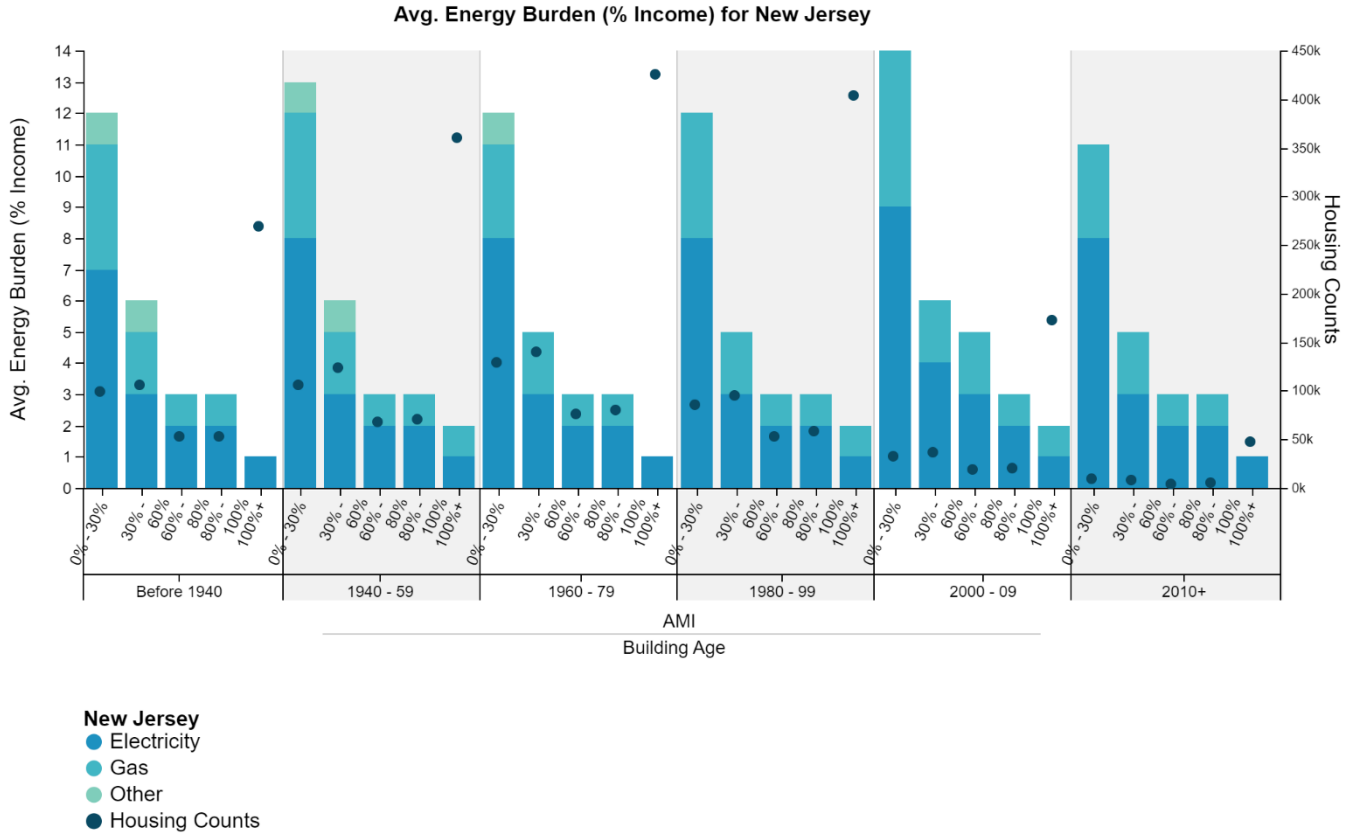

Figure 1: Avg. Energy Burden (% Income) for New Jersey

[1] Low-Income Community Energy Solutions. Department of Energy. Source: https://www.energy.gov/eere/slsc/low-income-community-energy-solutions

[2] Low-Income Energy Affordability Data (LEAD) Tool. Department of Energy. Source: https://www.energy.gov/eere/slsc/low-income-energy-affordability-data-lead-tool

in some cities, households can experience energy burden far higher than the national average. In a report published by ACEEE, it found that low-income households in six cities have a greater percentage of high energy burden than the national average (25 percent): Birmingham, Alabama (34 percent); Detroit (30 percent); Riverside, California (29 percent); Rochester, New York (29 percent); Atlanta, Georgia (28 percent); and Philadelphia, Pennsylvania (26 percent). Residents of manufactured homes have 71 percent higher energy burdens than average households. Households in multifamily (5+ unit) buildings have 23 percent lower burdens than average households, but low-income households in these same buildings have burdens 81 percent higher than average. The energy burden for households belonging to older adults (65+) is also 36 percent higher than the national median household's energy burden.[3]

In states around the country, households with a lower area median income (AMI) experience a significantly higher energy burden than households with a higher AMI (see Figure 1).[4]

Area Median Income (AMI)

The area median income is the midpoint of a region's income distribution – half of families in a region earn more than the median and half earn less than the median.

Renters are also more likely to live in older buildings and experience disproportionately higher energy burden due to old insulation, lack of air sealing, and low electrical capacity.

The purpose of this brief is to look at energy burden across the spectrum of building types and ages and highlight the technical aspects of what contributes to a household being energy burdened. Many states have utility programs that help remediate energy burden by providing home energy assessments, discounted weatherization, and high-efficiency HVAC systems (heat pumps, VRFs, etc.). These programs, however, can be improved so that they address the issue of energy burden more holistically and help make low-income and marginalized communities more resilient to destructive weather events, extreme heat/cold, and the other impacts of climate change.

Energy Burden Causes

Energy Burden Cause: Old Insulation or Lack of Insulation

Lack of adequate insulation in older homes is one of the leading causes of higher energy usage and utility costs. Homes and buildings that are poorly insulated cannot retain heat as well during winter heating months nor keep in cool air during summer cooling months. Also, older homes without attic insulation bleed heat as hot air rises out of the roof. This combination of lack of attic insulation and old insulation throughout the home or apartment building makes it difficult for households to maintain appropriate living temperatures. Inspectors and third-party energy raters can use heat mapping to visually see the heat loss in uninsulated and poorly insulated homes (see

[3] Report: Low-Income Households, Communities of Color Face High "Energy Burden" Entering Recession. ACEEE. Source: https://www.aceee.org/press-release/2020/09/report-low-income-households-communities-color-face-high-energy-burden

[4] Low-Income Energy Affordability Data (LEAD) Tool. Department of Energy. Source: https://www.energy.gov/eere/slsc/maps/lead-tool

Figure 2). Energy burdened households pay far more to stay comfortable, which creates a financial strain that can exacerbate other issues.

Figure 2: Thermographic Inspections

However, addressing insulation in older homes can be difficult because homes built before the 1960s were built without modern moisture barriers in the form of house wraps. House wraps are weather-resistant barriers that act as a shell between the exterior wall and interior wall assembly to keep out rain and other moisture.

Insulating without addressing moisture issues can lead to the formation of mold and rot. Mold can create an unhealthy indoor environment by affecting indoor air quality. Mold can cause allergic reactions and acute respiratory stress in individuals that have asthma and other respiratory illnesses. Rot caused by moisture can open up breaches in the wall or roof that allow outdoor weather into the home or building and exacerbate energy loss. All of these issues caused by moisture can worsen the energy burden for households living in poorly insulated homes.

In addition to energy loss created by uninsulated spaces, insulation efficiency has significantly improved since many older homes were built. Insulation efficiency is measured by the *R-value*, which is defined as "*an insulating material's resistance to conductive heat flow [that] is measured or rated in terms of its thermal resistance or R-value -- the higher the R-value, the greater the insulating effectiveness.*"[5]

Insulation R-values required for the most recent building energy code, the 2021 International Energy Conservation Code (IECC), are at R-30 for walls and R-60 for ceilings in climate zones 4-5 (*for more NEEP resources on 2021 IECC, please visit: https://neep.org/2021-iecc-modules*). The 2021 IECC has the most significant increase in energy efficiency in two code cycles. However, many older buildings and homes were built long before the first IECC edition was published in 1998, meaning that the energy burden in low-income households and marginalized communities is closely tied to the lack of insulation efficiency requirements for older buildings and homes.

Energy Burden Cause: Air Leakage in Homes and Building

Similar to poor insulation, air leakage results in high energy usage and utility costs. Older homes and buildings that are drafty leak air through doors, windows, and spaces in the walls/floors/attics that haven't been properly air sealed or have old air sealing. According to the Environmental Protection Agency's (EPA) ENERGY STAR program, 25-40 percent of energy use is lost through air leakage for heating and cooling.[6]

[5] Insulation. Department of Energy. Source: https://www.energy.gov/energysaver/insulation

[6] AIR SEALING: Building Envelope Improvements. Environmental Protection Agency's ENERGY STAR Program. Source: https://www.energystar.gov/ia/home_improvement/home_sealing/AirSealingFS_2005.pdf

Also similar to insulation, newer building energy codes require a better air change rate or ACH (3 ACH50 for climate zones 3-8 in the 2021 IECC)[7], which measures how many times the volume of air is changed within a space per hour. The lower the ACH of a building or home, the more airtight and/or well-controlled by mechanical ventilation. Older buildings and homes with high ACH because of poor air sealing subject households to a higher energy burden.

Air leakage can also make homes uncomfortable and unhealthy. Moisture and volatile organic compounds (VOCs) in the air can enter homes and buildings through air leaks. Low-income and marginalized communities, especially those located near industrial infrastructure, are especially vulnerable to the health risks of air leakage. During destructive weather events like hurricanes, leaky homes can become more inundated by storm surges and rain while also incurring more damage due to pressure differentials created by the storm inside and outside of the home through air leaks.

Energy Burden Cause: Low Electrical Capacity

Older buildings and homes, especially those built during and before the 1950s, often have lower electrical capacity and knob-and-tube wiring, unlike buildings and homes regulated by modern building codes. Knob-and-tube wiring, as the name suggests, uses ceramic tubes and knobs affixed to the inside of a wall to wire a building. Sections or portions of wires are left exposed to dissipate the heat conducted by electricity. However, this can make them vulnerable to moisture and lead to fires if the issue is not addressed before additional insulation is added inside the walls. Knob-and-tube wiring also isn't grounded, meaning that it can't handle high voltage appliances that use three-pronged outlets.

The existence of knob-and-tube wiring and generally low electrical capacity in older homes can put an energy burden on households. Walls can sometimes not be insulated until the knob-and-tube wiring is removed, which is expensive and disruptive, especially for low-income households. The lack of grounding systems and low electrical capacity can also prevent households from electrifying their HVAC systems by switching to high-efficiency heat pumps or other appliances like induction cooktops.

Conclusion and Recommendations

Overall, energy burden is a significant issue for low-income households and communities that have historically been denied access and resources to financing renovations and other programs to improve their buildings and homes. Communities containing buildings with insulation and air sealing that predate building energy codes are at a higher risk of energy burden due to the lack of energy efficiency requirements. However, many utilities and energy efficiency programs in the region have begun to address these issues through utility weatherization programs and directed state and federal funding.

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[7] Key Changes in the 2021 IECC for the Northeast and Mid-Atlantic. Northeast Energy Efficiency Partnerships. Source: https://neep.org/sites/default/files/media-files/2021_iecc_one-pager_.pdf

As states and communities continue to address the issue of energy burden and its acute impact on low-income and marginalized communities, creating more collaboration between programs is essential. Funding and resources should be paired effectively so that households don't fall through the cracks when weatherizing their homes affordably.

If there are barriers like knob-and-tube wiring or mold removal, programs should have a streamlined way of addressing those issues that don't place additional time commitment and cost burden on households already experiencing energy burden. By holistically addressing energy burden in a way that utilizes all available resources and strategies effectively, communities at a higher risk due to climate change can become more resilient to its future impacts.

U.S DOE Weatherization Assistance Program (WAP)

The Weatherization Assistance Program (WAP) reduces energy costs for low-income households by increasing the energy efficiency of their homes, while ensuring their health and safety. The program supports 8,500 jobs and provides weatherization services to approximately 35,000 homes every year using U.S. DOE funds.

However, in some cases WAP assistance can't help households with energy if mold, infestations, broken windows, and holes in roofs are not addressed first. These barriers fall outside the scope of the program and create roadblocks for energy burdened households experiencing these issues. Flaws in the system like this should be addressed internally so that the costs of fixing pre-weatherization issues aren't externalized for households that can't afford them.

Resources

https://www.energy.gov/energysaver/insulation

https://www.energy.gov/eere/slsc/low-income-community-energy-solutions

https://www.energy.gov/eere/slsc/low-income-energy-affordability-data-lead-tool

https://www.aceee.org/press-release/2020/09/report-low-income-households-communities-color-face-high-energy-burden

https://neep.org/2021-iecc-modules

https://www.energy.gov/energysaver/thermographic-inspections

https://www.energy.gov/energysaver/insulation

https://www.energystar.gov/ia/home_improvement/home_sealing/AirSealingFS_2005.pdf

https://www.energy.gov/eere/wap/weatherization-assistance-program