

**Energy Poverty in the United States: Structural Deficiencies Affecting Millions of Residents Across the Nation**

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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## **Introduction**

The issue of ‘energy poverty’ has become significant globally. Energy poverty has many definitions, but for the purpose of this analysis it is when a household spends more than 10% of their household income on electricity (Lee & Shepley, 2020). Currently on a global scale, 1.1 billion people do not have adequate access to electricity, and are therefore living in energy poverty (Lee & Shepley, 2020). The majority of the electricity in the United States is controlled by geographic utility monopolies that supply commercial, industrial, and residential electricity (Burke & Stephens, 2018). The structure of electrical utilities’ distribution traditionally consists of a centralized power plant and distribution center. Electrical utility companies dominate regionally in most areas of the United States. In most parts of the country, the consumer does not have a choice in which electrical company they will use. Large institutions that use a significant amount of energy are able to negotiate their electrical rates, while individual residences do not have negotiation power.

The question arises of why energy poverty still exists in a wealthy and developed country, such as the United States. Coupled with that question is how this problem can be remedied. In order to answer these two pertinent questions, this paper will analyze what energy poverty has looked like in the U.S. in the past, what reform is being done to ameliorate this problem, and where the shortcomings of these policies are. Energy poverty in the United States is significant. Lower income households are spending a greater portion of their income on electricity bills than higher income households. The majority of those living in energy poverty are also below the poverty line, however there is also a large portion that is above the poverty line. This disparity disproportionately affects minority communities (Bednar & Reames, 2020). Many people are having to forfeit money that would otherwise be spent on food and medicine in

order to pay their expensive energy bills. This analysis will be looking at which communities have been affected both historically and currently, and why. In addition, it will address the legislature in place that influences rates of energy poverty.

### **Part I: The Scope and Boundaries of Energy Poverty in the U.S.**

The term energy poverty can be interpreted and defined in multiple ways. The World Economic forum decided upon a global, broad definition of the phrase to be “the lack of access to sustainable modern energy services and products” (*Energy Poverty*, n.d.). The term sustainable is very important in this definition because in order to be an adequate energy supply it must be reliable and constant. Without a consistent supply of electricity, many households do not have access to water or cooking facilities. There are also more specific definitions for the term such as when a household spends more than 10% of their household income on energy utility bills (Lee & Shepley, 2020). This metric of 10% of household income is used in much of the literature that will be addressed in this analysis. While many global organizations define energy poverty, the U.S. government, however, does not have any formal definition (Bednar & Reames, 2020). Energy insecurity is also another term that is used interchangeably with energy poverty. Since the definition of energy poverty can be so broad, this analysis will address people who spend a substantial portion of their income on their energy bills, people who restrict their energy consumption because they cannot afford it, and people who face insufficient connection to the energy grid.

Energy poverty is often an under addressed issue that is not commonly thought of in the context of poverty as a whole. However, energy poverty can have a significant impact on people’s health and wellbeing. The digitized era of the COVID-19 pandemic has increased the reliance of society on electricity which in turn is a reliance on connectedness to the energy grid.

Education for all grades have been moved to online remote classrooms, so having access to the internet and electricity is highly important today for the future of younger generations. Thus, energy poverty can be an inescapable and vicious cycle for vulnerable communities (Drehobl et al., n.d.).

Another important concept that is relevant to the discussion of energy poverty is the term energy burden. An energy burden is the portion of gross income that a household has to forfeit in order to keep their energy supply on (*Low-Income Community Energy Solutions*, n.d.). The national average energy burden is 3%, however for low income households it averages approximately 9%. In addition to the increased reliance of energy supply, the COVID-19 pandemic has caused an economic recession which has led to a greater national energy burden. The median energy burden for African American households is 43% higher than that of non-Hispanic white households (Drehobl et al., n.d.).

## **Part II: Electricity as a Dividing Force**

This analysis will address energy poverty through the context of Emmanuel Mesthene's work, "The Role of Technology in Society". The overarching intention of Mesthene's work is to illustrate the dichotomous relationship between society and technology (Mesthene, 1969). This will be used to analyze how electricity can be both a beneficial and detrimental part of society. A prominent argument in Mesthene's work is how technology can be both good and bad. On the one hand technology can bring about new opportunities for the individual and society. On the other hand, technology also generates new problems for the individual and society. These problems stem from the fact that technological advancements interfere with existing social structures, in turn, practices that were achieved by means of older social structures can no longer be achieved in that way (Mesthene, 1969). This duality of technology can be seen in society's

relationship with electricity. Almost all aspects of society are reliant on electricity, which allows the majority of society to prosper. However, accessing basic needs such as water, heating, and sanitary systems is included in this reliance on electricity. This means that people without access to electricity also cannot meet their basic needs.

Mesthene outlines how advancements in technology bring about new private profit motives for corporations. These motives should be controlled by governments in order to reduce the consequences that can arise from technological change (Mesthene, 1969). The major policy that mitigates the consequences associated with the supply of electricity to individuals is the Low-Income Home Energy Assistance Program (LIHEAP) (Murray & Mills, 2014). LIHEAP, as it will be referred to in this paper, is currently the largest energy assistance program in the U.S.. In response to the rapid increase in energy prices in the late 1970s, LIHEAP was first enacted by Congress in 1981 as Title XXVI of the 1981 Omnibus Budget Reconciliation Act. The intention of the federal program was to protect low income households and the energy utility companies by providing states with block grants to be distributed to households that cannot afford their energy bills (Murray & Mills, 2014).

LIHEAP provides both annual block grants to states and emergency contingency funds to states during times of emergencies, such as natural disasters. There are three distinct ways that the LIHEAP block grants provide aid to households in need of assistance. The first way is through financial assistance during critically hot or cold months of the year. This accounts for the largest portion of the program; 53% of the total allocated funds go to heating assistance, and 3% go to cooling assistance (Perl, n.d.). The second way that LIHEAP assists low-income households is by providing emergency aid to families who have had or will imminently have their electricity shut off. This accounts for 19% of the overall funding. The third part of LIHEAP

aid is providing funds for minor household upgrades to repair or renovate old systems, insulation problems, and weather stripping. These repairs help to improve the energy efficiency of low-income housing, which in turn can reduce energy bills (Perl, n.d.).

It can be prohibitively difficult to qualify for federal eligibility in LIHEAP. A family must qualify for one of these two: their household income must be at or below 150% of the poverty line or 60% of the median household income in the state (*Report to Congress Low Income Home Energy Assistance Program (LIHEAP)*, 2020). According to federal guidelines, states are allowed to set even lower limits than these which make it even harder for households to access necessary aid. The reason for this is that the block grants are not evenly distributed among the states. The distribution of grants to states has remained the same since the original formula was derived in 1981. This formula was based on seven factors according to the 2019 LIHEAP congressional report. These factors are, “

1. Home heating expenditures;
2. Residential energy expenditures;
3. Heating degree days;
4. Population with income equal to or less than 125 percent of the poverty income guidelines;
5. Households with incomes equal to or less than the Bureau of Labor Statistics' lower living standard income level;
6. The previous-year's allotments; and
7. The previous-year's recipients.

(*Report to Congress Low Income Home Energy Assistance Program (LIHEAP)*,  
2020)

In addition to these classifications that LIHEAP candidates must meet, many are disincentivized by the application process. One example of this is in Massachusetts where annually there is a four-day window of time per year in which households can apply for energy assistance through LIHEAP (Hernández, 2016).

According to Diana Hernandez in her publishing ‘Understanding ‘energy insecurity’ and why it matters to health’, energy poverty encompasses three main dimensions: economic, physical, and behavioral. Her study focused on 72 participants in Dorchester, Massachusetts who were at or below 150% of the 2008 poverty level, and experienced housing insecurity such as hazardous conditions or frequent moves. Many of the participants spoke of living with a constant threat of energy supply shut offs and an inability to pay their energy bills. In the current literature and policies, the economic aspect of energy insecurity is the most commonly addressed of the three dimensions of energy insecurity. This is the financial hardship associated with energy bills that consume a large portion of a household’s income. The participants spoke of paying portions of their energy bills, but being unable to pay them in full, which resulted in an ever increasing debt to the utility companies (Hernández, 2016).

The second dimension of energy poverty that Hernandez highlights is the physical dimension. This consists of structural deficiencies that lead households to have higher energy bills. These infrastructure problems can consist of inefficient appliances, outdated heating and cooling systems, and poor insulation (Hernández, 2016). The part of LIHEAP that focuses on energy efficiency renovations aims to fix these problems, however there are still many who bear the burdens of these deficiencies. Frequently in low rent areas, landlords have few incentives to improve the efficiency of their units, which leaves the tenants to deal with the burden of high utility bills. Another pertinent issue has resulted from the switch from oil to gas systems in many

areas of the country. Gas is seen to be more energy efficient and desirable, however, in some low rent buildings these systems are improperly installed resulting in gas leaks and hazardous living conditions. In some cases when gas pipes burst, financial constraints prevent people from being able to fix them, causing harmful gases to be released into homes and disruption from heating and cooling in the home (*One in Three U.S. Households Faces a Challenge in Meeting Energy Needs - Today in Energy - U.S. Energy Information Administration (EIA)*, n.d.).

Hernandez addresses a third component of energy insecurity which is behavioral. This is when people change their behaviors in order to reduce their energy consumption and thus their energy bill. Many participants acknowledged that they used their energy sparingly by adjusting their thermal comfort so they do not turn on the heat or cooling. One household recounted that they turn the heat off at night since they are warmed by blankets when they sleep. Other practices include not turning lights on during the day and not using the air conditioning. Another common practice is partial payments on electrical bills in order to prevent a shut off, but this practice accumulates a growing amount of debt without the prospect of payoff. Many participants in Hernandez's study reported feeling despair and pessimism that they would never be able to pay off their electricity debt. Another sentiment expressed by some of the study participants was that their aid would be rescinded if they began working. This led them to a predicament of depending on the state and keeping their lights on, or being employed and potentially having their energy shut off (Hernández, 2016).

Hernandez's study participants also expressed grievances for the state of their children. Some with children who had medical conditions, were able to receive extra aid, however the medical circumstances were reviewed every 90 days. These time consuming processes consumed much physical and emotional effort of the families in need of assistance (Hernández, 2016).



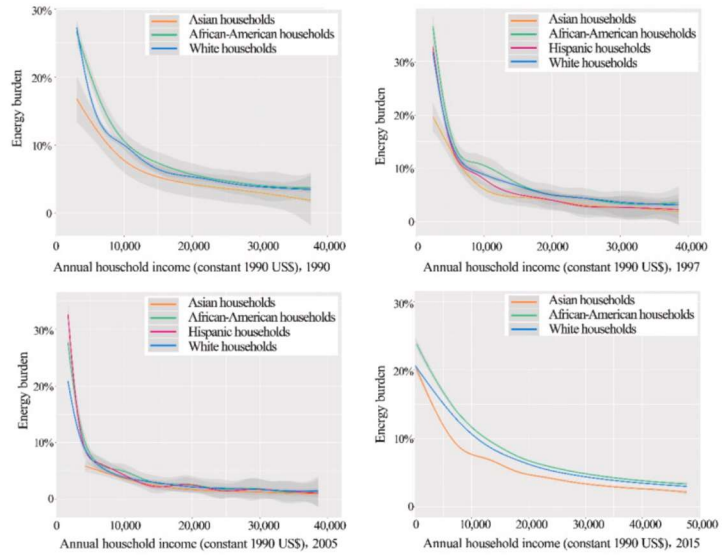


Figure 1: Household Energy Burden Statistics Divided by Race and Ethnicity (Wang et al., 2021)

In addition to the difficulty in applying for and receiving adequate aid from LIHEAP, energy issues disproportionately affect African American communities. In a study conducted by Qiang Wang et al. it was determined that within the same income bracket, African Americans have higher rates of energy poverty than any other race, as can be seen in Figure 1. The study looked into which factors in particular caused this racial disparity and found that African Americans relied most heavily on electricity as their primary source of energy. When electricity prices rose, African Americans were negatively affected, meanwhile other groups that relied more on their natural gas consumption, saw lower rates of energy poverty since natural gas prices were not as high (Wang et al., 2021).

### Part III: Energy Poverty as a Systemic Problem caused by Structural Deficiencies

The issue of energy poverty is not purely an economic issue. There are several structural systems that exacerbate the issue of energy poverty for many people in the United States. The primary issue is deteriorating infrastructure in many low-income areas. For low-income renters,

the amount of energy per dollar spent is the lowest out of any income bracket because the weatherization and efficiency of their units are also the lowest (Hernández & Bird, 2010). One reason for this is that low-income renters tend to have less knowledge about energy efficiency than upper- and middle-class renters, and therefore landlords are not pressured by tenants to invest in increasing energy efficiency of their units. The landlords are in control of the majority of the aspects of the apartment that consume the most energy such as the appliances and building shell. However, the landlord does not pay the energy bills, so their natural intention is to supply the appliances and the building shell at the lowest cost, which is usually not the most energy efficient. This leaves the renter to be stuck paying higher electricity bills and in no control of the efficiency of the unit they live in (Hernández & Bird, 2010).

The interdependence of modern society and energy utilities is complex and ever growing. Technology has infiltrated almost every aspect of our lives, and with that comes a dependence on electricity. According to the U.S. Energy Information Administration, by 2040, energy usage is set to increase by 28%. Climate change has exacerbated energy dependency with the increase in natural disasters and unprecedented temperatures. The national policies aimed at addressing energy poverty are already not adequately ameliorating the problem. LIHEAP, as discussed earlier, is the major energy assistance program to exist in the United States. Due to dropping energy prices and budgetary spending costs, the federal government has discussed reducing the budget allocations to the program, and even talked of cancelling the program. However, even if energy prices drop, the low-income households are still facing structural inefficiencies causing them to have higher energy burdens than other groups. As of 2015, one in three households in the U.S. reported to the Energy Information Administration that they cannot afford their energy

bills while maintaining adequate use (*One in Three U.S. Households Faces a Challenge in Meeting Energy Needs - Today in Energy - U.S. Energy Information Administration (EIA), n.d.*).

In order to promote energy equity, fair pricing and structural efficiency issues must be addressed. According to Mesthene, this responsibility lies on the federal and state governments to provide aid to communities facing energy vulnerability (Mesthene, 1969). Working towards energy equity will provide more households the abilities to maintain safe living situations and provide themselves with basic needs.

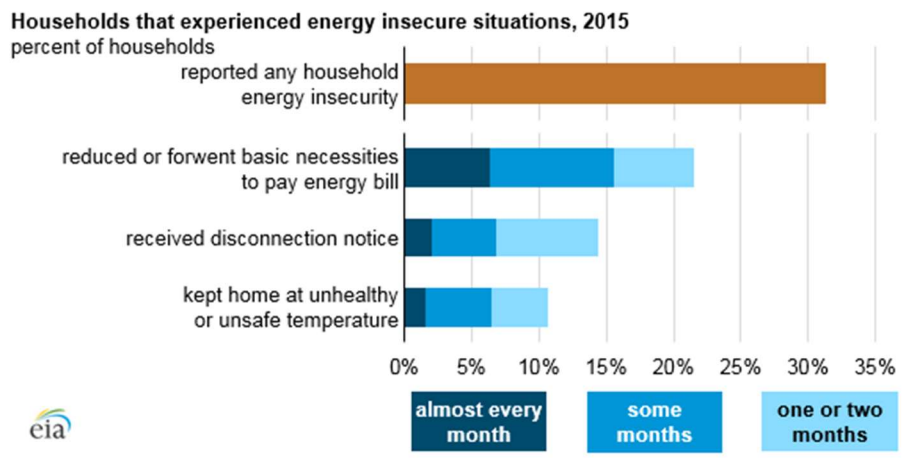


Figure 2: 2015 Household Energy Burden Statistics characterized by household type (*One in Three U.S. Households Faces a Challenge in Meeting Energy Needs - Today in Energy - U.S. Energy Information Administration (EIA), n.d.*)

As can be seen in Figure 2, households are sacrificing thermal comfort and necessities in order to be able to pay their energy bills and to reduce their energy debt (*One in Three U.S. Households Faces a Challenge in Meeting Energy Needs - Today in Energy - U.S. Energy Information Administration (EIA), n.d.*). Comprehensive energy assistance programs that target specifically the structural issues of weatherization and efficiency are necessary in order to reduce the number of people in energy poverty in the United States.

## Conclusion

Energy poverty poses a large problem that must be addressed on a global scale. However, it is imperative that energy poverty is addressed in developed nations, especially the United States. Energy poverty is just one of the systemic hurdles that minority and impoverished communities face on a daily basis. Without improved efficiency and weatherization, low income families will continue to pay higher amounts of money for the energy they use. Additionally, a more equitable energy grid, that includes greater subsidies for vulnerable populations, is another solution to the problem of energy poverty in the U.S.. With the rise of sustainable energy sources, there will be greater energy source diversification which poses the opportunity for time based pricing (Charlier et al., 2018). This is the idea that during off peak hours, which typically occur during the night time, energy rates are lower. This would present the opportunity for energy vulnerable populations to run appliances at off peak hours in order to reduce their energy bills. While this would not solve the behavioral dimension of energy insecurity, it could ameliorate the economic dimension.

## References

- Bednar, D. J., & Reames, T. G. (2020). Recognition of and response to energy poverty in the United States. *Nature Energy*, 5(6), 432–439. <https://doi.org/10.1038/s41560-020-0582-0>
- Burke, M. J., & Stephens, J. C. (2018). Political power and renewable energy futures: A critical review. *Energy Research & Social Science*, 35, 78–93. <https://doi.org/10.1016/j.erss.2017.10.018>
- Charlier, D., Risch, A., & Salmon, C. (2018). Energy Burden Alleviation and Greenhouse Gas Emissions Reduction: Can We Reach Two Objectives With One Policy? *Ecological Economics*, 143, 294–313. <https://doi.org/10.1016/j.ecolecon.2017.07.002>
- Drehobl, A., Ross, L., & Ayala, R. (n.d.). *An Assessment of National and Metropolitan Energy Burden across the United States*. 80.
- Energy poverty*. (n.d.). Habitat For Humanity. Retrieved May 10, 2021, from <https://www.habitat.org/emea/about/what-we-do/residential-energy-efficiency-households/energy-poverty>
- Hernández, D. (2016). Understanding ‘energy insecurity’ and why it matters to health. *Social Science & Medicine*, 167, 1–10. <https://doi.org/10.1016/j.socscimed.2016.08.029>
- Hernández, D., & Bird, S. (2010). Energy Burden and the Need for Integrated Low-Income Housing and Energy Policy. *Poverty & Public Policy*, 2(4), 5–25. <https://doi.org/10.2202/1944-2858.1095>
- Lee, J., & Shepley, M. M. (2020). Benefits of solar photovoltaic systems for low-income families in social housing of Korea: Renewable energy applications as solutions to energy poverty. *Journal of Building Engineering*, 28, 101016. <https://doi.org/10.1016/j.jobe.2019.101016>
- Low-Income Community Energy Solutions*. (n.d.). Energy.Gov. Retrieved May 10, 2021, from <https://www.energy.gov/eere/slsc/low-income-community-energy-solutions>
- Mesthene, E. G. (1969). Some General Implications of the Research of the Harvard University Program on Technology and Society. *Technology and Culture*, 10(4), 489–513. <https://doi.org/10.2307/3101569>
- Murray, A. G., & Mills, B. F. (2014). The Impact of Low-Income Home Energy Assistance Program Participation on Household Energy Insecurity. *Contemporary Economic Policy*, 32(4), 811–825. <https://doi.org/10.1111/coep.12050>
- One in three U.S. households faces a challenge in meeting energy needs—Today in Energy—U.S. Energy Information Administration (EIA)*. (n.d.). Retrieved May 10, 2021, from <https://www.eia.gov/todayinenergy/detail.php?id=37072>
- Report to Congress Low Income Home Energy Assistance Program (LIHEAP): An Assessment of the Program's Formula and Allocations of Funding Among States*. (n.d.). Retrieved May 10, 2021, from

[https://www.acf.hhs.gov/sites/default/files/documents/ocs/rpt\\_liheap\\_congressional\\_request\\_for\\_formula\\_analysis\\_fy2020\\_final.pdf](https://www.acf.hhs.gov/sites/default/files/documents/ocs/rpt_liheap_congressional_request_for_formula_analysis_fy2020_final.pdf)

Perl, L. (n.d.). *LIHEAP: Program and Funding*. 44.

Wang, Q., Kwan, M.-P., Fan, J., & Lin, J. (2021). Racial disparities in energy poverty in the United States. *Renewable and Sustainable Energy Reviews*, 137, 110620.

<https://doi.org/10.1016/j.rser.2020.110620>