BEFORE THE PUBLIC UTILITY COMMISSION

OF OREGON

UE 416

In the Matter of

PORTLAND GENERAL ELECTRIC COMPANY

Request for a General Rate Revision and 2024 Annual Power Cost Update

OPENING TESTIMONY

OF THE

COMMUNITY ENERGY PROJECT

June 13, 2023

BEFORE THE PUBLIC UTILITY COMMISSION

OF OREGON

UE 416

In the Matter of PORTLAND GENERAL ELECTRIC COMPANY Request for a General Rate Revision and 2024 Annual Power Cost Update	DIRECT TESTIMONY OF CHARITY FAIN

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I. INTRODUCTION

Q. Please state your name and position with Community Energy Project (CEP) and relevant experience.

A. My name is Charity Fain, and I am the Executive Director of Community Energy Project. I have included a description of my credentials in the attached Witness Qualifications Statement.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to address the rate revision proposal presented by Portland General Electric (PGE) for 2023, which would result in a significant increase of approximately 16% for residential customers starting in 2024. This rate hike would translate to an additional monthly cost of $15 for average multifamily residents and $23 for average single-family homes. Even for those that may be able to afford it over time, it will be difficult for customers to absorb this rate shock.

Energy insecurity affects a large number of Oregonians, causing cascading impacts to their health, well-being, and financial security. The purpose of CEP's testimony is to advocate for the interests of Oregonians, particularly low-income households and climate justice community customers, in response to the rate hike proposed by PGE in its opening testimony. By highlighting the potential impacts of energy insecurity on the health, well-being, and financial security of Oregonians, CEP seeks to ensure that equitable and energy justice considerations are upheld in this case.

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CEP's testimony aims to require the consideration of energy justice in all aspects of this rate case. In summary, energy justice refers to the goal of achieving equity in social and economic participation in the energy system, but also remediating burdens on those harmed in the past. It is characterized by the advancement of energy democracy, the alleviation of energy insecurity, the reduction of energy burdens, and the alleviation of energy poverty, including clean energy poverty.[1]

Achieving an appropriate level of equity will require exploring all options to reduce customer bills, maximize assistance, develop or leverage new sources to enhance energy efficiency, and restructuring regressive residential rates. CEP's goals here include:

1) Moving PGE's rate structure to one that caps a household's energy burden to six percent and avoids most disconnections by encouraging PGE and the PUC to explore long-term solutions rather than relying solely on band-aid measures like the IQBD program. Instead of applying temporary discounts to ever-increasing rates, CEP will urge re-designing rates or establishing a new rate class specifically designed for low-income customers. While CEP intends to move the low-income energy justice rate design discussion in this proceeding, CEP will, at minimum, seek an investigation for a new rate class that will enable the incorporation of the valuable perspectives and voices of other advocates and

[1] See generally, S. Baker, S. DeVar & S. Prahash, The Energy Justice Workbook, Section 1 – Defining Energy Justice, Initiative for Energy Justice (Dec. 2019), available at: ttps://iejusa.org/wp-content/uploads/2019/12/The-Energy-Justice-Workbook-2019-web.pdf.

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experts.

2) Increasing the discount levels offered in PGE's Income-Qualified Bill Discount (IQBD) program, to absorb whatever rate increase is achieved, recognizing the growing financial challenges faced by many customers and the resulting ineffectiveness of the current program.

3) Emphasizing the importance of energy efficiency initiatives, which can help mitigate the burden of increased energy costs for vulnerable households and pursue mechanisms to increase the resources devoted to deep home retrofits.

4) Lastly, addressing broader issues of procedural justice and accessibility within the context of the case. Recognizing the historical lack of equitable representation and meaningful involvement of marginalized communities in energy-related proceedings, CEP asks for some measures to foster more inclusive participation, and transparent and accessible processes.

II. ENERGY INSECURITY AND ENERGY JUSTICE

Q. Describe the concept of energy insecurity.

A. Energy is essential to meeting our basic needs: cooking, boiling water, lighting and heating, and is a prerequisite for good health.[2] As costs for residential heating, cooling and other household energy needs increase, they account for a higher percentage of

[2] World Health Organization . Fuel for Life: Household Energy and Health. WHO; Geneva: 2006. Available at https://www.who.int/publications/i/item/9789241563161.

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household budgets.[3] Energy insecurity or energy poverty is a public health threat and is extremely prevalent in the United States.[4] Energy insecurity is defined as the inability to adequately meet basic household energy needs.[5] For renters, landlords may not weatherize or invest in energy efficiency due to the high upfront costs, forcing renters to bear the financial burden of increased energy bills. When low-income, energy insecure households choose to defer utilities payments in order to prioritize other household expenses, such as rent or mortgage payments, they can enter a cycle of debt accumulation and payment deferral that puts them at an even greater risk of losing their home altogether.[6]

There are different aspects to energy insecurity. Economic energy insecurity is the disproportionate financial burden that imposes high energy costs on low-income households.[7] This economic insecurity is linked to financial hardship, and the prioritization of basic needs. Households often experience a "cliff effect" where they

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[3] D. Hernandez, "Understanding 'energy insecurity' and why it matters to health," :Soc Sci Med. 2016 Oct; 167: 1–10, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5114037/

[4] K. Jowers, et al., "Housing Precarity & the Covid-19 Pandemic: Impacts of Utility Disconnection and Eviction Moratoria on Infections and Deaths Across U.S. Counties," Nat'l Bureau of Econ. Research ("NBER"), at 3 (Jan. 2021), http://www.nber.org/papers/w28394.

[5] D. Hernandez, Supra, note 3.

[6] K. Jowers, et al., Supra note 4.

[7] D. Hernandez, Supra note 3.

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become ineligible for safety net benefits once they gain some form of employment, but they still lack the financial resources to experience full economic self-sufficiency.[8] Economic energy insecurity reflects not only the limited resources of the individual to pay for bills, but also the excessive cost for home energy needs. These costs accumulate as arrearages build up, when households are unable to pay their full bill balance. They also occur in cheap or subsidized housing that lacks adequate weatherization and energy efficiency appliances - causing high energy costs to heat homes or use other basic services.[9] Physical energy insecurity includes deficiencies in the physical structure of the home that impacts home heating, and increases energy costs - such as malfunctioning heating systems.[10]

Q. Would you explain why low-income individuals often have a high energy burden?

A. The answer starts with defining the term "low-income," because income is the primary lens by which a person qualifies for public assistance programs including utility benefits such as bill assistance, or bill discount programs. When creating a new program, defining the income threshold will have significant implications on who benefits from the service.[11] Defining this term should take into account service territory, equity and

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[8] *Id.*

[9] *Id.*

[10] *Id.*

[11] Community Energy Project, Defining and Verifying Low-Income Participants, https://www.communityenergyproject.org/wp-content/uploads/2021/11/Self-Verification-and-Income-Levels.pdf.

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access. If services are limited and highly sought-after, you may choose lower income guidelines to reach those most in need. If a program is new, niche, complicated, or serves a high number of participants, you may want to cast a wider net and increase the income guidelines.[12]

The experience of financial insecurity varies depending upon where a person lives. Common income thresholds include the federal poverty line, state median income, and area median income for a smaller area such as a county or city. CEP recommends using either state median income ("SMI") or Area Median Income ("AMI") depending on the program provided and its reach. SMI can provide greater advantage to areas with higher poverty rates across the state, but may put higher income urban areas with more expensive living conditions at disadvantage. If the program is city or county-wide, CEP recommends using AMI as that will most accurately reflect the needs of the community being served.[13]

In Oregon, 13% of people earned income below the federally defined poverty threshold, representing over half a million Oregonians, 134,000 of which are children.[14] People of

[12] *Id.*

[13] *Id.*

[14] Or. Dep't of Energy, 2020 Biennial Energy Report, at 92 (Nov. 1, 2020), https://www.oregon.gov/energy/Data-and-Reports/Documents/2020-BER-Energy-101.pdf at 94.

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color experienced double the rate of poverty as white Oregonians from 2014-2018. Approximately 156,000 people live on the edge of homelessness in Oregon, meaning they spend at least 50% on rent and have a range of risks that make their house insecure including—unexpected medical bills, a lay-off, utility shut-off, or a car repair.[15]

Additionally, a comprehensive study conducted in 2021 by United Ways of the Pacific Northwest and United for ALICE found that a significant portion of Oregonian families, specifically 744,985 households representing 44% of the population, are classified as ALICE, which stands for "Asset Limited, Income Constrained, and Employed." Essentially, these households fall into the category of either poverty or financial instability. Despite earning incomes that surpass the Federal Poverty Level, ALICE households often face the harsh reality of being ineligible for public assistance programs, making it challenging for them to meet their basic cost of living. The study also found that the number of financially vulnerable households in Oregon skyrocketed by a staggering 42,000 during the first 2 years of the pandemic, which translates to a 6% increase between 2019 and 2021.[16]

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[15] *Id.*

[16] UnitedForAlice.org, "ALICE in the Crosscurrents, Covid and Financial Hardship in Oregon, 2023 Report at 9 and 11. https://www.google.com/url?q=https://www.unitedforalice.org/Attachments/AllReports/23UFA_Report_Oregon_4.11.23_Final.pdf.

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Next, I would like to define the term energy burden, to help the Commission understand why low-income households experience financial stress when they pay for utility bills. Energy burden is the percentage of household income spent on energy and transportation costs, as an indication of energy affordability. Home energy burden specifically focuses on energy bills for a home in comparison to the total income of the household.[17] In Oregon, if a household spends 6% or more of their total income on energy bills for their home they are considered energy burdened, and if they spend 10% or more on energy bills - they are considered severely energy burdened.[18]

Of Oregon's total of approximately 1.5 million households, almost 400,000 Oregonian households struggle to pay their energy bills. The Oregon Department of Energy reported that about 25% of Oregon households are energy burdened. In addition, the 100,456 households that earn incomes below 50 percent of the Federal Poverty Level are severely energy burdened, and paid an average 23% of their annual income on home energy bills.[19] Further, a recent study published in the well-respected publication, Nature Energy, found that the Covid-19 pandemic has deepened the prevalence of energy insecurity nationwide among low-income households with indication of growing

[17] Or. Dep't of Energy, 2020 Biennial Energy Report, Supra note 14 at 92.

[18] *Id.* at 93.

[19] *Id.* at 94.

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disparities.[20]

The Oregon Department of Energy identifies four key drivers of home energy burden as including:

1) **Physical**: Housing age (older homes are less efficient), energy costs to heat and cool homes, building envelope issues (e.g. poor insulation, leaky roofs, inefficient heating and cooling systems, and inadequate air sealing), appliances and lighting efficiency, topography and location, and climate change creating weather extremes;

2) **Socio economic**: economic hardship due to persistent low-income, sudden economic hardship due to illness, unemployment or disaster, inability to afford upfront costs of energy efficiency investments, difficulty qualifying for financing options for energy efficiency investments, systemic inequalities related to race, income, disability or other factors;

3) **Behavioral:** informational barriers to access bill assistance and energy efficiency programs, lack of trust about investments or savings opportunities, lack of cultural competence in outreach and education, and increased energy use due to occupant age, number of people, health related needs or disability;

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[20] T. Memmott, et al., "Sociodemographic disparities in energy insecurity among low-income households before and during the COVID-19 pandemic," Nature Energy volume 6, pages 186–193 (2021), https://www.nature.com/articles/s41560-020-00763-9.

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4) **Policy related**: insufficient or inaccessible policies and programs for bill assistance, energy efficiency, and weatherization for low-income households, utility rate design that include high customer fixed chargers that limit customer ability to respond through energy efficiency or conservation.[21]

High home energy burdens may affect mental and physical health of families through increased financial stress, and can be an indicator of poor efficiency of a home. If homes are not heated and cooled properly or ventilated, they can contribute to asthma, respiratory problems, heart disease, arthritis, and rheumatism. [22]

Q. Describe the concept of energy justice in relation to this rate case.

A. Energy justice encompasses the equitable distribution of energy benefits and burdens, recognizing historical disparities and ensuring access to affordable, reliable, and sustainable energy for all.

Within this rate case, energy justice concerns are particularly relevant as they impact residential customers, who are disproportionately affected by energy-related policies. Frontline communities, low-income households, and vulnerable populations bear the brunt of energy costs, face challenges accessing affordable and reliable energy services, and are more susceptible to environmental and health impacts associated with energy

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[21] Or. Dep't of Energy, 2020 Biennial Energy Report, Supra note 14 at 94-95.

[22] *Id.* at 95.

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production and consumption.

PGE's proposed rate revision is the largest in twenty years, with a total increase of 16 percent. The proposals will have a disparate impact on energy justice community customers. State law and policy now requires the consideration of equity considerations in rates, identifies an environmental justice customer class and supports the use of classifications, tariff schedules, rates, bill credits, demand response and weatherization to address and mitigate energy burdens.[23]

PGE acknowledges that its rate changes should not disproportionately burden low income and otherwise vulnerable customers. Yet, PGE does not provide sufficient data or point to sufficient mechanisms to demonstrate this proposed rate change meets that goal. CEP intends to advance the mechanisms that can address and mitigate energy burden and energy insecurity through advocacy about rate design, pricing structures and other practices by PGE that will provide affordable energy for all environmental justice customers.

III. INCREASED ENERGY ASSISTANCE

Q. Why does PGE have a Income Qualified Bill Discount (IQBD) program for low-income customers?

[23] H.B. 2475, Sec. 7(1).

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A. Pursuant to HB 2475, utilities must consider "differential energy burdens on low-income customers and other economic, social equity or environmental justice factors that affect affordability for certain classes of utility customers[.]"[24] Considering these criteria, the Commission may authorize "may authorize classifications or schedules of rates applicable to individual customers or groups of customers[,]" otherwise known as differential rates.[25] H.B. 2475 was passed during the 2021 legislative session. The Commission set differential rates through a separate docket, Dkt. No. UM 2211, and Dkt. No. ADV 1365, and CEP is participating in those dockets.

Q: Describe PGE's IQBD.

A. For PGE's IQBD, the utility adopted a three tiered approach that is income dependent, which launched in April 2022. The company uses state median income ("SMI") as a qualifier for a bill discount, and provides discounts ranging from 15% to 25% depending upon need:

* For households earning 60% SMI, PGE provides a 15% discount on the total monthly bill.
* For households earning 45% SMI, PGE provides a 20% discount on the total monthly bill.
* For households earning 30% SMI, PGE provides a 25% discount on the

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24 H.B. 2475, Sec. 2.

25 *Id.*

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total monthly bill.

Q. Why do you think it's important to consider PGE's IQBD program in this rate case?

A. PGE must do more to address the significant energy burden extremely low-income customers face because PGE is proposing to increase residential bill rates by 16% in this general rate case. PGE's IQBD program as it stands does not address the additional burden that customers would have to face with these substantial rate increases. Therefore, PGE must offer steeper discounts to offset the additional energy burden on low-income customers. Without steeper discounts, in addition to including more tiers, PGE will fail to fulfill the goals laid out by PUC staff's baseline evaluation criteria to prioritize low-income customers with the highest energy burden.[26]

Q: Are you asking the PUC to change the structure of PGE's IQBD program in this proceeding?

A. Yes. PGE does not place a monetary ceiling on residential bills for low-income customers, but rather offers these customers a percentage reduction on their monthly payments. PGE's bill discount program, even with a proposed discount percentage increase of up to 40%, would defray the cost of the proposed bill increase put forward by PGE in this rate case.[27] However, low-income ratepayers already cannot afford the

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[26] https://edocs.puc.state.or.us/efdocs/HAH/um2211hah114912.pdf

[27] On May 25, 2022, PGE staff announced during an IQBD program outreach stakeholder meeting that they plan to increase their discount levels up to 40% from their original 25% level.

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existing rates of PGE's service. Further, because the proposed bill assistance only provides a percentage reduction, not a cap on total bill amount, low-income customers remain vulnerable to future rate increases.

Therefore, CEP proposes that PGE offer one or two additional tiers with steeper discounts, available to those at 10-25% SMI. Without detailed data, it is difficult to suggest the discount amount for any additional tiers, but we hope to see PGE release more data explaining how various discount levels provide meaningful impact to households with different SMI levels, especially customers with the highest energy burden. Therefore, we would like PGE to conduct a low-income needs assessment (LINA) to gain detailed insights into the energy needs and challenges faced by low-income households.

We would also like PGE to expand eligibility requirements to include minimum wage earners in Portland working 40 hours a week (above 60% SMI). Capping SMI requirements at 60% is problematic as many of Oregon's BIPOC communities reside in the Portland area where the minimum wage is higher due to the higher cost of living in the region.

Furthermore, CEP proposes that PGE implement up to a 90% discount in their IQBD, as

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is proposed in the Avista's UTC 2022 General Rate Case.[28] This discount would provide substantial, and much needed, relief for customers experiencing extreme energy poverty and alleviate their energy burden.

Q. Would you summarize CEP's recommendations for PGE's IQBD?

A. Yes, CEP recommends PGE improve its IQBD by:

1) Conducting a LINA to gain comprehensive insights into the energy needs and challenges faced by low-income households;

2) Introducing additional tiers with steeper discounts;

3) Considering a 90% discount level;

4) Expanding eligibility requirements to better support vulnerable customers and address energy poverty.

IV. THE NEED FOR EFFICIENCY RELATED BURDEN REDUCING INITIATIVES

Q. What are some other initiatives that can reduce energy burden?

A. As the study prepared by the Commission, the Oregon Department of Energy, and the Oregon Housing - the 2018 "Ten-Year Plan" - states, there are several ways to reduce energy burden: energy efficiency (including heating, cooling, appliances, weatherization, lighting, and behavioral measures), energy assistance, renewable energy, reduced utility

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[28] See, generally Washington Utilities and Transportation Commission dockets UE-220053, UG-220054, UE-210854 (Consolidated).

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rates.[29] We discuss energy assistance above and reduced utility rates below. The Commission should consider whether we are achieving our energy efficiency and renewable energy goals and support the design of mechanisms within this proceeding to advance those goals.

Q. Why is weatherization one of the most effective solutions to provide relief for energy burdened Oregonians?

A. Low income and environmental justice community customers are more likely to live in less efficient housing, causing higher energy burdens. Such customers also have limited access to energy efficiency resources. [30]

Weatherization service typically refers to programs that address the efficiency of the building envelope and building systems (such as unit heating, cooling, lighting, windows, and water heating) through energy audits and upgrades. Housing interventions that promote weatherization are among the most effective options to improve health outcomes because they improve housing conditions, lower bill costs, and thereby beneficially improve the socio-economic determinants of health. Studies show that investments in weatherization improve housing conditions, reduce fuel costs, and increase comfort and a

[29] S. Beaulieu, et al., Ten-Year Plan: Reducing the Energy Burden in Oregon's Affordable Housing, Or. Dept of Energy, Or. PUC, and Or. Housing & Community Services Dep't, at 2-3; www.oregon.gov/energy/Get-Involved/Documents/2018-BEEWG-TenYear-Plan-Energy-Burden.pdf.

[30] See Drehbol, Ross, Ayala, "How High Are Household Energy Burdens, An Assessment of National and Metropolitan Energy Burden accross the United States," (2020) (submitted herewith as exhibit 103) at 11.

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sense of pride in one's home, which then lead to direct and indirect improvements in general health, respiratory health, and mental health. Improved health outcomes mean less sick time away from school and work, helping parents and children stay productive and thriving.[31] Addressing energy insecurity through home weatherization has the potential to break chronic cycles of hardship along this path of disadvantage.

Home weatherization is also an investment in climate resilience because it makes a dwelling less vulnerable to temperature extremes. Particularly for energy insecure Oregonians, home weatherization can mean the difference between eating a healthy meal and heating one's home. Reducing the need for home heating reduces associated energy costs, lowering the financial stress on low-income ratepayers. Comprehensive weatherization makes homes more climate resilient, and provides lasting benefits to low-income customers that reduce energy consumption and total bill costs.

Q. How does home weatherization make Oregonians more climate resilient and reduce climate emissions?

A. As climate change impacts the planet, it will create more extreme weather events in Oregon that require significant home energy expenditures for temperature regulation - heating in winter and cooling in the summer. Weatherizing homes makes them more resilient to these temperature extremes because it changes building envelope efficiencies

[31] *Id.* at 25.

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to reduce heat loss in the winter, while also keeping buildings cooler in the summer. These changes reduce energy consumption by low-income customers, and make homes more comfortable to live in and less expensive. These changes also have the potential to significantly reduce greenhouse gas emissions. The Ten Year Plan prepared by the Commission, the Oregon Department of Energy, and the Oregon Housing and Community Services found that investing in weatherization and energy efficiency in low-income homes would reduce greenhouse gas emissions by 396,000 metric tons of CO2eq annually and would cumulatively save low-income rate payers $114 million annually.[32]

Q. Why is it important to consider low-income weatherization programs in this rate case?

A. Weatherizing homes of low-income ratepayers would reduce their energy burdens and would make their monthly electricity utility expenses more affordable. In E.O. 20-04, the Governor tasked the Commission with considering energy burdens. Similarly, in H.B. 11 2475, the Legislature tasked the Commission with considering energy burdens on low-income communities when setting rates.[33] Further, as previously stated, the Oregon Legislature specifically authorized the Commission to mitigate energy burdens through weatherization:

> In addition to comprehensive classifications, tariff schedules, rates and bill credits, the Public Utility Commission may address the

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[32] S. Beaulieu, et al, Supra, note 29 at iii.

[33] H.B. 2475, Sec. 2.

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> mitigation of energy burdens through bill reduction measures or programs that may include, but need not be limited to, demand response or weatherization.[34]

PGE imposes a Public Purpose Charge on all ratepayers in Oregon to pay for energy efficiency and low-income weatherization programs. It is important for the Commission to analyze and review these programs in this proceeding because they can lower energy burdens for low-income customers, making gas utility rates more affordable.

Q. What concerns do you have about the efficacy of PGE's efficiency and weatherization expenditures?

A. Through its Public Purpose Charge, PGE does fund some weatherization work but more should be done. CEP recommends adding to the relevant schedules or designing a new one to increase efficiency charges/funding and implementing a program specifically designed for weatherization services with an emphasis on attic and wall insulation and fuel switching (which can be an energy conservation measure and a health and safety measure). The program should provide the services even where these investments do not achieve the 1:1 cost efficiency ratio or, alternatively, when they do achieve such by using a social cost of carbon input. Given that Oregon Housing and Community Services Department's Guidelines on Low-Income Weatherization have not been updated in ten years, this rate case presents an important opportunity to provide a new path toward weatherization that will consider technological, social, economic, scientific and political

[34] H.B. 2475, Sec. 7(1).

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advances and changes.

V. EXPLORING LONG-TERM SOLUTIONS FOR EQUITABLE RATES

Q. How does CEP view PGE's current approach to addressing energy burden?

A. Portland General Electric's (PGE) current approach of relying solely on the Income Qualified Bill Discount (IQBD) program to address the issue of energy burden is, quite frankly, a "bandaid solution" to a more profound and persistent problem. In order to tackle this challenge effectively, CEP believes that PGE needs to shift its focus towards exploring long-term solutions that can actually address energy affordability in a sustainable and equitable manner.

Rather offering discounts that lose their effectiveness and purpose as rates rise year after year, CEP would like the PGE and the PUC to consider establishing a new rate class specifically designed for low-income customers. This approach would involve a comprehensive evaluation of cost allocation and a fair distribution of the revenue requirement among different customer classes. By creating a separate rate class, low-income customers could potentially benefit from lower rates that accurately reflect the costs associated with providing them with electric service.

CEP recognizes the complexities involved in rate design and the importance of fair cost allocation. While there may be concerns about potential manipulation of cost causation

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principles, it is crucial to address historic disparities and ensure that any new rate class is established based on a comprehensive understanding of the underlying factors contributing to the energy burden faced by low-income communities. This investigation would provide an opportunity to engage in meaningful negotiations and discussions to ensure that the allocation of costs is fair, transparent, and aligned with the goal of achieving energy justice.

Q. Does CEP expect the creation of a new rate class in this rate case?

A. Not necessarily. CEP's objective is not to establish a new rate class within the current rate case, but may advocate for rate re-design to reach these goals and others presented by the parties. CEP will certainly call for an investigation for the development of a new rate class, rate program or other rate re-design to be led by the PUC that involves the meaningful participation and input of various stakeholders, including advocates and experts in the energy justice space.

VI. PROCEDURAL JUSTICE AND ACCESSIBILITY

Q. What is the significance of procedural justice and accessibility in this rate case?

A. Energy justice encompasses equitable access to affordable and reliable energy services, sustainability, and addressing historical disparities in energy-related impacts. Procedural justice and accessibility - meaningful participation by those affected by decisions - is a part of the broader concept of energy justice and must have a critical role in rate revision cases at the PUC. It is necessary to ensure an equitable and transparent decision-making

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process that includes all stakeholders, especially the voices of communities impacted the most by rate cases, and a process that safeguards their interests. The lack of effective public participation and meaningful engagement in rate case proceedings has historically limited the ability of stakeholder, especially from frontline communities, to contribute to decision-making. PGE and the PUC must adhere to principles of procedural justice to demonstrate its commitment to fairness and justice, accountability and equitable outcomes.

Q. What are broader concerns related to procedural justice that are raised by this rate case?

A. Meaningful involvement of frontline communities is hardly available in rate cases because the proceedings are technical and legal. While some progress has been made through the passage of HB 2475, historically, there has been a lack of effective public participation and meaningful engagement in rate case proceedings. Therefore, emphasizing procedural justice and accessibility becomes crucial to actually achieving energy justice in regulatory spaces.

CEP requests that the Commission conduct public workshops throughout the proceeding aimed to inform the public of the relevant concepts and positions of the parties and allow for additional opportunities for public comment.

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Another step in the right direction would be to adopt a mechanism to at least ensure that the public hearing comments are brought forward to the negotiations. CEP recommends that PGE prepare a comprehensive matrix of public comments and provide an adequate responses to each. This could provide some additional modicum of transparency in the negotiation processes and opportunity to genuinely considered and incorporate the public comments effectively.

We also suggest that staff identity comments that have received insufficient response or consideration from PGE and seek further response or resolution. This, again, would helps provide transparency, and accountability and make the public hearing process more meaningful.

VII. SUMMARY OF RECOMMENDATIONS

Q. Please Summarize your recommendations.

A. At this time CEP respectfully recommends the Commission:

1) Apply principles of energy justice throughout the proceedings;
2) Enhance public participation by providing education and transparency though workshops and additional public comment opportunities;
3) Require PGE to respond to public comments and staff to ensure the consideration of the comment in the negotiations and decisions;
4) Require PGE to conduct a low-income needs assessment;

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5) Reject the proposed rate increase;

6) Alternatively, mitigate any rate increase impacts and otherwise reduce energy burdens for PGE's low-income and environmental justice communities by requiring:

a) An increase in the discount levels offered in PGE's IQBD

b) Provide additional investment and new mechanisms to achieve energy efficiency for environmental justice community and low-income customers

c) Identify opportunities to further mitigate energy burden and energy insecurity through rate design, pricing structures and other practices that will provide affordable energy for all environmental justice customers.

7) Initiate a broad and comprehensive investigation to generally consider how rate design, pricing structures and other practices could better address energy justice issues and specifically consider the development of an environmental justice rate class.

Q. Does this conclude your opening testimony?

A. Yes.

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WITNESS QUALIFICATION STATEMENT

NAME: Charity Fain

EMPLOYER: Community Energy Project

TITLE: Executive Director

ADDRESS: 2705 E. Burnside, Suite 112
Portland, OR 97214

EDUCATION: Bachelor of Arts, International Relations
The American University, Washington, D.C.

EXPERIENCE: I have over 25 years of experience building stronger communities in the US and around the world. As the Executive Director of the Community Energy Project ("CEP"), where I have been for almost nine years, I am responsible for the overall direction, leadership and management of the organization.

Community Energy Project, Inc. believes that everyone deserves a safe, healthy and efficient, home, regardless of income. CEP provides free home services focused on safety, health, and energy efficiency. We provide free community education and supplies, as well as direct home energy upgrades and repairs. All our services are made possible by partnerships with community members and service organizations, utilities, corporations, foundations, and government agencies. Through our work we hope to create a future where all people can afford to live in their homes with dignity, comfort, and safety. We believe in equitable distribution of resources, reducing barriers to entry, empowering everyone to be capable, reaching clients where they are, and reducing our environmental impact.

CEP has worked in residential weatherization, repairs and energy efficiency since 1979, and we continue to be committed to ensuring safe, healthy, and efficient homes, regardless of income. CEP began life in 1979 as a project of Responsible Urban Neighborhood Technology (RUNT) in response to the oil crises of the 1970's. A VISTA national service member offered the first workshops, teaching people practical energy conservation solutions like caulking and building temporary plastic storm windows. CEP incorporated in Oregon in 1987 and became a contractor with the City of Portland's Bureau of Housing and Community Development, offering training to low-income people through workshops and direct weatherization services to seniors and people with disabilities. Over time, we added workshops in water conservation and lead poisoning prevention. Currently, our workshops are open to people of all income levels.

Thanks to our community partners, we serve a diversity of clients. Fifty-nine percent of our clients are people of color, and 66% live at or below the 50% Median Family Income level. Twenty-four percent of the people served have someone in the household with a disability. The large majority, 74%, of our clients identify as women. Further, we've managed to provide the bulk of our services to renters, with 68% of our clients being renters, and 22% being homeowners. Further, 29% of our clients are over the age of 55.

CEP's programs teach people to weatherize their homes, and our direct install program provides weatherization and energy efficiency upgrades directly to low-income homeowners. I oversee staff who are experts in Home Performance and home repair who work with clients and contractors to make needed upgrades.

I also work closely with Energy Trust of Oregon. For example, I have served on the Diversity Advisory Council and the Foundational DAC. I also work with ETO staff to design new programs to better serve low-income customers. CEP's insights into the needs of low-income homeowners and renters for energy efficiency help ETO staff in the residential markets.

I have testified and provided written comments in various Commission dockets, including DSP (UM 2005) and COVID relief (UM 2114), and I was very active in community solar implementation and rulemaking (UM 1930). I have also testified before the Portland Clean Energy Fund's committee on low-income energy efficiency program design, and to the Portland City Council in support of the Home Energy Score program.

I have presented at a Home Performance Conference in Portland, at Commission DSP workshops, and an Efficiency Exchange conference. I just spoke this week at the Grid FWD conference on equity in DSP and grid innovation.

Attached hereto as Exhibit CEP/102 is a copy of my resume.

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CHARITY FAIN

EDUCATION: The American University, Washington, DC
B. A. International Studies, Russian Minor, *Cum Laude*

Professional Experience

Community Energy Project, 9/13-Present:
Executive Director
Serve as chief executive officer responsible for managing the affairs of the organization. Direct new program development in sustainability, energy efficiency, weatherization, solar and healthy homes for low-income, BIPOC and seniors. Direct advocacy efforts on climate and energy justice initiatives. Develop annual budget and oversee finances and accounting practices in accordance with non-profit organization best practices and legal requirements. Maintain internal administrative policies and procedures to carry out CEP programs and policies.

City Club of Portland, 6/08-9/12
Executive Director
Acted as chief executive officer responsible for managing the affairs of the organization. Developed annual budget and oversaw finances and accounting practices in accordance with non-profit organization best practices and legal requirements. Developed and promoted the visibility, image, and influence of the Club through positive community relations. Maintained internal administrative policies and procedures to carry out City Club programs and policies.

Internews Network, Bishkek, Kyrgyzstan,10/05-9/07
Country Director
Directed Kyrgyzstan-based activities under USAID funded media support programs including: a grants program, training program, media law advocacy program and a media policy reform project. Supervised thirty employees in the Kyrgyzstan office including: hiring and training, planning, assigning and directing work, appraising performance, addressing complaints and resolving problems. Managed financial matters including: receiving cash, overseeing financial reporting and compliance with U.S government regulations and Internews' policies, as well as projecting expenditures and burn rates.

International Women's Media Foundation, 02/04-09/05
Program Manager
Managed IWMF programs including: *Leadership Institute*, *IWMF Fellowship*, *Public Health Fellowship* and *Elizabeth Neuffer Fund*. Maintained accurate records for assigned projects, including ensuring financial expenditures remained within budgeted amounts and that records were accurate and up-to-date. Organized conferences and events relating to IWMF programs, including securing locations, catering arrangements, publicizing programs and other logistical details.

The Advocacy Project, Consultant, 02/02-06/02
Open Society Institute, Coordinator, 04/98-6/00

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SEPTEMBER 2020

How High Are Household Energy Burdens?

An Assessment of National and Metropolitan Energy Burden across the United States

Ariel Drehobl, Lauren Ross, and Roxana Ayala

aceee.org

ACEEE
American Council for an Energy-Efficient Economy

ABOUT THE AUTHORS

Ariel Drehobl conducts research, analysis, and outreach on local-level energy efficiency policies and initiatives, with a focus on energy affordability, energy equity, and limited-income communities. Ariel earned a master of science in environmental science, policy, and management from a joint-degree program that awarded degrees from Central European University in Hungary, Lund University in Sweden, and the University of Manchester in the United Kingdom. She earned a bachelor of arts in history and international studies from Northwestern University.

Lauren Ross oversees ACEEE's work related to the local implementation of energy efficiency. Her research concentrates on the nexus of affordable housing, energy efficiency, and cities. She leads ACEEE's efforts to improve policies and expand utility programs to promote energy efficiency in low-income and multifamily households. Lauren earned a PhD in urban sociology from Temple University, a master of arts in urban sociology from the George Washington University, and a bachelor of arts in political science from the University of Delaware.

Roxana Ayala assists with research, writing, and technical support on local-level energy efficiency policies and initiatives, with a focus on energy equity. Roxana earned a bachelor of arts in environmental studies and urban studies from the University of California, Irvine.

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Contents

Executive Summary

KEY TAKEAWAYS

- New research based on data from 2017 finds that high energy burdens remain a persistent national challenge. Of all U.S. households, 25% (30.6 million) face a high energy burden (i.e., pay more than 6% of income on energy bills) and 13% (15.9 million) of U.S. households face a severe energy burden (i.e., pay more than 10% of income on energy).[1]
- Nationally, 67% (25.8 million) of low-income households (≤ 200% of the federal poverty level [FPL]) face a high energy burden and 60% (15.4 million) of low-income households with a high energy burden face a severe energy burden.
- The East South Central Region (i.e., Alabama, Kentucky, Mississippi, and Tennessee) has the highest percentage of households with high energy burdens (38%) as compared to other regions.
- Black, Hispanic, Native American, and older adult households, as well as families residing in low-income multifamily housing, manufactured housing, and older buildings experience disproportionally high energy burdens nationally, regionally, and in metro areas.
- Weatherization can reduce low-income household energy burdens by about 25%, making it an effective strategy to reduce high energy burdens for households with high energy use while also benefiting the environment.
- Leading cities and states have begun to incorporate energy burden goals into strategies and plans and to create local policies and programs to achieve more equitable energy outcomes in their communities. They are pursuing these goals through increased investment in energy efficiency, weatherization, and renewable energy.

1 Researchers estimate that housing costs should be no more than 30% of household income, and household energy costs should be no more than 20% of housing costs. This means that affordable household energy costs should be no more than 6% of total household income. For decades, researchers have used the thresholds of 6% as a high burden and 10% as a severe burden (APPRISE 2005). Note that high and severe energy burdens are not mutually exclusive. All severe energy burdens (> 10%) also fall into the high burden category (> 6%).

This report provides an updated snapshot of U.S. energy burdens (i.e., the percentage of household income spent on home energy bills) nationally, regionally, and in 25 select metro areas in the United States.[1,2] Both high and severe energy burdens are caused by physical, economic, social, and behavioral factors, and they impact physical and mental health, education, nutrition, job performance, and community development. Energy efficiency and weatherization can help address energy insecurity (i.e., the inability to adequately meet basic household heating, cooling, and energy needs over time) by improving building energy efficiency, reducing energy bills, and improving indoor air quality and comfort (Hernández 2016).

We recognize that the economic recession brought on by the global COVID-19 pandemic has greatly increased U.S. energy insecurity and also interrupted weatherization and energy efficiency programs nationally. While this report measures energy burdens using 2017 data from the American Housing Survey (AHS), we anticipate the recession will lead to a further increase in energy insecurity and higher energy burdens in 2020 and beyond.

Methods

This study calculates energy burdens using the AHS, which includes a national and regional dataset as well as a dataset of 25 metropolitan statistical areas.[4] We calculate energy burdens across all households and in a variety of subgroups to identify those that spend disproportionally more of their income on energy bills than otherwise similar groups, analyzing across income, housing type, tenure status, race, ethnicity, and age of occupant and structure. We also calculate the percentage of households nationally, regionally, and in each select metro area that have high energy burdens (i.e., spend more than 6% of income on home energy bills) and severe energy burdens (i.e., spend more than 10% of income on home energy bills). We do not include households who do not directly pay for their energy bills.

Energy Burden Findings

NATIONAL ENERGY BURDENS

U.S. households spend an average of 3.1% of income on home energy bills. Figure ES1 presents our national energy burden findings by subgroup. We acknowledge that many highly burdened groups are intersectional, meaning that they face compounding, intersecting causes of inequality and injustice, with energy burden representing one facet of inequity. The following are key national findings:

- Low-income households spend three times more of their income on energy costs compared to the median spending of non-low-income households (8.1% versus 2.3%).
- Low-income multifamily households spend 2.3 times more of their income on energy costs compared to the median spending of multifamily households (5.6% versus 2.4%).
- The median energy burden for Black households is 43% higher than for non-Hispanic white households (4.2% versus 2.9%), and the median energy burden for Hispanic households is 20% higher than that for non-Hispanic white households (3.5% versus 2.9%).
- The median renter energy burden is 13% higher than that of the median owner (3.4% versus 3.0%).
- More than 25% (30.6 million) of U.S. households experience a high energy burden, and about 50% (15.9 million) of households with a high energy burden face a severe energy burden.[5]
- Of low-income households (≤ 200% FPL), 67% (25.8 million) experience a high energy burden, and 60% (15.4 million) of those households with a high energy burden face a severe energy burden.
- Low-income households, Black, Hispanic, Native American, renters, and older adult households all have disproportionately higher energy burdens than the national median household.

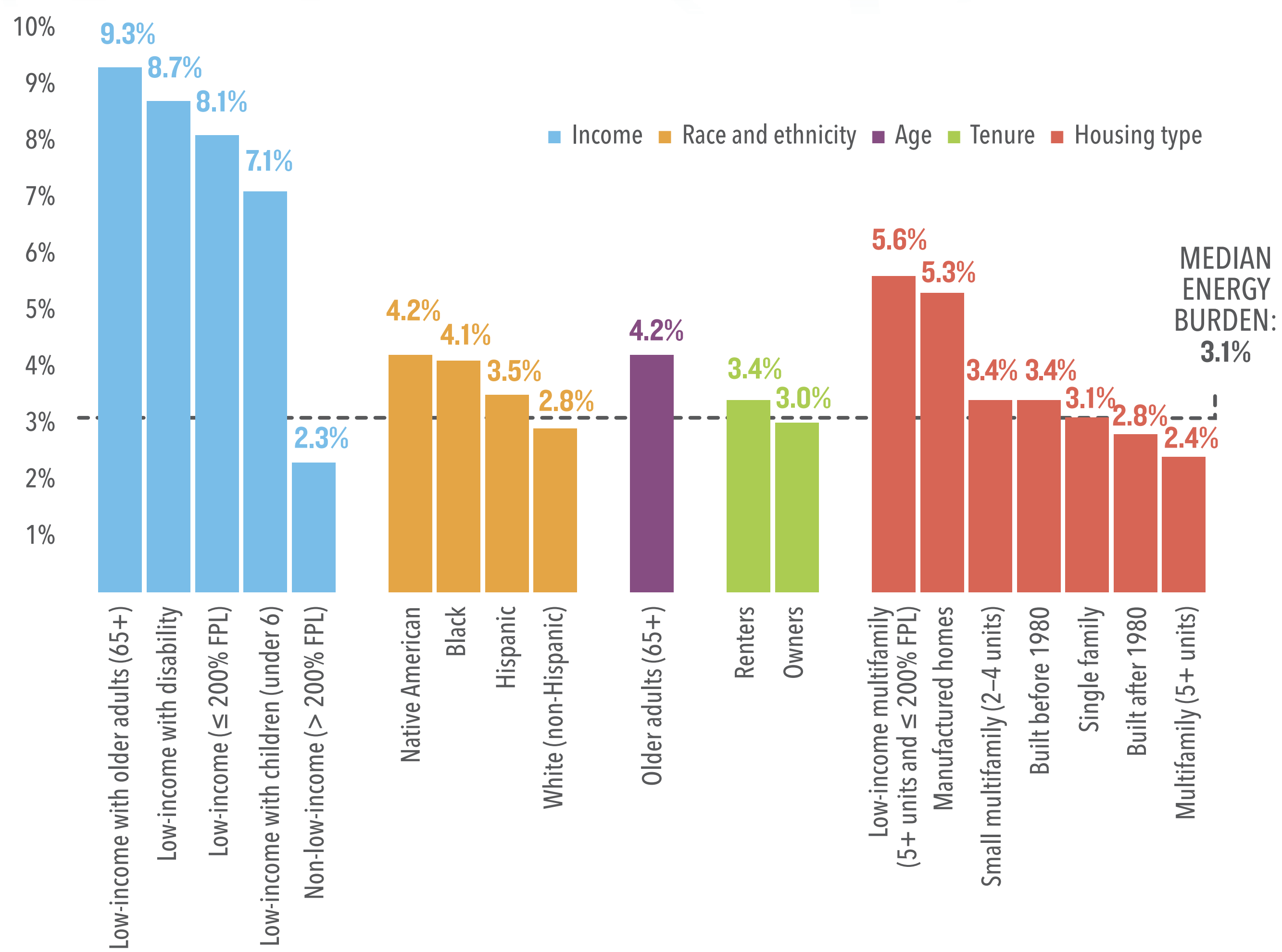
[2] This study focuses on home energy burden and includes electricity and heating fuels. Note that the study does not include transportation, water, or telecommunication cost burdens in its energy burden calculations.

[3] This report provides an update to ACEEE's previous energy burden research. Drehobl and Ross (2016) analyzed 2011 and 2013 American Housing Survey (AHS) data, and Ross, Drehobl, and Stickles (2018) analyzed 2015 AHS data. This report analyzes 2017 AHS data, the most recent data available as of publication.

[4] We include the 25 metropolitan statistical areas (MSAs) sampled for the 2017 AHS: Atlanta, Baltimore, Birmingham, Boston, Chicago, Dallas, Detroit, Houston, Las Vegas, Los Angeles, Miami, Minneapolis, New York City, Oklahoma City, Philadelphia, Phoenix, Richmond, Riverside, Rochester, San Antonio, San Francisco, San Jose, Seattle, Tampa, and Washington, DC.

[5] Note that high and severe energy burdens are not mutually exclusive. All severe energy burdens (> 10%) also fall into the high burden category (> 6%).

FIGURE ES1. National energy burdens across subgroups (i.e., income, race and ethnicity, age, tenure, and housing type) compared to the national median energy burden



REGIONAL ENERGY BURDENS

We find that the national trends hold true across the nine census regions. The following are our key regional findings:

- Across all nine regions, low-income household energy burdens are 2.1–3 times higher than the median energy burden.
- The East South Central region (i.e., *Alabama, Kentucky, Mississippi, Tennessee*) has the greatest percentage of households (38%) with high energy burdens, followed by East North Central (i.e., *Illinois, Indiana, Michigan, Ohio, Wisconsin*), New England (*Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont*), and Middle Atlantic regions (i.e., *New Jersey, New York, Pennsylvania*) (all 29%).
- The gap between low-income and median energy burdens is largest in the New England, Pacific (i.e., *Alaska, California, Hawaii, Oregon, Washington*), and Middle Atlantic regions.
- The South Atlantic region (i.e., *Delaware, DC, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia*) had the greatest number of households (6.3 million) with high burdens, followed by the East North Central (5.4 million) and Middle Atlantic (4.6 million) regions.

METRO AREA ENERGY BURDENS

National and regional patterns are mirrored in cities. The following are our key metropolitan area findings:

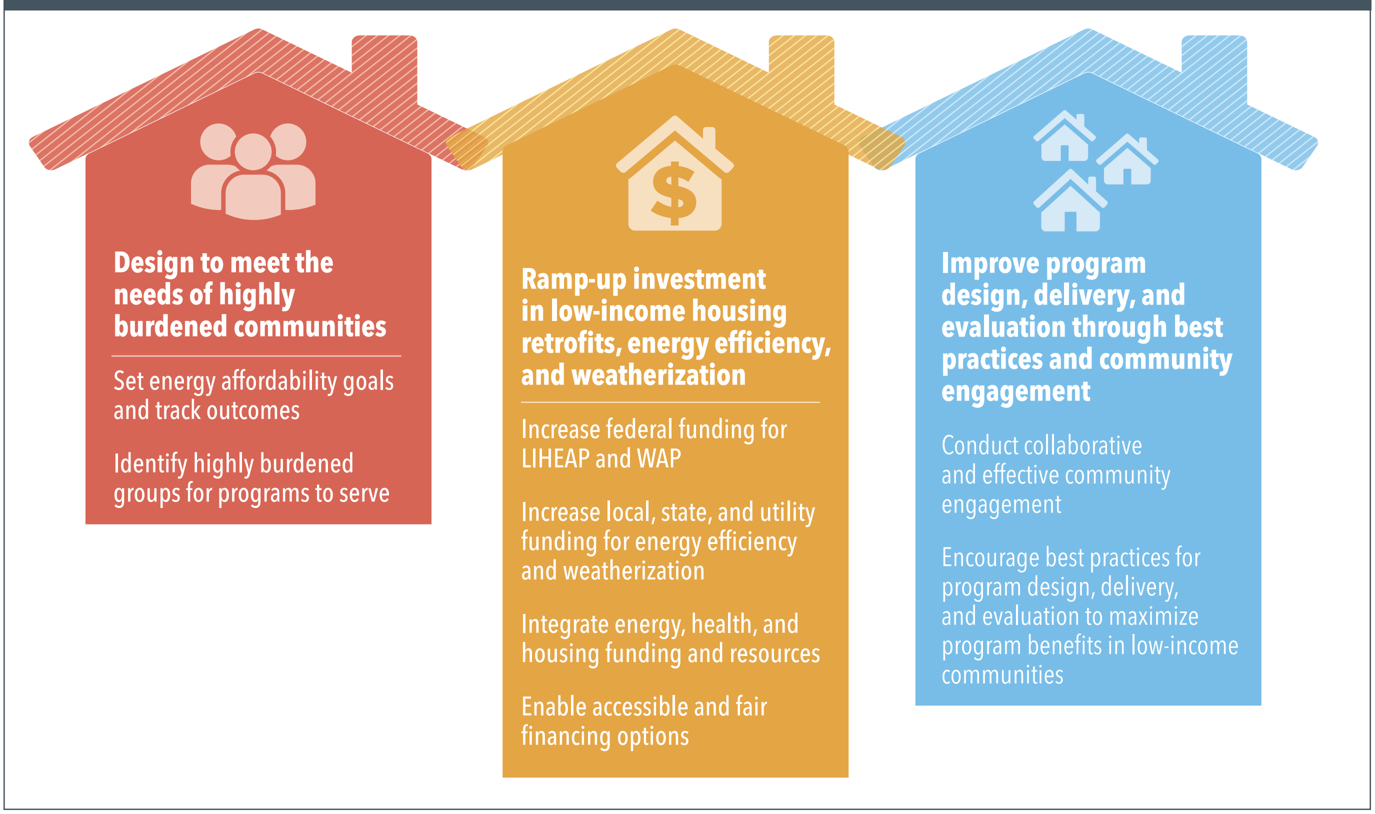
- Low-income households experience energy burdens at least two times higher than that of the average household in each metropolitan area included in the study.[6]
- Black and Hispanic households experience higher energy burdens than non-Hispanic white households; renters experience higher energy burdens than owners; and people living in buildings built before 1980 experience higher energy burdens than people living in buildings built after 1980 across all metro areas in the study.
- Six metro areas have a greater percentage of households with a high energy burden than the national average (25%), including Birmingham (34%), Detroit (30%), Riverside (29%), Rochester (29%), Atlanta (28%), and Philadelphia (26%).
- In five metro areas—Baltimore, Philadelphia, Detroit, Boston, and Birmingham—at least one-quarter of low-income households have energy burdens above 18%, which is three times the high energy burden threshold of 6%.

See the body of the report for additional images, maps, charts, and data on energy burden calculations nationally, regionally, and in metro areas.

Strategies to Accelerate, Improve, and Better Target Low-Income Housing Retrofits and Weatherization

Clean energy investments—such as energy efficiency, weatherization, and renewable energy—can provide a long-term, high-impact solution to lowering high energy burdens. By investing in energy efficiency and weatherization first or alongside renewable energy technologies, these measures can reduce whole-home energy use to maximize the costs and benefits of

FIGURE ES2. Strategies to improve and expand low-income energy efficiency and weatherization programs



[6] We define the "average household" energy burden as the median across all households in the sample (i.e., in each MSA).

Based on prior evidence of how weatherization reduces average customer bills, we estimate that it can reduce low-income household energy burden by 25%.

additional renewable energy generation. This report focuses on weatherization and energy efficiency as long-term solutions to reducing high energy burdens; these solutions can be combined with renewable energy investments and/or electrification strategies that reduce energy bills for additional impact. Based on prior evidence of how weatherization reduces average customer bills, we estimate that it can reduce low-income household energy burden by 25%.[7]

To ensure that more low-income and highly energy burdened households receive much-needed energy efficiency and weatherization investments, we recommend that policymakers and program implementers design policies and programs to meet the needs of highly burdened communities and set up processes for evaluation and accountability processes. This involves engaging with community members from the start, increasing funding for low-income weatherization and energy efficiency, and integrating best practices into program design and implementation. Figure ES2 depicts this actionable framework. For more information about these strategies, see the full report.

Conclusions and Next Steps

Energy affordability remains a national crisis, with low-income households, communities of color, renters, and older adults experiencing disproportionally higher energy burdens than the average household nationally, regionally, and in metro areas. This study finds that each MSA has both similar and unique energy affordability inequities. Further research can help better understand the intersectional drivers of high energy burdens and the policies best suited to improve local energy affordability. Climate change and the global pandemic also underscore the urgency in addressing high household energy burdens. As temperatures continue to rise and heat waves become more common, access to clean, affordable energy is needed more than ever to prevent indoor heat-related illnesses and deaths.

Cities, states, and utilities are well positioned to build on this research and conduct more targeted and detailed energy burden analyses, such as the Pennsylvania Public Utility Commission's study on home energy affordability for low-income customers. Studying energy burden and more broadly analyzing energy insecurity factors are first steps toward setting more targeted energy burden reduction goals and creating policies and programs that lead to more vibrant and prosperous communities.

[7] We assume 25% savings from energy efficiency upgrades based on the U.S. Department of Energy's estimate (DOE 2014) and use the median low-income household values to calculate a 25% reduction. We reduced the median low-income energy bill by 25% from $1,464 to $1,098. Using the median low-income household income of $18,000, this equates to a reduced energy burden of 6.1%. Reducing the median low-income energy burden from 8.1% to 6.1% is a 25% reduction.

Introduction

Energy insecurity—that is, the inability to adequately meet basic household heating, cooling, and energy needs over time (Hernández 2016)—is increasingly viewed as a major equity issue by policymakers, energy utilities, and clean energy and environmental justice advocates. This multidimensional problem reflects the confluence of three factors: inefficient housing and appliances, lack of access to economic resources, and coping strategies that may lead some residents to dangerously under-heat or under-cool their homes (Hernández, Aratani, and Jiang 2014).

Household energy burden—the percentage of annual household income spent on annual energy bills—is one key element contributing to a household's energy insecurity. Energy burden as a metric helps us visualize energy affordability (i.e., the ability to afford one's energy bills); identify which groups shoulder disproportionally higher burdens than others; and recognize which groups most need targeted energy-affordability- and energy-justice-related policies and investments to reduce high energy burdens. Three strategies can reduce both energy insecurity and high energy burdens: increasing household income, increasing bill payment assistance through government or utility resources, and reducing household energy use. This study discusses policy considerations that focus on the third solution of reducing excess energy use to lower high household energy burdens.

This report provides a snapshot of energy burdens nationally and in 25 of the largest U.S. metro areas. We examine median household energy burdens among groups—varying by income, housing type and age, and tenure status—as well as the percentage of households experiencing high (> 6%) and severe (> 10%) energy burdens nationally, in metro areas, and across groups (APPRISE 2005). Building on ACEEE's 2016 urban energy burden study and 2018 rural energy burden study (Drehobl and Ross 2016; Ross, Drehobl, and Stickles 2018), this report analyzes national-, regional-, and metro-level data from the U.S. Census Bureau's most recent American Housing Survey (AHS) conducted in 2017.

Local policymakers, utilities, and advocates can use this report's data and policy recommendations to better understand both which groups tend to have disproportionally higher energy burdens and how they can measure these burdens in their communities. The subsequent policy recommendations focus on low-income energy efficiency and weatherization as high-impact strategies to alleviate high energy burdens and improve overall energy affordability.

Background

Systemic Patterns and Causes of Inequities

Household access to energy is central to maintaining health and well-being, yet one in three U.S. households reported difficulty paying their energy bills in 2015 (EIA 2018). Black, Indigenous, and People of Color (BIPOC) communities often experience the highest energy burdens when compared to more affluent or white households (Kontokosta, Reina, and Bonczak 2019; Drehobl and Ross 2016; Hernández et al. 2016).[8] These communities often experience racial segregation, high unemployment, high poverty rates, poor housing conditions, high rates of certain health conditions, lower educational opportunity, and barriers to accessing financing and investment (Jargowsky 2015; Cashin 2005). Many of these characteristics are due in part to systemic racial discrimination, which has led to long-standing patterns of disenfranchisement from income and wealth-building opportunities for BIPOC communities as compared to white communities (Rothstein 2017).

8 We use the term BIPOC in this report to describe communities that experience especially acute systemic inequities, barriers, and limited access to energy programs. By specifically naming Black and Indigenous (Native American) communities, the term BIPOC recognizes that Black and Indigenous people have historically experienced targeted policies of systemic economic exclusion, classism, and racism in the United States. It is important to recognize this history and how it has led to disproportionally high energy burdens and unique barriers to accessing clean energy technologies and investments.

Policies and practices that have led to economic and/or social exclusion in BIPOC communities include neighborhood segregation and redlining, lack of access to mortgages and other loans, mass incarceration, employment discrimination, and the legacy of segregated and underfunded schools (Jargowsky 2015; McCarty, Perl, and Jones 2019).[9] These types of systemic exclusions, underinvestments, discriminative lending practices, and limited housing choices have also limited BIPOC communities' access to efficient and healthy housing (Lewis, Hernández, and Geronimus 2019). In addition, Black communities are 68% more likely to live within 30 miles of a coal-fired power plant, and properties in close proximity to toxic facilities average 15% lower property values than those in other areas (National Research Council 2010). Black children are three times as likely to be admitted to the hospital for asthma attacks than white children (Patterson et al. 2014). According to a study by the American Association of Blacks in Energy, while Black households spent $41 billion on energy in 2009, they held only 1.1% of energy jobs and gained only 0.01% of the revenue from energy-sector profits (Patterson et al. 2014).

Systemic exclusions, under-investments, discriminative lending practices, and limited housing choices have limited Black, Indigenous, and People of Color communities' access to efficient and healthy housing.

Limited Access to Energy Programs

A growing body of research shows that BIPOC and low-income communities experience disparate access to residential energy-saving appliances and other energy efficiency upgrades. While low-income and communities of color on average consume less energy than wealthier households, they are more likely to live in less-efficient housing (Bednar, Reames, and Keoleian 2017). Researchers found that, when holding income constant, BIPOC households experience higher energy burdens than non-Hispanic white households (Kontokosta, Reina, and Bonczak 2019). BIPOC and low-income communities also may experience higher costs when investing in energy-efficient upgrades. For example, a study based in Detroit found that energy-efficient lightbulbs were less available in high-poverty areas and smaller stores, and when they were available, they were more expensive than in other areas (Reames, Reiner, and Stacey 2018).

Others have found that untargeted utility-administered energy efficiency programs do not effectively reach BIPOC and low-income communities—particularly those living in multifamily buildings (Frank and Nowak 2016; Samarripas and York 2019). Low-income communities face economic, social, health and safety, and information barriers that impact their ability to access programs, and many programs fail to address these barriers through specific targeting practices. Limited access to energy efficiency resources and investments coupled with lower incomes increase the proportion of income that low-income and BIPOC households spend on energy bills (Jessel, Sawyer, and Hernández 2019; Berry, Hronis, and Woodward 2018).

Where utilities do administer programs targeted at low-income customers, participant needs far exceed available resources. Reames, Stacy, and Zimmerman (2019) found that 11 large investor-owned utilities across six states have distributional disparities in low-income investments; that is, they do not spend energy efficiency dollars proportionally on programs designed to reach low-income populations. A 2018 report found that only 6% of all U.S. energy efficiency spending in 2015 was dedicated to low-income programs (EDF APPRISE 2018). Most states require that utility energy efficiency program portfolios be cost effective, often using tests that focus mostly on direct economic costs to the utility (Woolf et al. 2017; Hayes, Kubes, and Gerbode 2020). This requirement places an additional burden on utilities, states, and local governments that invest in programs that serve low-income communities because it does not account for nonenergy and additional health, economic, and community benefits in program planning and evaluations.

Definition and Drivers of High Energy Burdens

High energy burdens are often defined as greater than 6% of income, while *severe energy burdens* are those greater than 10% of income (APPRISE 2005).[10] Past research found that low-income, Black, and Hispanic communities, as well as older adults, renters, and those residing in low-income multifamily buildings experienced disproportionally higher energy burdens than other households (Drehobl and Ross 2016; Ross, Drehobl, and Stickles 2018).

[9] *Redlining* is the discriminatory practice of fencing off areas in which banks would avoid investments based on community demographics. Redlining was included in local, state, and federal housing policies for much of the 20th century. For more information on historical forms of economic and social exclusion, see *The Color of Law: A Forgotten History of How Our Government Segregated America* by Richard Rothstein.

[10] Researchers estimate that housing costs should be no more than 30% of household income, and household energy costs should be no more than 20% of housing costs. This means that affordable household energy costs should be no more than 6% of total household income.

TABLE 1. Key drivers of high household energy burdens	
Drivers	**Examples of factors that affect energy burden**
Physical	Housing age (i.e., older homes are often less energy efficient)
	Housing type (e.g., manufactured homes, single family, and multifamily)
	Heating and cooling system (e.g., system type, fuel type, and fuel cost)
	Building envelope (e.g., poor insulation, leaky roofs, inefficient and/or poorly maintained poorly maintained heating and cooling systems (HVAC), and/or inadequate air sealing)
	Appliances and lighting efficiency (e.g., large-scale appliances such as refrigerators, washing machines, and dishwashers)
	Topography and location (e.g., climate, urban heat islands)
	Climate change and weather extremes that raise the need for heating and cooling
Socioeconomic	Chronic economic hardship due to persistent low income
	Sudden economic hardship (e.g., severe illness, unemployment, or disaster event)
	Inability to afford (or difficulty affording) up-front costs of energy efficiency investments
	Difficulty qualifying for credit or financing options to make efficiency investments due to financial and other systemic barriers
	Systemic inequalities relating to race and/or ethnicity, income, disability, and other factors
Behavioral	Information barriers relating to available bill assistance and energy efficiency programs and relating to knowledge of energy conservation measures
	Lack of trust and/or uncertainty about investments and/or savings
	Lack of cultural competence in outreach and education programs
	Increased energy use due to occupant age, number of people in the household, health-related needs, or disability
Policy-related	Insufficient or inaccessible policies and programs for bill assistance, energy efficiency, and weatherization for low-income households
	Utility rate design practices, such as high customer fixed charges, that limit customers' ability to respond to high bills through energy efficiency or conservation

Source: Updated from Ross, Drehobl, and Stickles 2018

Drivers of high household energy burdens are often the result of the systemic factors, barriers, and challenges that these households face. Previous research identified drivers that can raise energy burdens, including the dwelling's physical structure, the resident's socioeconomic status and behavioral patterns, and the availability of policy-related resources (Drehobl and Ross 2016; Ross, Drehobl, and Stickles 2018). Table 1 shows an updated list of key drivers of high energy burdens.

ENERGY INEFFICIENCY AS A DRIVER OF HIGH ENERGY BURDENS

While low incomes are a substantial factor driving higher energy burdens, inefficient housing is also a contributor. According to the 2017 AHS data, 9% of total U.S. households completed an energy-efficient improvement in the past two years, but only 17% were low-income households (Census Bureau 2019). Low-income households (≤ 200% of the federal poverty level [FPL]) make up about 30% of the population, which means that they are underrepresented in households completing energy efficiency upgrades and thus are not proportionally accessing and benefiting from these investments.

Additional research examining energy benchmarking data in a few major cities has found that households from both the lowest- and highest-income brackets had the highest *energy use intensity* (EUI)—that is, they had the highest energy consumption per square foot. While consumption behaviors are regarded as the driver for high EUI among higher-income households, the researchers point to inefficient heating and lighting infrastructure to help explain the high EUI among low-income households (Kontokosta, Reina, and Bonczak 2019). High-income households use large amounts of energy to power larger homes—as well as more electronics and devices that use large amounts of energy—while low-income households tend to use fewer, less-efficient devices that require relatively large amounts of energy due to the inefficiency of the dwelling or the appliance itself. Therefore, household inefficiencies rather than inefficient behaviors tend to lead to higher energy use and expenditures for low-income households. Generally, energy efficiency investments can allow households to engage in the same activity while using less energy, thus reducing high energy burdens and improving comfort, health, and safety.

Adverse Effects of High Energy Burdens

Our comprehensive evaluation of energy burden research reveals both that low-income households spend, on average, a higher portion of their income on energy bills than other groups, and that energy burdens are also higher for communities of color, rural communities, families with children, and older adults (Brown et al. 2020; Lewis, Hernández, and Geronimus 2019; Reames 2016; Hernández et al. 2016; Drehobl and Ross 2016; Ross, Drehobl, and Stickles 2018). Energy burden is one indicator to measure energy insecurity, and high energy burdens are associated with inadequate housing conditions and have been found to affect physical and mental health, nutrition, and local economic development.

EXCESSIVE ENERGY COST CAN IMPACT RESIDENTS' HEALTH AND COMFORT.

Researchers have found that many households with high energy burdens also live in older, inefficient, and unhealthy housing. Inefficient housing is associated with other health impacts, such as carbon monoxide poisoning, lead exposure, thermal discomfort, and respiratory problems such as asthma and chronic obstructive pulmonary disease (COPD); it is also associated with the potential for hypothermia and/or heat stress resulting from leaky and/or unrepaired heating and cooling equipment (Brown et al. 2020; Norton, Brown, and Malomo-Paris 2017).

Households experiencing energy insecurity may forego needed energy use to reduce energy bills, forcing them to live in uncomfortable and unsafe homes. Hernández, Phillips, and Siegel (2016) found that half of the study's participants who experienced high monthly utility bills engaged in coping strategies such as using secondary heating equipment (i.e., stoves, ovens, or space heaters) to compensate for inefficient or inadequate heating systems. Employing this coping measure can compromise resident safety and comfort, and it may increase exposure to toxic gases. Teller-Elsberg et al. (2015) found that excess winter deaths potentially caused by fuel poverty kill more Vermonters each year than car crashes. In addition, according to the Residential Energy Consumption Survey, one in five U.S. households reported reducing or forgoing necessities such as food or medicine to pay an energy bill (EIA 2018). These tradeoffs can impact long-term health and well-being.

Climate change, rising temperatures, and subsequent cooling demands will continue to exacerbate household energy burdens—and prove deadly for some. In Maricopa County, Arizona—one of the hottest regions in the southwest—more than 90% of residents have access to a cooling system, yet up to 40% of heat-related deaths occur indoors (Maricopa County Department of Public Health 2020). A recent survey of homebound individuals found that one-third faced limitations on home cooling system use, with the overwhelming majority (81%) citing the "cost of bills" as a contributing factor (Maricopa County Department of Public Health 2016). As residents are increasingly forced to weigh the cost of properly cooling their homes, high energy burdens will likely become an even greater public health priority in the years to come.

HIGH ENERGY BURDENS IMPACT MENTAL HEALTH OF RESIDENTS.

High energy burdens can have mental health impacts—such as chronic stress, anxiety, and depression—associated with fear and uncertainty around access to energy, the complexities of navigating energy assistance programs, and the inability to control energy costs (Hernández, Phillip, and Siegel 2016). In addition, Hernández (2016) found that low-income residents who were experiencing energy insecurity worried about losing their parental rights as they struggled to maintain essential energy services, such as lighting, in their homes.

HIGH ENERGY BURDENS CAN LIMIT INDIVIDUALS' ABILITY TO BENEFIT FROM ECONOMIC DEVELOPMENT IN THEIR COMMUNITIES.

Households with high energy burdens are more likely to stay caught in cycles of poverty. After controlling for common predictors of poverty status such as income loss, illness, health, marital status, education, health insurance, and head of households—Bohr and McCreery (2019) found that, on average, energy-burdened households have a 175–200% chance of remaining in poverty for a longer period of time compared to nonenergy-burdened households.[11] BIPOC communities, older adults, and low-income households often experience this pernicious cycle, which includes persistent income inequality along with limited funding to invest in education or job training, and high energy burdens can perpetuate this cycle (Bohr and McCreery 2019; Lewis, Hernández, and Geronimus 2019).

Households with high energy burdens are more likely to stay caught in cycles of poverty.

Impact of COVID-19 on Energy Insecurity

As the world enters a global recession in the wake of the coronavirus pandemic, more households—especially in BIPOC communities—may have difficulty paying their energy bills due to massive job losses; reduced income; a warming climate; and higher energy bills resulting from more time at home due to stay-at-home orders and to students and adults learning and working from home, respectively. For example, in March and April 2020, the California Public Utility Commission stated that residential electricity usage increased by 15–20% compared to the previous year (CPUC 2020). Because such factors lead to higher home energy bills, energy burdens will increase for households across the United States.

COVID-19 disproportionally impacts BIPOC communities due to many of the policies that have led to systemic economic and social exclusion. These policies have led to BIPOC communities experiencing higher rates of underlying health conditions, a lack of health insurance or access to testing, and a higher likelihood of working in the service industry or in other essential worker roles that do not allow for teleworking (SAMHSA 2020; CDC 2020). COVID-19 has also impacted the ability of energy efficiency and weatherization programs to operate, and limited the mix of measures that can be installed; many energy efficiency and weatherization programs have slowed down or are on hold (Ferris 2020). Policies and programs that address energy insecurity are even more important now in the face of rising energy bills and burdens.

Given these factors, energy burdens in 2020 are likely to be much higher than the burdens we calculate in this report, which uses 2017 data. The economic situation has clearly shifted drastically since 2017. While we expect post-2020 burden trends to be similar, yet more acute, we cannot visualize the full extent of current and future energy burdens until the release of post-2020 data in the 2023 AHS, which will include data from 2021.

[11] This study does not examine the relationship between energy burden and rent burden (i.e., the percentage of income spent on housing costs). Studies have found that rent burdens are also increasing, especially for communities of color, older adults, and families (Currier et al. 2018).

Methods

This analysis builds on the methods used in ACEEE's previous two energy burden studies, *Lifting the High Energy Burden in American's Largest Cities* (Drehobl and Ross 2016) and *The High Cost of Energy in Rural America* (Ross, Drehobl, and Stickles 2018). This new study analyzes 2017 data from AHS, which is issued by the U.S. Department of Housing and Urban Development (HUD). The AHS is a biennial household-level survey by the Census Bureau that collects wide-range housing and demographic data from a nationally and regionally representative cross section of households across the United States and in a subset of metropolitan statistical areas (MSAs). The AHS includes household-level income data and energy cost data that we use as the basis of our energy burden calculations. The AHS models its energy cost data based on household characteristics ascertained through its survey and also uses data collected through the Residential Energy Consumption Survey (RECS) for a different national set of households.[12]

As we noted earlier, we define households with high energy burdens as those spending more than 6% of their income on electricity and heating fuel costs, and households with severe energy burdens as those spending more than 10% of their income on energy costs.[13] These two categories are not mutually exclusive; *severe burden* is a worse-off subset of high burden households.

[12] Beginning with the 2015 edition, the AHS stopped including questions on energy costs. Previously, the majority of these data was self-reported. As part of the 2015 AHS redesign, researchers began estimating energy costs through regression-model–based imputation. They created the utility estimation system (UES) to estimate annual energy costs using regression models developed from the RECS, which collects administrative data from suppliers on actual billing amounts. This estimate was divided by 12 to calculate average monthly energy costs. The RECS also collects some housing characteristics similar to those the AHS collects, which allows the construction of models that can then be applied to the AHS. For more on the energy cost estimation model development and decisions for the 2015 AHS, see www.huduser.gov/portal/sites/default/files/pdf/American-Housing-Survey.pdf.

[13] HUD determines affordable housing costs to be 30% of total household income. Researchers have determined that, typically, 20% of total housing expenses are energy costs. This equates to 6% of total income spent on energy bills as an affordable level (Fisher Sheehan & Colton 2020). We consider energy burdens above 6% to be high burdens, with burdens above 10% to be severe. This method is in line with other research (APPRISE 2005).

The following are our study's inclusion and exclusion criteria:

- *Electricity and heating fuels*. The study does not include water, transportation, telecommunications, or Internet costs. Although such costs can create additional monetary burdens for households, we include only electricity and heating fuel costs in our energy burden calculations.
- *Households must report household income and the amount they pay for their electricity and their main heating fuel*.[14] If households did not include all three factors, we did not include them in our analysis.

We examine energy burdens for a variety of household subsets at the national, regional, and metropolitan levels, including the following:

- *Income level*. All households that fall into low-income (≤ 200% FPL) and non-low-income (> 200% FPL) categories.[15]
- *Low-income households with vulnerable persons at home*. Low-income households with a household member over the age of 65, under the age of 6, or who has a disability.
- *Housing type and age*. Single-family, small multifamily (two to four units), large multifamily (five or more units), low-income multifamily (five or more units and ≤ 200% FPL), manufactured housing, buildings built before 1980, and buildings built after 1980.[16]
- *Tenure*: Renters and owners.
- *Race and ethnicity*. Black, Hispanic, and non-Hispanic white households. We also include Native American households in the national analysis.
- *Age*. Households with one or more adults over the age of 65.

Limitations

We included 48 MSAs in our last urban energy burden report, which used both 2011 and 2013 AHS data. This report uses only 2017 data, which limits our sample to 25 MSAs (AHS 2019). AHS includes modeled energy costs, which are determined by matching characteristics of households in the AHS to characteristics of households in the RECS. We also exclude households that do not report income, do not have a heating source, or do not pay for their heating costs. Thus, our report findings do not include data on renters who pay for their heating and/or electricity in their rent, or households with no annual income reported.

Our study does not explore causality, so we cannot determine *why* energy burdens differ across metro areas and demographic and other groups. Additional research is needed to determine the causes of disproportionate energy burdens, which can include building efficiency, income and poverty rates, and other timely economic factors. We are unable to compare trends across our energy burden reports, as this study does not explore why and how energy burdens may have changed over time.

Finally, our study includes only the 25 metro areas sampled by the AHS, which are not necessarily the best or worst performing metro areas regarding energy burdens. Ranking metro areas is thus limited since this is only a partial sample of cities. ACEEE plans to update this research with additional metro areas as more AHS data are available in the fall of 2020.

The following are the 25 MSAs with representative samples in the 2017 AHS dataset:

1. Atlanta	6. Dallas	11. Miami	16. Phoenix	21. San Francisco
2. Baltimore	7. Detroit	12. Minneapolis	17. Richmond	22. San Jose
3. Birmingham	8. Houston	13. New York City	18. Riverside	23. Seattle
4. Boston	9. Las Vegas	14. Oklahoma City	19. Rochester	24. Tampa
5. Chicago	10. Los Angeles	15. Philadelphia	20. San Antonio	25. Washington, DC

[14] AHS calculates household income as total money before taxes and other payments, including Social Security income, cash public assistance, or welfare payments from the state or local welfare office, retirement, survivor or disability benefits, and other sources of income such as veterans' payments, unemployment and/or worker's compensation, child support, and alimony. For more information, see: www2.census.gov/programs-surveys/ahs/2017/2017%20AHS%20Definitions.pdf.

[15] In ACEEE's 2016 urban energy burden report, we defined low-income as 80% of the area median income (AMI), while this report defines low-income as 200% FPL. We made this change due to data availability. The 200% FPL definition also lines up with the Weatherization Assistance Program and is the most common qualification criterion for utility-led low-income programs. Because of this, low-income data in the 2016 and 2020 reports do not use the same definitions and are therefore not directly comparable.

[16] We chose 1980 as our cutoff point as states and cities began adopting the first building energy codes in the late 1970s and early 1980s. At this time, builders around the country began to consider energy and minimal energy efficiency measures due to increasing awareness of efficiency measures and concerns about energy as a result of the energy-related economic shocks of the 1970s.

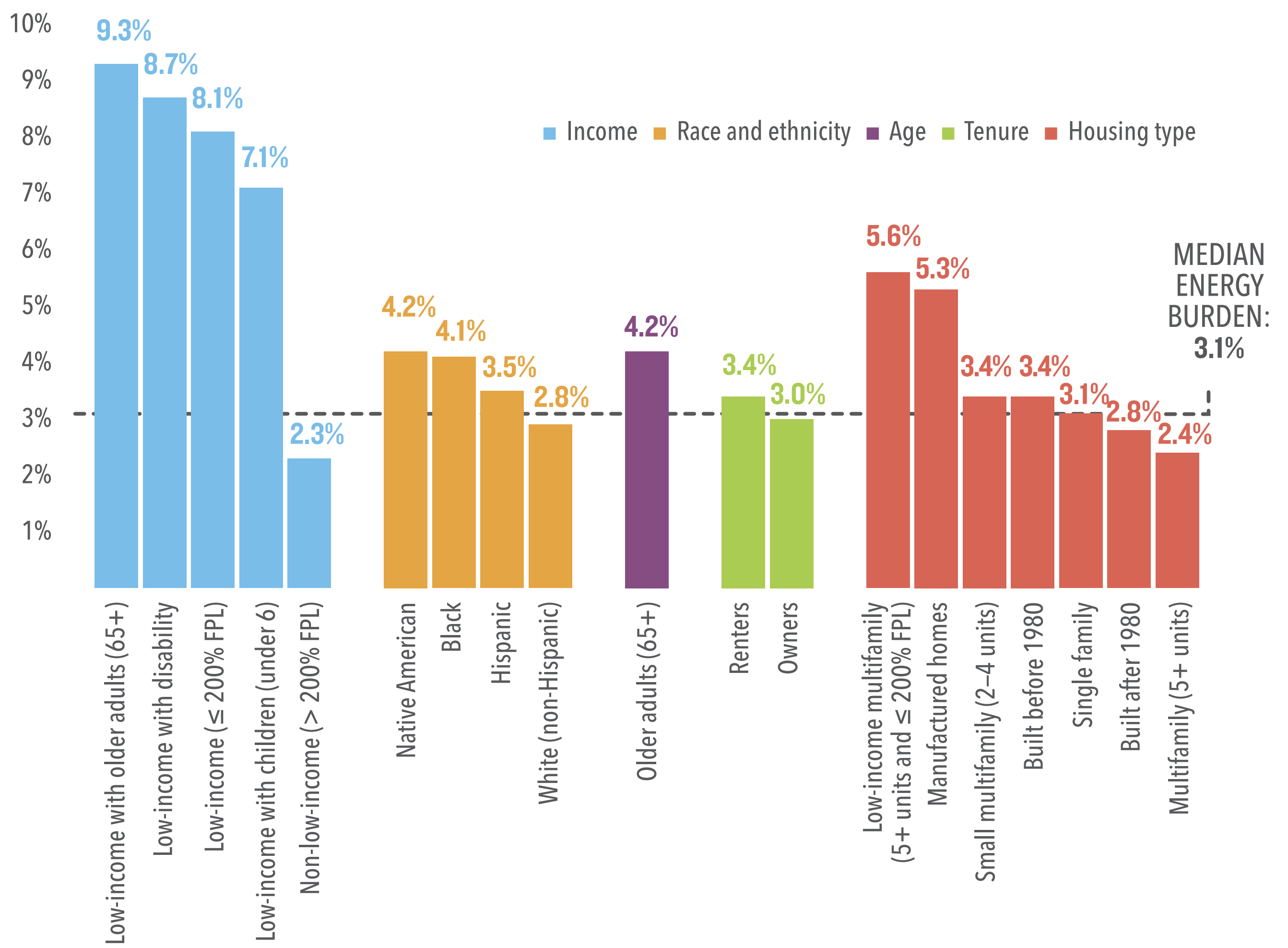
Energy Burden Findings

The results of this energy burden analysis reflect previous ACEEE studies in finding that nationally, regionally, and across all 25 metro areas, particular groups experience disproportionately high energy burdens. See **Appendices A** and **B** for tables including national, regional, and metro energy burden data.

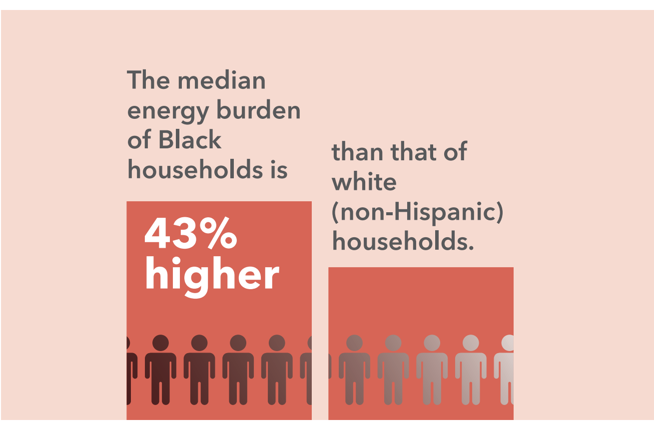
National Energy Burdens

Across the nationally representative sample, we find that low-income, Black, Hispanic, renter, and older adult households have disproportionately higher energy burdens than the average household. Figure 1 shows the median energy burden for different groups nationally, across categories of income, race and ethnicity, age, tenure status, and housing type. We find that the median national energy burden is 3.1%, and that the median low-income (≤ 200% FPL) household energy burden is 3.5 times higher than the non-low-income household energy burden (8.1% versus 2.3%).

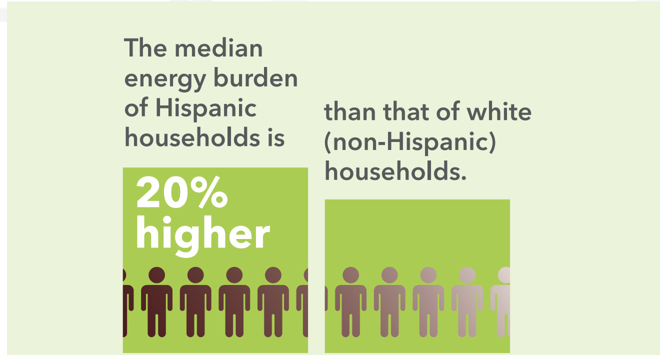
FIGURE 1. National energy burdens across subgroups (i.e., income, race and ethnicity, age, tenure, and housing type) compared to the national median energy burden



Many groups experience disproportionately high energy burdens, with low-income households having the highest energy burdens. These households have limited discretionary income and often have older, less-efficient housing stock and appliances that lead to higher energy bills. Even for cases in which monthly energy costs are similar between low-income and non-low-income households, the former devote a greater proportion of their income to these costs. Given this, reducing excess energy use in low-income households is critical for addressing energy insecurity.



We also recognize that many highly burdened groups are intersectional—that is, they face compounding, intersecting causes of inequality and injustice. For example, nearly half of the older adult population in general is economically vulnerable, as are the majority of older Black and Hispanic households (Cooper and Gould 2013). Policies and programs that focus on addressing low-income household energy burdens will likely intersect with other highly burdened groups. Further research can help identify how high energy burdens are impacted by differences in race, ethnicity, income, education, housing type, occupant age, and other factors.



NATIONAL DATA: HIGH AND SEVERE ENERGY BURDENS

Median energy burdens allow us to compare burdens between groups, yet they do not illustrate how many people experience the impacts of energy insecurity, or the degrees to which they experience it. We therefore also calculate the percentage of households that experience high and severe energy burdens for different demographic groups. Figure 2 shows the percentage of households across subgroups that experience a high energy burden (above 6%), along with the total number of households experiencing a high energy burden. Figure 2 also indicates the percentage of those households that experience a severe energy burden (above 10%).

Nationally, more than 25% (30.6 million) of all households experience a high energy burden, and about 50% (15.9 million) of all households that experience a high energy burden have a severe energy burden. These burdens are even more acute for low-income households, of which 67% (25.8 million) experience a high energy burden and 60% (15.4 million) of those experience a severe energy burden. **Appendix B** includes high and severe energy burden percentages and total households that experience a high and severe

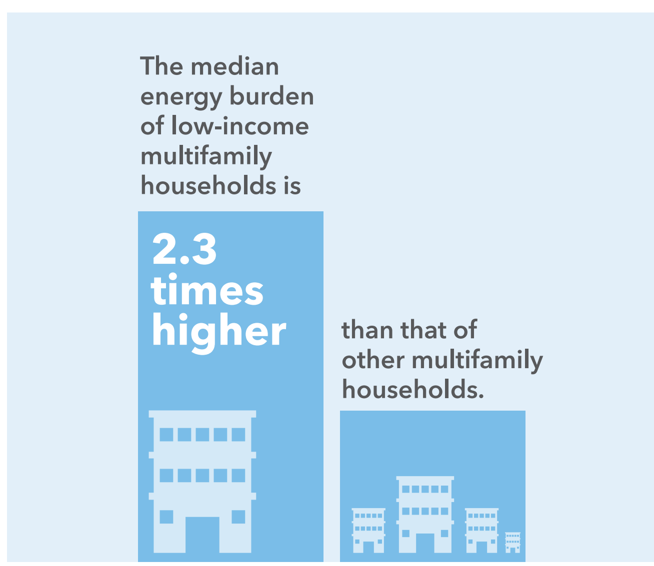
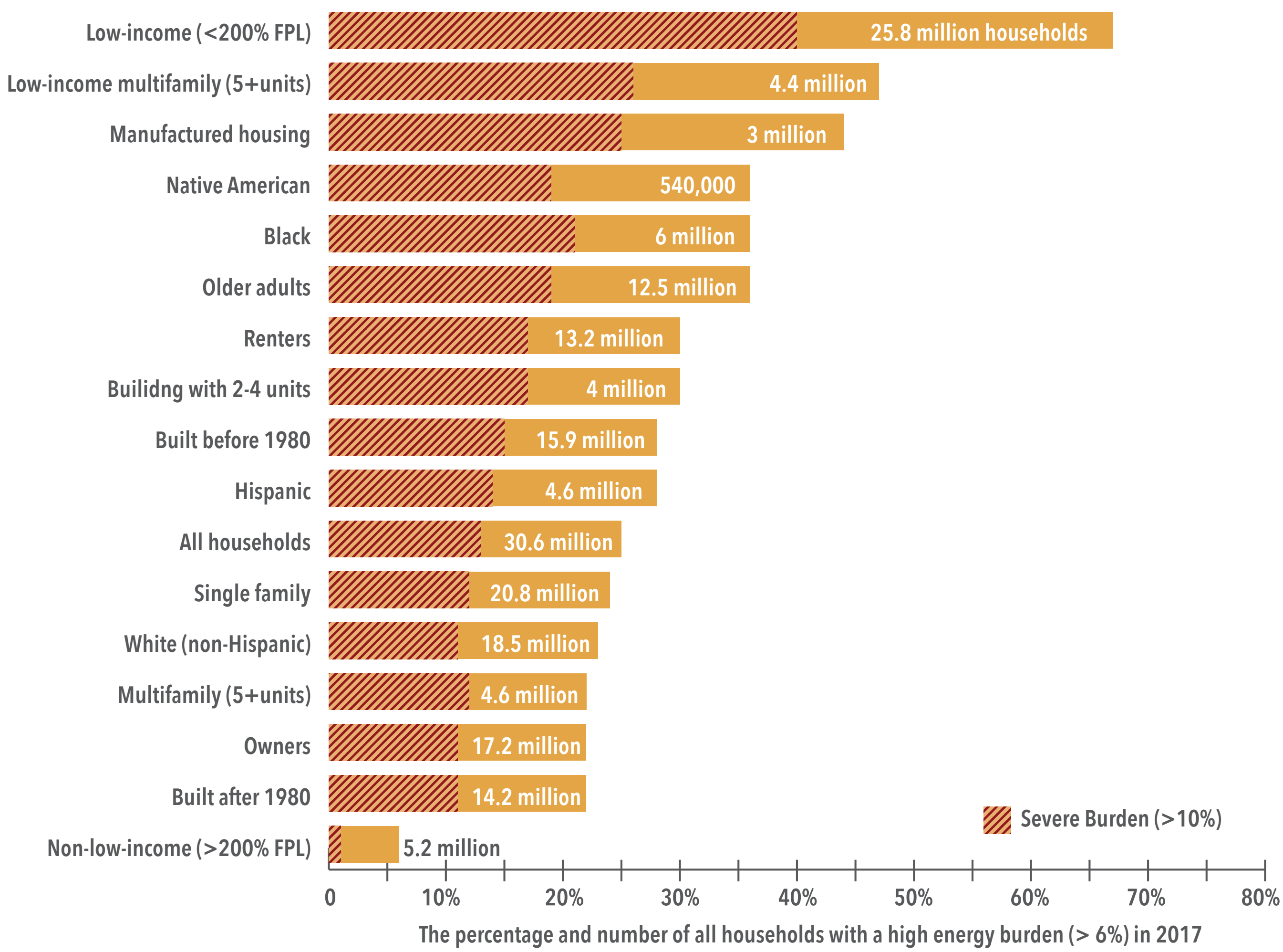


FIGURE 2. The percentage and number of households nationally with a high energy burden (> 6%) across different subgroups in 2017

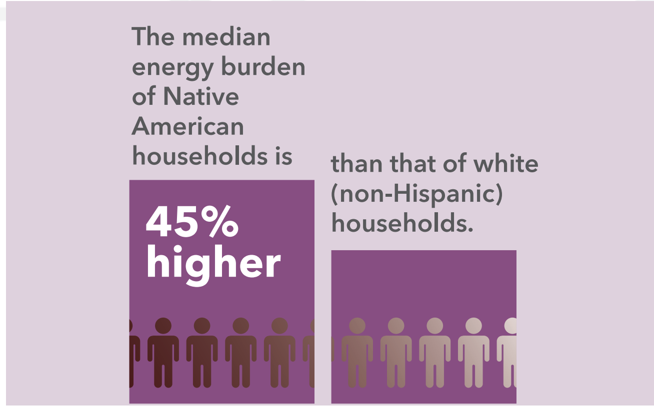


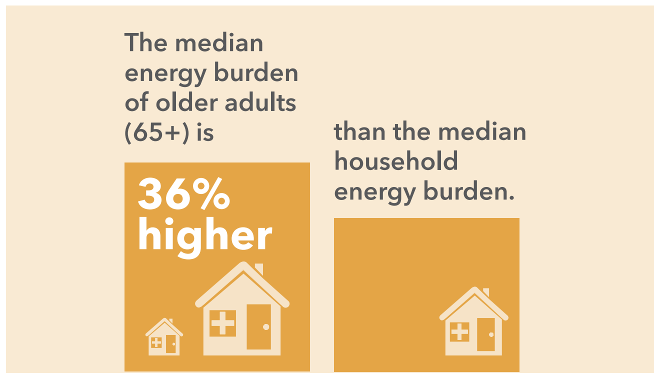
Note: High and severe energy burdens are not mutually exclusive, meaning that the number of households experiencing a severe burden are also counted in the percentage that experience high burdens. All severe energy burdens (> 10%) also fall into the high burden category (> 6%). The red and orange bars in figure 2 sum to the total high energy burdened households, and the number of households is the total that experience a high energy burden.

burden nationally, regionally, and in each MSA across all households and across low-income, Black, Hispanic, older adult, and renting households.

As figure 2 illustrates, U.S. residents experience high and severe energy burdens at different rates depending on factors such as income, occupant age, race, and tenure. Almost 50% of low-income multifamily residents; 36% of Black, Native American, and older adult households; 30% of renters; and 28% of Hispanic households experience a high energy burden.

Many households also have severe energy burdens, spending more than 10% of their income on energy. For example, 21% of Black households experience severe energy burdens as compared to 1% of non-low-income and 9% of non-Hispanic white households. For context, households with severe energy burdens spend at least three times more of their income on home energy bills than the median household.





Regional Energy Burdens

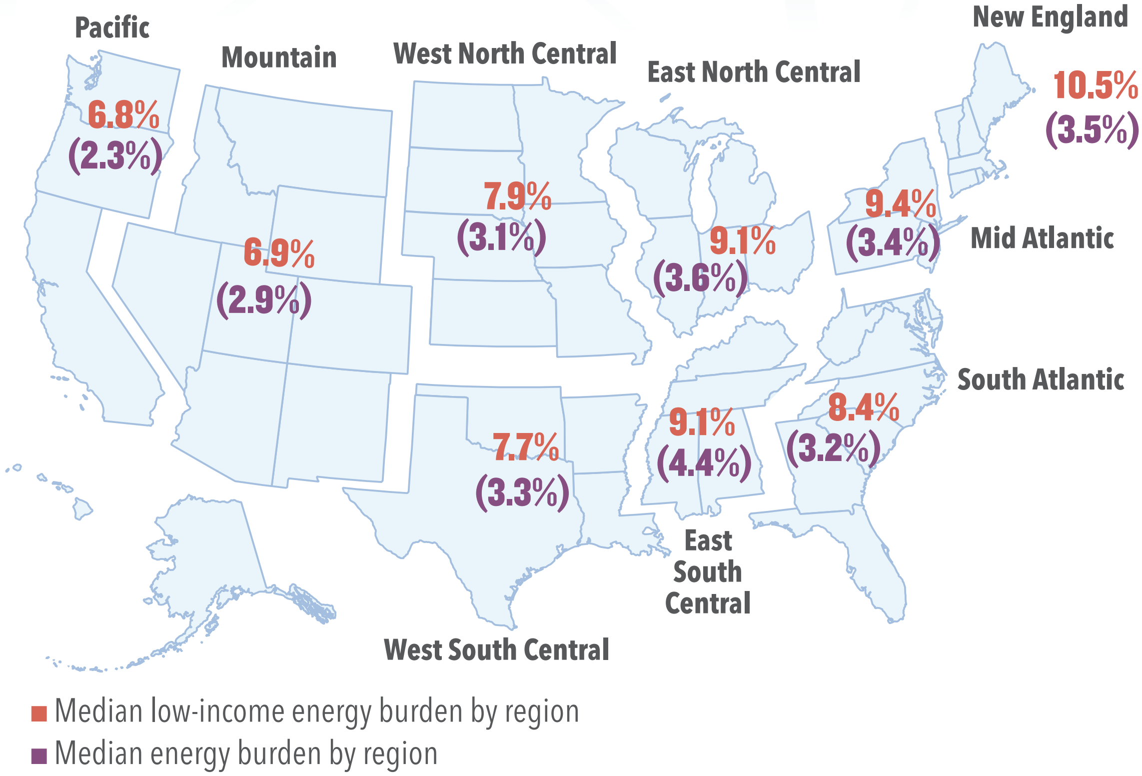
National patterns play out across all regions, where low-income, Black, and Hispanic households; renters; manufactured housing residents; and older adults all have disproportionately higher energy burdens than each region's average household. Table 2 shows the states in each census region in the study.

Across all nine regions, low-income household energy burdens are 2.1–3 times higher than the median energy burden. The gap between low-income and median energy burdens is largest in the New England, Pacific, and Mid-Atlantic regions (3.0, 2.9, and 2.8 times higher, respectively). Figure 3 illustrates low-income energy burdens and the median energy burden across the nine census regions.

TABLE 2. States within each census region

Region	States
New England	Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont
Middle Atlantic	New Jersey, New York, Pennsylvania
East North Central	Illinois, Indiana, Michigan, Ohio, Wisconsin
West North Central	Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota
South Atlantic	Delaware, DC, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia
East South Central	Alabama, Kentucky, Mississippi, Tennessee
West South Central	Arkansas, Louisiana, Oklahoma, Texas
Mountain	Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming
Pacific	Alaska, California, Hawaii, Oregon, Washington

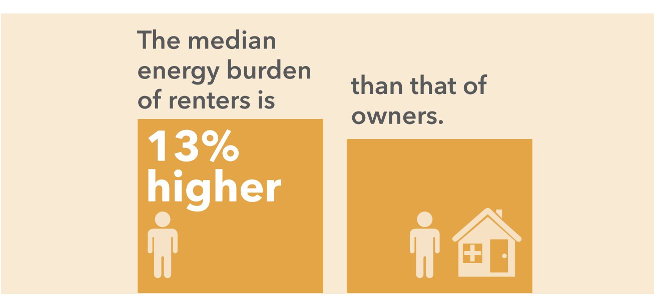
FIGURE 3. Median low-income (< 200% FPL) energy burdens by region (red) compared to median energy burdens by region (purple)



REGIONAL DATA: HIGH AND SEVERE ENERGY BURDENS

Figure 4 shows the percentage and total number of households that experience high and severe energy burdens in each region.

The percentage and total number of households that experience a high energy burden vary across regions. The East South Central region has the greatest percentage of households with high energy burdens (38%), followed by East North Central, New England, and Middle Atlantic regions, all with 29%. The South Atlantic region had the greatest number of households (6.27 million) with high burdens, followed by the East North Central (5.40 million) and Middle Atlantic (4.57 million) regions. See **Appendix B** for the total number of highly burdened households across different groups in each region.

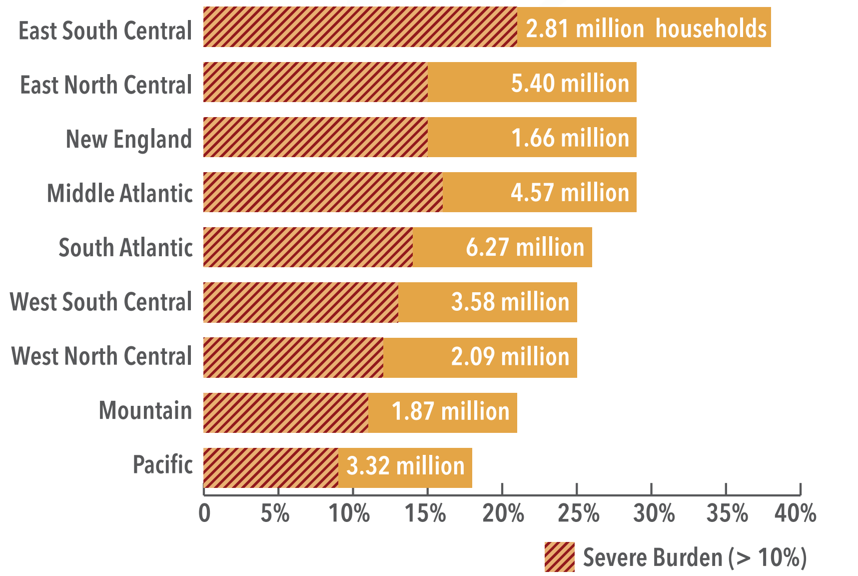


Metro Area Energy Burdens

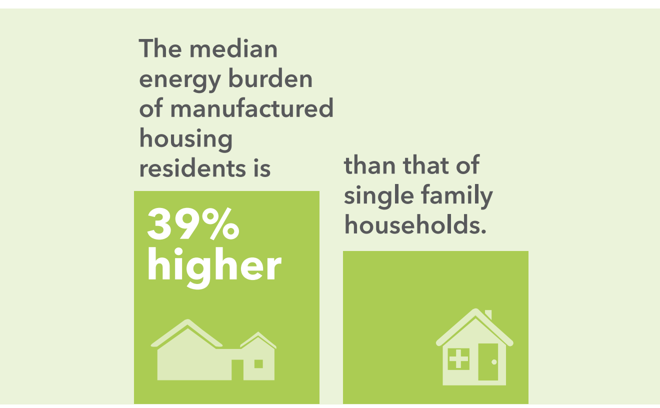
Across the select MSAs—which represent 38% of all households nationally—low-income households, low-income multifamily households, and older adult households are the most energy burdened groups. Groups with the lowest energy burdens are non-low-income, those living in buildings built after 1980, and those living in market-rate multifamily housing. Table 3 includes the median energy burdens for the most highly burdened groups in each metro area; **Appendices A** and **B** offer more details.[17]

[17] **Appendix A** includes national, regional, and metro area sample sizes, median energy burdens, median incomes, median monthly bills, upper-quartile energy burdens, percentage with a high burden, and percentage with a severe burden. **Appendix A** also includes median and upper-quartile energy burdens for subgroups nationally, regionally, and in metro areas, including low-income, low-income with older adults, low-income with a child under 6, low-income with disability, low-income multifamily, non-low-income, Black, Hispanic, non-Hispanic white, older adult, renters, owners, multifamily, built before 1980, and built after 1980. **Appendix B** includes the number of households nationally, regionally, and in metro areas that experience a high or severe energy burden.

FIGURE 4. The percentage and number of all households with a high energy burden (> 6%) in each region in 2017



The percentage and number of all households with a high energy burden (> 6%) in 2017



Across the 25 MSAs, low-income households experience energy burdens at least two times higher than the average household in all cities. In all metro areas, Black and Hispanic households experience higher energy burdens than non-Hispanic white households. Renters and people living in buildings built before 1980 experience higher energy burdens than owners in almost all metro areas in the study.

Median energy burdens do not tell the whole energy affordability story, as half of households in each group experience a higher energy burden than the median.

Figure 5 includes the energy burdens at the median and upper quartile, showing that 50% of households in each city experience a burden above the median and 25% experience a burden above the upper quartile. For example, in Baltimore, 25% of low-income households experience an energy burden above 21.7%, which is seven times the national median burden. In five cities—Baltimore, Philadelphia, Detroit, Boston, and Birmingham—a quarter of low-income households have energy burdens above 18%, which is three times the 6% high energy burden threshold.

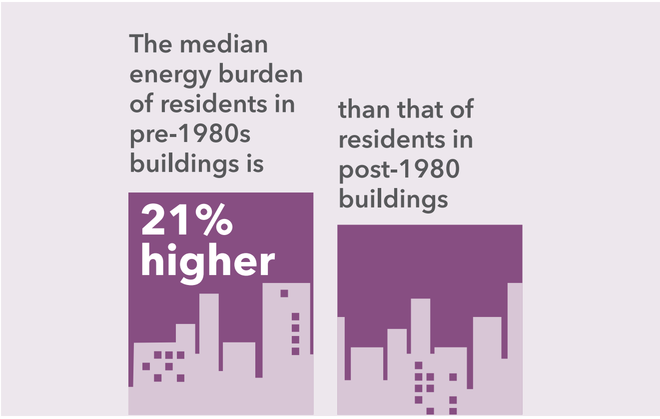
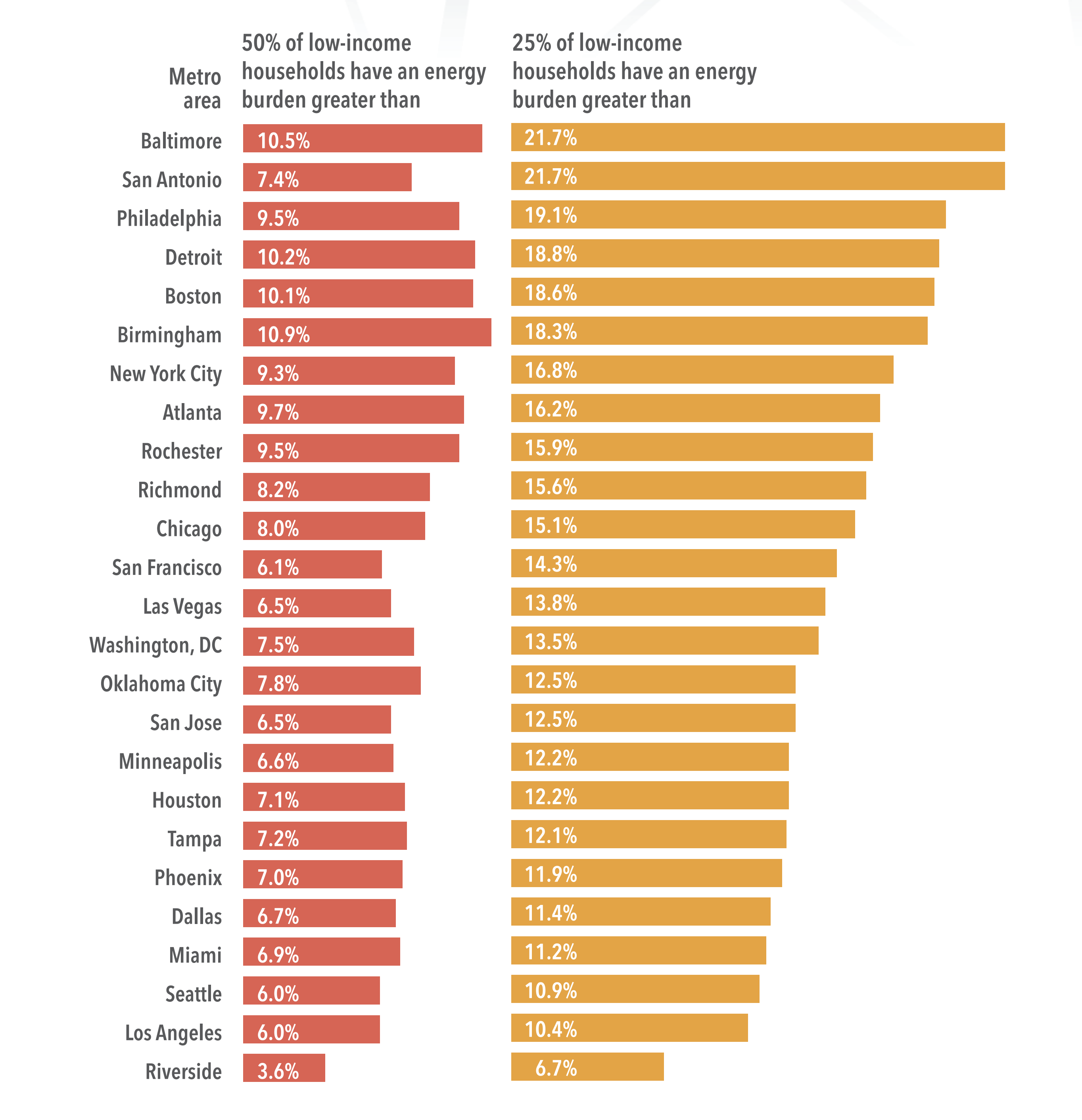


TABLE 3. Median energy burdens in metro areas for all households and highly impacted groups, including low-income, Black, Hispanic, older adult (65+), renters, low-income multifamily residents, and those residing in buildings built before 1980

Metro area	All households	Low-income (≤ 200% FPL)	Black	Hispanic	Older adults (65+)	Renters	Low-income multifamily*	Built before 1980
National data	3.1%	8.1%	4.2%	3.5%	4.2%	3.4%	3.1%	3.4%
Atlanta	3.5%	9.7%	4.1%	4.7%	5.1%	3.7%	6.6%	4.5%
Baltimore	3.0%	10.5%	3.8%	3.3%	4.1%	3.2%	2.5%	3.6%
Birmingham	4.2%	10.9%	5.6%	4.8%	5.8%	5.2%	6.8%	5.1%
Boston	3.1%	10.1%	3.7%	3.6%	4.4%	3.2%	6.6%	3.2%
Chicago	2.7%	8.0%	4.1%	3.0%	3.7%	3.1%	6.4%	2.9%
Dallas	2.9%	6.7%	3.3%	3.8%	3.8%	2.9%	5.0%	3.5%
Detroit	3.8%	10.2%	5.3%	4.5%	5.2%	4.6%	6.0%	4.3%
Houston	3.0%	7.1%	3.5%	3.4%	4.1%	3.3%	5.8%	3.4%
Las Vegas	2.8%	6.5%	3.2%	3.0%	3.4%	3.0%	5.3%	3.6%
Los Angeles	2.2%	6.0%	3.6%	2.6%	3.2%	2.4%	4.8%	2.3%
Miami	3.0%	6.9%	3.4%	3.1%	4.2%	3.1%	5.5%	3.3%
Minneapolis	2.2%	6.6%	2.6%	2.7%	3.0%	2.3%	4.3%	2.5%
New York City	2.9%	9.3%	3.6%	3.8%	4.2%	3.3%	8.0%	3.0%
Oklahoma City	3.3%	7.8%	3.9%	4.2%	4.0%	3.9%	6.5%	3.8%
Philadelphia	3.2%	9.5%	4.4%	5.2%	4.4%	3.9%	6.5%	3.6%
Phoenix	3.0%	7.0%	3.2%	3.6%	4.0%	2.8%	4.6%	3.6%
Richmond	2.6%	8.2%	3.4%	2.9%	3.5%	2.9%	5.0%	3.1%
Riverside	3.6%	8.7%	3.9%	3.7%	5.1%	4.0%	6.1%	4.3%
Rochester	3.8%	9.5%	5.1%	5.4%	4.8%	4.3%	6.0%	4.0%
San Antonio	3.0%	7.4%	3.1%	3.4%	4.1%	3.1%	4.8%	3.9%
San Francisco	1.4%	6.1%	2.4%	1.2%	2.4%	1.4%	4.9%	1.4%
San Jose	1.5%	6.5%	1.8%	1.9%	2.4%	1.5%	4.7%	1.6%
Seattle	1.8%	6.0%	2.3%	2.0%	2.4%	1.8%	4.1%	2.0%
Tampa	2.8%	7.2%	3.6%	3.5%	3.8%	2.8%	4.9%	3.3%
Washington, DC	2.0%	7.5%	2.9%	2.7%	2.9%	2.0%	5.2%	2.3%

* Low-income multifamily households are below 200% FPL and in a building with five or more units.

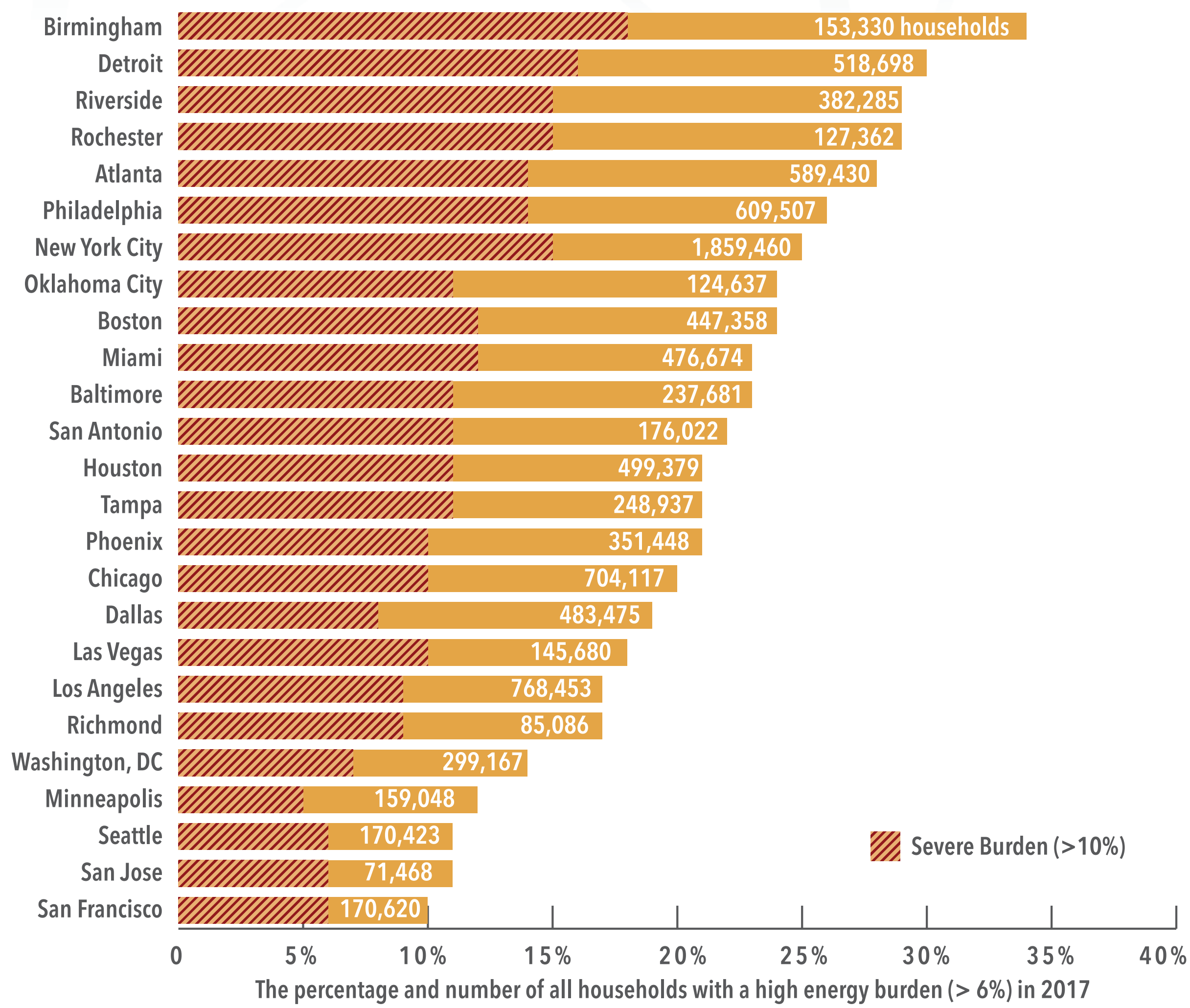
FIGURE 5. Energy burden experienced by 50% and 25% of low-income households in 25 metro areas



METRO DATA: HIGH AND SEVERE ENERGY BURDENS

The percentage of households experiencing a high energy burden varied across the select metro areas, with up to one-third of residents in some cities facing a high energy burden. Figure 6 shows the percentage and total number of households in each metro area that experience high and severe energy burdens. Six metro areas have a greater percentage of households with a high energy burden than the national average (25%), including Birmingham (34%), Detroit (30%), Riverside (29%), Rochester (29%), Atlanta (28%), and Philadelphia (26%).

FIGURE 6. The percentage and number of all households with a high energy burden (> 6%) in each of the 2017 AHS MSAs



Appendix B includes data on high and severe energy burdens in each metro area in our sample. In nine metro areas, 12% or more of households experienced a severe energy burden, spending more than 10% of their income on energy bills; among these are 1.1 million households in New York City, 333,000 in Philadelphia, and 288,000 in Atlanta.

As these findings illustrate, high and severe energy burdens are both a national and a local challenge. Even though some metro areas have lower percentages of households with high energy burdens than the national average, each city has tens to hundreds of thousands of households with high energy burdens. In addition, both the national energy burden trends and the metro-level trends show similar patterns of energy burden vulnerability for specific groups and are therefore likely reflected in other metro areas nationally as well. This indicates that both the metro areas studied and other cities have energy burden disparities in their communities. They also have opportunities to create policy and programs to lower these energy burdens for their residents.

By focusing on the needs of those who are disproportionally burdened—particularly at the intersection of criteria such as of low-income, communities of color, older adults, and renters—policymakers can set policies and create programs that have the greatest impact on energy insecurity. As they do so, they should recognize that many households—especially those with high energy use due to building inefficiencies—experience much higher than average energy burdens. These households are therefore likely to need targeted and long-lasting interventions, such as energy efficiency and weatherization, to achieve long-term affordability.

Low-Income Weatherization Can Reduce High Energy Burdens

Energy efficiency and weatherization provide a long-term solution to reducing high energy burdens, while also complementing bill payment assistance and programs aimed at energy-saving education and behavior change. *Weatherization* refers to programs that address the efficiency of the building envelope and building systems (such as unit heating, cooling, lighting, windows, and water heating) through energy audits; these audits identify cost-effective energy efficiency upgrades provided through energy efficiency programs. Other low-income energy efficiency programs may include additional measures such as appliance replacements, efficient lighting, and health and safety measures. While these recommendations focus on weatherization and energy efficiency as a long-term solution to reducing high energy burdens, these investments can be combined with renewable energy technologies and/or electrification strategies to further reduce energy bills.

Energy efficiency programs and investments that provide comprehensive building upgrades—such as insulation, air sealing, heating and cooling systems, appliances, lighting, and other baseload measures—can strongly impact long-term energy affordability, as low-income households tend to live in older buildings and have older, less-efficient appliances than higher income households (Cluett, Amann, and Ou 2016). Research suggests that weatherization measures can reduce energy use by 25–35% (DOE 2014, 2017; DOE 2011). Assuming a 25% reduction in energy use and using the 2017 AHS data, we estimate that energy efficiency and weatherization can reduce the energy burden of the average low-income household by 25%.[18]

Low-income energy efficiency and weatherization programs are especially important in the wake of the economic recession and pandemic. These programs can both reduce high energy burdens and help stimulate the economy through local job creation and workforce development. Policies that accelerate investment in, improve the design of, and better target low-income energy efficiency, weatherization, and housing retrofit programs can have a high impact on long-term energy affordability.

[18] We assume a 25% savings from energy efficiency upgrades based on the U.S. Department of Energy's estimate (DOE 2014) and use the median low-income household values to calculate a 25% reduction. We reduced the median low-income energy bill by 25% from $1,464 to $1,098. Using the median low-income household income of $18,000, this equates to a reduced energy burden of 6.1%. Reducing the median low-income energy burden from 8.1% to 6.1% is a 25% reduction. Following this same methodology, our 2016 metro energy burden report estimates a 30% reduction based on the 2011 and 2013 AHS data.

Strategies to Accelerate, Improve, and Better Target Low-Income Housing Retrofits, Energy Efficiency, and Weatherization

Many local and state governments, utilities, and community-based organizations have already begun to identify energy efficiency as a key strategy for lowering high energy burdens. To date, we have identified nine cities (Atlanta, Cincinnati, Houston, Minneapolis, New Orleans, Oakland, Philadelphia, Pittsburgh, Saint Paul) and six states (Colorado, New Jersey, New York, Oregon, Pennsylvania, Washington) that have set energy-burden-focused policies, goals, or programs with energy efficiency as a key component (see **Appendix C**). For example, the State of Oregon's *Ten-Year Plan to Reduce the Energy Burden in Oregon Affordable Housing* states that its goal is to "reduce the energy burden on the low-income population in Oregon, while prioritizing energy efficiency to achieve that reduction" (OR DOE, OR PUC, and OHCS 2019). At the city level, Philadelphia's Clean Energy Vision Plan set a goal to eliminate the energy burden for 33% of Philadelphians. To accomplish this, the city has designed and funded multiple pilot programs to reduce high energy use in multifamily and single-family buildings. See **Appendix C** for more information on energy-burden-focused city- and state-led actions.

FIGURE 7. Key strategies to lower high energy burdens by better targeting low-income energy efficiency programs, ramping up investment, and improving program design and best practices

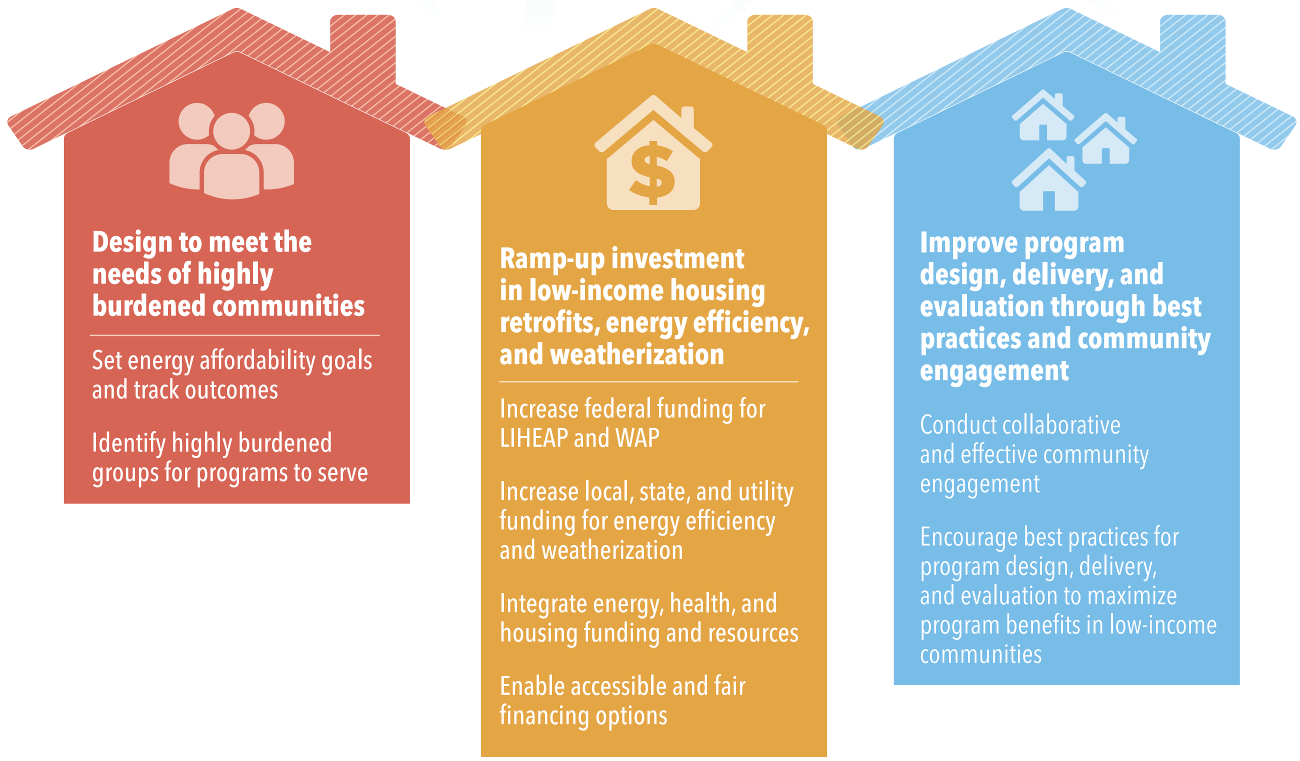


Figure 7 illustrates the key strategies to design programs to meet the needs of highly burdened communities, increase funding, and improve program design to have the greatest impact.

Design to Meet the Needs of Highly Burdened Communities

Focusing low-income energy efficiency and weatherization investment on residents with the highest burdens can greatly alleviate energy insecurity. Local and state governments and utilities can conduct more granular and detailed energy insecurity studies or analyses to help identify which local communities have the highest burdens. They can also use other energy equity and justice-related metrics and indicators to target resources to and investment in these communities. One tool for doing this analysis is the U.S. Department of Energy (DOE) Low Income Energy Affordability Data (LEAD) tool (see text box 1). Policymakers and program implementers can use a community-based approach to develop programs to invest in communities with high burdens. Cities and states can also set energy affordability goals and policies, and then track outcomes to ensure that the communities most impacted by energy insecurity receive the benefits of energy efficiency investments.

TEXT BOX 1. ENERGY BURDEN ASSESSMENTS: LOW INCOME ENERGY AFFORDABILITY DATA (LEAD) TOOL

The Department of Energy's Low Income Energy Affordability Data Tool (LEAD), developed with the National Renewable Energy Laboratory, aims to help states, communities, and other stakeholders create better energy strategies and programs by improving their understanding of low-income housing and community energy characteristics. LEAD is a web-accessible interactive platform that allows users to build their own state, county, and census tract and city profiles with specific household energy characteristics associated with various income levels and housing type, vintage, and tenure. The tool provides three principal metrics—energy burden, annual average housing energy costs, and housing counts—along with map and chart-based visualizations (Ma et al. 2019). States and local governments have begun using the LEAD tool in planning. For example, New Jersey cited its use of LEAD in the development of its new Office of Clean Energy Equity (New Jersey Legislature 2020).

LEAD is available for free at energy.gov/eere/slsc/maps/lead-tool.

SET ENERGY AFFORDABILITY GOALS AND TRACK OUTCOMES

State and local policymakers can set energy affordability and energy burden goals as a first step to addressing energy insecurity in their communities. Examples of such goals include reducing energy burdens by certain percentages, lowering energy burdens for all households to a certain threshold, or targeting resources toward individuals with high energy burdens. By focusing on the needs of those who are disproportionally burdened—particularly at the intersection of criteria such as income, race and ethnicity, and age—policymakers can set policies and create programs that have the greatest impact on addressing energy insecurity. Table 4 lists cities that have established energy burden and affordability goals. **Appendix C** includes additional city and state energy burden policies.

To establish energy burden goals, cities, states, and utilities can conduct baseline studies to understand the state of energy burdens, poverty, housing, and access to energy efficiency investments in their communities. They can then establish an appropriate goal and strategies to accomplish that goal.

Coordinating goal setting with other state and local priorities can help cities to streamline their efforts. Some cities—such as Minneapolis and New Orleans—include energy burden goals in their climate action plans as a strategy to reduce greenhouse gas emissions and achieve more equitable outcomes. States such as New York have also used energy burdens in statewide energy affordability policy plans.

Energy burden maps and visualizations are a useful tool for cities and states to achieve more equitable and affordable energy in their communities, move resources toward overburdened communities, and address other climate and equity goals. The DOE's LEAD tool provides one way to create energy burden visualizations. Plans should include specific strategies for lowering high energy burdens, as well as methods and strategies to track iterative progress.

In addition to goals, some cities have begun using energy burden as an equity indicator metric. For example, the city of Oakland includes energy cost burden as a metric in its *2018 Equity Indicators* report (City of Oakland 2018) to measure equity within essential housing services. The city found that energy burdens were higher for Black, Hispanic, and Asian households in the city as compared to white households. Similarly, the Minneapolis Climate Action Plan indicates that reporting on plan progress should also include equity indicators to measure whether energy burden reductions are equitable (City of Minneapolis 2013). Text box 2 offers examples of how governors and policymakers in four states—Pennsylvania, New York, Oregon, and Washington—created goals and policies around energy burdens to address energy insecurity in their states. To date, energy burden goals are largely set and acted upon by climate and energy officials at the city and state level. Such metrics and goals are rarely part of larger

TABLE 4. Cities with energy burden goals and strategies

City	Description	Data source
Atlanta	The Resilience Strategy includes action to lift energy burden on 10% of Atlanta households.	City of Atlanta 2017
Cincinnati	The Green Cincinnati Plan set a goal to reduce household energy burdened by 10% compared to current levels.	City of Cincinnati 2018
Houston	The Climate Action Plan includes a goal to promote weatherization programs to reduce residential energy consumption and focus on reducing energy burdens of low-income populations.	City of Houston 2020
Minneapolis	The Climate Action Plan states that the city will prioritize neighborhoods with high energy burdens for strategy implementation.	City of Minneapolis 2013
New Orleans	The Climate Action Plan includes two strategies to reduce the high energy burdens of the city's residents.	City of New Orleans 2017
Philadelphia	The Clean Energy Vision Plan set a goal to eliminate the energy burden for 33% of Philadelphians.	City of Philadelphia 2018
Saint Paul	The city set a 10-year goal to reduce resident energy burden so that no household will spend more than 4% of its income on energy bills.	City of Saint Paul 2017

TEXT BOX 2. CASE STUDIES: STATE-LED ENERGY AFFORDABILITY EFFORTS

New York Energy Affordability Goal. In 2016, Governor Andrew M. Cuomo became one of the first U.S. government officials to issue a policy aimed at addressing high energy burdens. Through the state's first ever Energy Affordability policy, he aims to ensure that no New Yorker spends more than 6% of their household income on energy (New York 2016). New York continues to explore pathways to reducing energy burden to 6% for all New Yorkers through a combination of enhanced bill assistance, energy efficiency, and increased coordination among state agencies responsible for energy, bill assistance, and affordable housing.

Oregon's Strategies to Achieve Affordability. Issued by Governor Kate Brown in 2017, Executive Order 17-20 targets state agencies to improve energy efficiency. Section 5(b) emphasizes a prioritization of energy efficiency in affordable housing to reduce utility bills (Oregon 2017). In response to this directive, the Oregon Housing and Community Service Department partnered with the DOE and the Public Utility Commission to develop an assessment to identify the energy burden of Oregon's low-income population and also prioritize energy efficiency. The interagency assessment concluded that energy costs for low-income Oregonians are nearly $350 million per year, and it identified more than $113 million annual potential energy cost savings that can be achieved through low-income energy efficiency programs across the state (OR DOE, OR PUC, and OHCS 2019). The order identifies a number of strategies to achieve these cost savings, such as adopting energy codes for new buildings and including retrofit measures, such as smart thermostats and replacing electric resistance heating.

Pennsylvania Energy Affordability Study. In 2019, the Pennsylvania Public Utility Commission (PA PUC) released a report that examined home energy affordability for the state's low-income customers (Pennsylvania PUC 2019a). The report's goal was to determine what constitutes an affordable energy burden for low-income households in the state, which would advise changes to the bill payment assistance programs to achieve these affordable energy burden levels. In 2020, the PA PUC set a new policy to direct the state's regulated utilities to ensure that low-income customers spend no more than 10% of their income on energy bills and that the lowest-income customers spend no more than 6% of their income on energy bills (Pennsylvania PUC 2019b).

Washington Clean Energy Transformation Act. In 2019, Governor Jay Inslee passed the Clean Energy Transformation Act (CETA), which sets specific goals to achieve 100% clean electricity across Washington by 2045. Under CETA, the Washington Department of Commerce will assess the energy burdens of low-income households and the energy assistance offered by electric utilities. The department will consult with local advocates of vulnerable populations and low-income households to improve energy assistance programs. The department will publish a statewide summary to include the estimated level of energy burden and energy assistance among electric customers, identify drivers of energy burden and energy efficiency potential, and assess the effectiveness of current utility programs and mechanisms to reduce energy burdens (Washington State Department of Commerce 2020).

public health strategies and priorities despite their wide-reaching health implications.

IDENTIFY HIGHLY BURDENED GROUPS FOR PROGRAMS TO SERVE

Overburdened households, especially Black, Native American, Hispanic, and other communities of color, often are either marginalized and overlooked by utilities' energy efficiency program marketing or face additional barriers to program participation, such as high cost or financing barriers (Leventis, Kramer, and Schwartz 2017). Creating targeted energy efficiency marketing beyond direct billing mailers can drive positive outcomes for the whole system.

Policymakers can also look beyond energy burden as an indicator to identify highly burdened groups, taking into account factors such as income, unemployment rates, race and ethnicity, geography, education, and multiple other stressors—including air pollution and health indicators. By using metrics beyond energy burden, policymakers and program implementers can better invest resources in communities that experience the highest levels of marginalization underinvestment, and negative social and health impacts (Lin et al. 2019). Policymakers can design and implement programs that meet the needs of highly burdened groups through robust community engagement. For example, local governments can design programs to improve access to affordable, energy-efficient housing by mandating or incentivizing stringent energy efficiency standards, streamlining permit and inspection processes, and amending zoning codes for construction of more housing units, while also using neighborhood approaches to involve and empower community members in these processes (Samarripas and de Campos Lopes 2020).

TEXT BOX 3. MEETING THE NEEDS OF HIGHLY BURDENED GROUPS: CASE STUDIES

Minneapolis Green Zones: The Minneapolis Climate Action Plan's Environmental Justice Working Group developed the idea of *Green Zones*, a place-based policy initiative aimed at improving health and supporting economic development. The city used data to identify two such zones—a Northern Green Zone and a Southern Green Zone—where residents face disproportionate burdens across areas such as equity, displacement, air quality, brownfields and soil contamination, housing, green jobs, food access, and greening (City of Minneapolis 2020). Once created, the city designed programs to direct investment into these communities. The Green Zones provide an example of how policymakers can work to identify highly burdened communities and create programs that meet the needs of residents in these areas.

Energy Burden as a Program Qualification: Efficiency Vermont. Efficiency Vermont (EVT), the energy efficiency program implementer for the state's utility-funded energy efficiency programs, conducted a 2018 study of equity measurements to better understand how the clean energy industry defines, collects, analyzes, and reports data on equity. This study informed changes to the design of EVT's Targeted High Use Program, which launched in 2011 and originally qualified customers based on two factors: income (< 80% of Area Median Income [AMI]) and a minimum energy use of 10,000 kWh/year. The program historically served approximately 350 households per year, working with the DOE's Weatherization Assistance Program (WAP) to conduct energy assessments and then install LEDs and water-saving measures, identify appliances for replacement, and replace high-efficiency heat pumps and heat pump water heaters where appropriate. Through its equity analysis, EVT determined that the energy use threshold was too high and excluded many customers with high energy burdens—but lower energy use—from accessing the program. In 2019, EVT changed the program qualification to two factors: income (< 80% AMI) and electric energy burden (≥ 3%). This change allowed it to recenter the program around energy burden reduction by qualifying not only more customers but also those who have high energy burdens yet may have previously been disqualified based on their energy use.

Efforts to alleviate high energy burdens should aim not only to identify those with high burdens and energy use but also to understand who has been overlooked by past efforts and develop strategies to address the needs of these households. Text box 3 contains additional case studies of city- and utility-led strategies to meet the needs of their overburdened communities.

Accelerate Investment in Low-Income Housing Retrofits, Energy Efficiency, and Weatherization

The current need for low-income energy efficiency and weatherization far exceeds allocated resources. In 2017, utility-led energy efficiency administrators allocated only 5% of electric and 22% of natural gas energy efficiency expenditures to low-income programs (CEE 2019). This funding allocation shows that energy efficiency funds are not currently distributed to ensure that low-income households have equitable access to these investments and their benefits.

Policymakers and advocates can work toward leveraging and allocating additional funding for low-income energy efficiency and weatherization programs. They can also help ensure that these programs follow best practices to increase their impact. Following are several useful strategies for ramping up additional funding for low-income energy efficiency and weatherization.

INCREASE FEDERAL FUNDING FOR LIHEAP AND WAP

Although an estimated 36 million U.S. households are currently eligible for weatherization, the DOE's Weatherization Assistance Program (WAP) has served only 7 million households over the past 40 years (Bullen 2018; DOE 2016). WAP serves about 100,000 homes per year through DOE and leveraged funds, which is far fewer than both the eligible households nationally and the 15.7 million severely energy burdened households estimated in this study (NASCSP 2020b). At the current rate, it would take 360 years to weatherize all eligible households through WAP—assuming no more households become WAP-eligible over time.

Congress funds WAP and allows funds to be transferred to the program from the Department of Health and Human Services' Low-Income Home Energy Assistance Program (LIHEAP). WAP can also utilize additional leveraged funds. States can transfer 15% (or up to 25% with a waiver) of LIHEAP bill assistance funds to WAP to supplement DOE weatherization funding. Over the past 10 years, annual expenditures directed toward weatherization have ranged from $1 billion to $3 billion per year, with the American Recovery and Reinvestment Act greatly increasing low-income funding for WAP (Brown et al. 2019). The National Association for State Community Services Programs' 2018 funding report estimates that WAP grantees had access to $1.1 billion in total available funding in 2018, with $247 million direct base funding from the DOE, $453 million from LIHEAP-transferred funding, and $408 million from utilities, state-sourced revenue, and other sources (NASCSP 2020b). Non-DOE WAP funds in 2018 added an additional $861 million, or $3.48 for every DOE-invested dollar (NASCSP 2020b).

The federal government has the ability to increase both WAP and LIHEAP budgets to better meet households' needs. From 2008 to 2018, DOE base funding for WAP has fluctuated from a high of $450 million in 2009 to a low of $68 million in 2012 (DOE 2009, 2012). In 2020, Congress allocated $305 million to WAP—a 23% increase ($58 million) compared to the funds allocated in 2018 (DOE 2020). Even so, leveraging additional state, local, and other funding helps supplement and increase available weatherization funds. In addition, states can decide to increase the LIHEAP percentage they transfer to WAP to better support the program. Further, it is essential that the increased demand for adequate cooling systems be assessed in the allocation of WAP and LIHEAP funds. For households across the South, rising temperatures and the increasing frequency and duration of heat waves are likely to increase cooling needs—and thus energy expenses (Berardelli 2019).

The COVID-19 pandemic has added to the urgency of increasing support for low-income bill payment assistance. On May 8, 2020, the federal government authorized $900 million in supplemental LIHEAP funding to help "prevent, prepare for, or respond to" home energy needs surrounding the national emergency created by COVID-19 (HHS 2020). On May 15, 2020, the U.S. House of Representatives passed the Health and Economic Recovery Omnibus Emergency Solutions (HEROES) Act, which would add an additional $1.5 billion for LIHEAP to address energy access and security issues resulting from the COVID-19 pandemic (116th Congress 2020). As of publication, the Senate has not passed this legislation.

INCREASE STATE, LOCAL, AND UTILITY FUNDING FOR ENERGY EFFICIENCY AND WEATHERIZATION

Funding from states, local governments, and utilities can also support low-income energy efficiency and weatherization efforts. In many states, PUCs can set low-income energy efficiency spending and/or savings requirements—as well as energy burden reduction targets—for their regulated utilities. As of 2017, of the 27 states with electric and/or natural gas Energy Efficiency Resource Standards (EERS), 18 had low-income energy efficiency spending requirements in place (Berg and Drehobl 2018; Gilleo 2019). States and local governments can also fund and implement their own energy efficiency and weatherization programs separately from WAP or as a WAP add-on. They can, for example, allocate funds—such as from Community Development Block Grants (CDGB)—to joint or independent energy efficiency and weatherization programs.

Policy approaches can be aligned to leverage funding resources and maximize benefits for residents, including reduced energy burdens and safer and healthier housing.

Appendix C and text box 4 include examples of cities and states that created independent energy efficiency and weatherization programs to address high energy burdens.

INTEGRATE ENERGY, HEALTH, AND HOUSING FUNDING AND RESOURCES.

High energy burdens, housing, and health are inextricably linked. In our study, many of the groups who experience high energy burdens also live in inadequate housing and disproportionally suffer from a variety of other harms, including higher than average exposures to environmental pollution (Tessum et al. 2019) and higher than average rates of certain preventable illnesses and diseases (CDC 2013). Although the recent COVID-19 pandemic has sharply illustrated this disparity, the same story plays out across a variety of preventable harms.[19] Policy approaches can be aligned to leverage funding resources and maximize benefits for residents, including reduced energy burdens and safer and healthier housing.

The benefits of these programs can be much greater when the goals of saving energy and protecting health are sought in tandem. Typical energy efficiency and weatherization services can provide a range of health benefits. Poorly sealed building envelopes allow pests, moisture, and air pollution to infiltrate (Institute of Medicine 2011), which can harm respiratory health through pest allergies, mold growth, and lung disease. Leaky windows, faulty HVAC systems, and poor insulation can lead to cold drafts and extreme home temperatures during summer and winter months. This can trigger heat-related illnesses and asthma attacks, as well as exacerbate other respiratory illnesses (AAFA 2017; American Lung Association 2020; CDC 2016). Addressing these issues through energy efficiency and weatherization will result in improved health outcomes; it will also reduce household energy burdens.

[19] For more on the disparities among COVID-19 fatalities, see Malcolm and Sawani (2020); Hooper, Nápoles, and Pérez-Stable (2020); and CDC (2020).

TEXT BOX 4. CITY- AND STATE-FUNDED ENERGY AFFORDABILITY PILOT PROGRAMS

Philadelphia: To meet its energy burden goals, Philadelphia has partnered on multiple pilot programs to reduce high energy burdens for low-income single and multifamily households. In 2017, the Philadelphia Energy Authority (PEA) launched its Multifamily Affordable Housing Pilot program in partnership with public and private-sector groups, including the local electric and natural gas utilities, property owners, energy service companies, program implementers, contractors, and technology providers (PEA 2020a). The program's goal was to deliver deep energy savings of more than 30% to low-income multifamily building residents in the city. In 2018, PEA and partners completed the program's first phase, which included low-cost measures and measures to collect energy data. These data were then used in the second phase to design deeper savings measures, such as HVAC and building envelope measures.

In response to COVID-19, PEA is developing a platform with its partners and advocates to coordinate and streamline low-income homeowner services aimed at improving home safety, health, affordability, and comfort (PEA 2020b). Set to launch in 2021, PEA's Built to Last pilot program aims to deliver comprehensive home improvements that will reduce energy burden while improving health and safety. The program will serve 80–100 homes and will streamline benefit screening, property assessment, and construction management. To cover program costs, Built to Last aims to combine available funding with grants and microfinancing options. PEA plans to deploy the Built to Last program at a larger scale in 2022 (PEA 2020b).

Pittsburgh. The city recognized that while Pittsburgh residents have some of the lowest utility rates in the country, they still pay almost twice the national average for their energy bills, leading to high energy burdens. Over the course of a few years, Pittsburgh developed a Climate Action Plan and launched both its resilience strategy (OnePGH) and its equality indicator project. These three projects helped the city identify residential energy burden as one of the primary challenges that local communities face (City of Pittsburgh 2019). As part of the Bloomberg Mayor's Challenge, Pittsburgh created Switch PGH to address high energy burdens through a civic engagement tool that gamifies home improvement (Mayors Challenge 2018). Switch PGH helps residents make lasting energy efficiency behavior changes and incentivizes home upgrades to reduce energy burdens.

Colorado. The Colorado State Energy Office awarded GRID Alternatives, a solar installer that focuses on the low-income market, a $1.2 million grant to launch a demonstration project with the goal of reducing the energy burden for more than 300 low-income households. The program also aimed to improve understanding of how to make community solar programs with low-income participants mutually beneficial for both utilities and participants (Cook and Shah 2018) Through this program, households saved from 15% to more than 50% on their utility bills, with an average annual savings of $382.

Myriad programs exist to address health and safety issues within homes, as well as to preserve and grow the affordable housing stock. Opportunities exist to integrate these programs and resources to more comprehensively address the energy, health, and housing needs of the households most in need of assistance.[20] For example, many homes must defer energy efficiency investments due to a home's physical issues, such as those related to structural deficiencies, moisture, and/or mold. According to Rose et al. (2015), WAP agencies estimated that such issues led to a 1–5% deferral rate for WAP income-eligible homes. In some areas, however, the problem is worse. In western Wisconsin, for example, a Community Action Agency and WAP provider serving four counties reported a deferral rate approaching 60% (NASCSP 2020a). Addressing nonenergy-related housing issues would allow more homes to be weatherization-ready.

Integrating programs creates opportunities to streamline administration and reduce operating redundancies that can leave more funding for energy efficiency and weatherization measures that enable households to save on energy costs. Pooling resources and establishing cross-sector referral networks not only stretches program budgets, but it also can make programs more accessible for residents by streamlining eligibility and enrollment processes. For instance, offering a single contact point or a streamlined process can give participants a variety of services simultaneously to meet their energy, health, and housing needs (Levin, Curry, and Capps 2019). This can help mitigate barriers that arise when people have to navigate multiple separate services with varying eligibility requirements and enrollment processes. Efficiency Vermont's Healthy Homes Initiative (HHI) is one such example. A partnership between the state's WAP partners and community-based organizations that offer health interventions, HHI is coordinated through Vermont's Office of Economic Opportunity. Using

[20] ACEEE recently published several reports exploring the intersection of health and energy, including *Protecting the Health of Vulnerable Populations with In-Home Energy Efficiency: A Survey of Methods for Demonstrating Health Outcomes* (www.aceee.org/research-report/h1901); *Making Health Count: Monetizing the Health Benefits of In-Home Services Delivered by Energy Efficiency Programs* (www.aceee.org/research-report/h2001); and *Braiding Energy and Health Funding for In-Home Programs: Federal Funding Opportunities* (www.aceee.org/research-report/h2002).

One Touch, an electronic platform for healthy home resources, HHI has established a robust referral network and successfully integrated healthy home principles into its residential energy efficiency program design.

The health sector is also beginning to realize the efficiencies of combining health and energy assessments and interventions (Hayes and Gerbode 2020). For example, a single contractor could be trained to both identify and address a family's asthma triggers, energy efficiency needs, and fall risks, thereby reducing the associated logistical burden on residents who might otherwise have to coordinate each service individually. Efforts such as this are beginning to appear across the country. In 2015, the state of Washington directed more than $4 million in competitive grants to fund collaborations among clinical practitioners, home retrofitters, and community service organizations as a means of empowering clinicians and others to refer participants for a range of coordinated services (e.g., comprehensive in-home repairs and community health worker visits) (Levin, Curry, and Capps 2019). In New York, the State Energy Research and Development Authority (NYSERDA) recently kicked off a value-based payment pilot program that seeks to implement a healthy homes approach; through this program, Medicaid managed care organizations will partly cover residential upgrades when healthcare cost savings and benefits to residents are verified (NYSERDA 2018). Such cross-sectoral approaches to energy efficiency and weatherization seek to address some of the major root causes of health and energy inequities while making enrollment and participation feasible and accessible for residents. The benefits of energy efficiency cut across the health and energy sectors; by working to integrate resources, policymakers can maximize these benefits.

Housing policy can also help ensure that energy efficiency is integrated into efforts to upgrade and expand the affordable housing stock. State and local governments can play a key role in these integrating approaches. For example, a growing number of state housing finance agencies (HFAs)—state-chartered entities responsible for ensuring affordable housing across states—have included energy efficiency requirements in their allocation criteria for low-cost financing programs such as federal Low-Income Housing Tax Credits and grant programs administered to local governments. The same is true for local housing authorities, which increasingly incorporate energy efficiency into the maintenance and repair of their subsidized housing stock (EPA 2018). Text box 5 offers a brief case study of how one local government systematically required energy efficiency in its rental certification process, ensuring that all types of rental housing meet a specific level of energy performance.

ENABLE ACCESSIBLE AND FAIR FINANCING OPTIONS

Many low-income households face barriers—such as credit eligibility—to investing in energy efficiency; these barriers can prevent them from participating in energy efficiency programs or installing energy efficiency upgrades that require financing for up-front costs. With the right consumer protections in place, financing can enable households to undertake cost-effective energy efficiency investments to lower their energy usage and bills. Local and state governments, utilities, private lenders, and nonprofit or community-based organizations can act to create and/or enable low- or no-cost financing options (i.e., payments are offset by energy cost savings) for energy efficiency investments.

Several types of financing instruments, such as on-bill payment (i.e., loan repayments included on the utility bill) and energy service agreements are becoming more common (Leventis, Kramer, and Schwartz 2017). Similarly, opportunities such as Commercial Property Assessed Clean Energy (C-PACE) can increase energy efficiency financing in the affordable multifamily sector. SEE Action's 2017 report, *Energy Efficiency Financing for Low- and Moderate-Income Households,* provides a comprehensive overview of the pros and cons of various financing options for both single and multifamily low-income households (Leventis, Kramer, and Schwartz 2017).

Improve program design, delivery, and evaluation through best practices and community engagement

Program designers and implementers can collaborate and effectively engage with a community to create programs that fit its specific needs rather trying to fit the community into an existing program design. They can also incorporate best practices into their program design, delivery, and evaluation, and can emulate successful peer program models to increase program effectiveness and impact.

CONDUCT COLLABORATIVE AND EFFECTIVE COMMUNITY ENGAGEMENT

To create programs that effectively reduce high energy burdens, energy efficiency and renewable energy program designers and implementers can work to engage and include local stakeholders throughout the program planning and implementation processes.

By connecting with, listening to, and partnering with community-serving organizations and community members in highly impacted communities, program

TEXT BOX 5. THE CITY OF BOULDER'S SMARTREGS PROGRAM

In 2010, the city council in Boulder, Colorado, adopted SmartRegs, a program that requires all rental housing units in the city to demonstrate that their efficiency approximates or exceeds the standards set by the 1999 Energy Code. The program was integrated into the city's existing rental license program, which requires a rental property to obtain and renew its rental license every four years. This renewal entails an inspection for health and safety measures, and SmartRegs added energy efficiency requirements that must be met to certify that the property is approved for rental. All single- and multifamily units that offer long-term licensed rental housing are subject to the requirement. For larger multifamily buildings, a sample of representative apartments can be inspected.

Boulder also offers a companion EnergySmart program that provides technical assistance, help with selecting contractors for energy efficiency improvements, and financial incentives beyond those offered by the local utility. EnergySmart is funded primarily by Boulder County and provides services to all municipalities in the county.

SmartRegs has been recognized not only for saving energy and related costs but also for leading to widescale upgrades in the city's rental housing stock. Over the course of the eight-year compliance timeline, nearly all of the approximately 23,000 licensed rental units have become compliant (City of Boulder 2020a). The most common upgrades were attic, crawlspace, and wall insulation. The average upgrade cost has been about $3,000 per unit, of which an average of $579 was paid by city- and utility-sponsored rebates. As of 2018, the city estimates that the program has saved about 1.9 million kWh of electricity, 460,000 therms of natural gas, $520,000 in energy costs, and 3,900 million metric tons of carbon dioxide. The city estimates the total investment in the program at just over $8 million, including nearly $1 million in rebates (City of Boulder 2020b).

administrators can identify the best measures, financing options, delivery methods, and marketing strategies to help residents reduce high energy burdens and meet their needs. Achieving this connection requires partnering with the community on program design and identifying and addressing barriers to participation for key stakeholders. This often requires engagement and trust-building over a long time period.

Robust community engagement incorporates the voices of and/or delegates power to community members. Such engagement can help develop neighborhood-centered programs that are most successful when combined with consistent funding, quality delivery infrastructure, and targeted outreach and engagement (USDN 2019). For more information on best practices in stakeholder engagement, see the DOE's Clean Energy for Low-Income Communities (CELICA) Online Toolkit at betterbuildingssolutioncenter.energy.gov/CELICA-Toolkit/stakeholder-engagement.

To include residents with high energy burdens in policy and program design, cities, states, and utilities can establish working groups, task forces, committees, and other structures that give residents a formal decision-making role. Creating this engagement when energy insecurity strategies, goals, and/or programs are first being developed allows for more input and direction from community members. Local energy planning efforts can also start with a community needs assessment led by a formal body of community residents. Local government and community leaders can then use this assessment's findings to drive local energy affordability policies and program developments based on the findings' prioritized needs and strategies.

Policymakers and program implementers can minimize stakeholder and community participation barriers by funding or compensating participants for their time and participation in stakeholder engagement processes. For example, offering stipends to compensate participants for their time and expertise, setting realistic time expectations, creating accessible logistics, and offering additional incentives can increase participation and access (Curti, Andersen, and Write 2018). Other incentives to reduce engagement barriers include childcare, meals, and transit passes.

Policymakers can also move to a model of *energy democracy* in which community residents are innovators, planners, and decision makers on how to use and create energy in a way that is local, renewable, affordable, and just (Fairchild and Weinrub 2017). Communities that have transitioned to an energy democracy have shifted away from "an extractive economy, energy, and governance system to one that is regenerative, provides reparations, transforms power structures, and creates new governance and ownership practices (ECC 2019)." The Emerald Cities Collaborative led the creation of an *Energy Democracy Scorecard*, which provides a framework for communities to move toward an energy democracy. Policymakers can work to create energy democracy frameworks in their communities by working with community members to recognize power imbalances and create dialogues about systemic barriers that must be addressed in order to correct long-standing injustices and inequalities in the energy and related sectors. This can help move the energy planning model to one of community self-determination and shared ownership. For more information, see emeraldcities.org/about/energy-democracy-scorecard.

ENCOURAGE BEST PRACTICES FOR PROGRAM DESIGN, DELIVERY, AND EVALUATION TO MAXIMIZE BENEFITS IN LOW-INCOME COMMUNITIES

Researchers from ACEEE and other organizations have established numerous best practice strategies and case studies of ways to improve and expand low-income energy efficiency programs and investments (Aznar et al. 2019; Nowak, Kushler, and Witte 2019; EDF 2018; Gilleo, Nowak, and Drehobl 2017; Samarripas and York 2019; Cluett, Amann, and Ou 2016; Ross, Jarrett, and York 2016; Reames 2016).

Table 5 includes low-income program best practices across five categories: coordination, collaboration, and segmentation; funding and financing; measures, messaging, and targeting; evaluation and quality control; and renewables and workforce development. **Appendix D** offers more detailed descriptions and examples of each of these best practices.

TABLE 5. Low-income program best practices by category

Coordination, collaboration, and segmentation	Funding and financing	Measures, messaging, and targeting	Evaluation and quality control	Renewables and workforce development
Community engagement and participatory planning	Leverage diverse funding sources	Include health and safety measures and healthier building materials	Collect and share metrics	Integrate energy efficiency and solar
Statewide coordination models	Inclusive financing models	Prioritize deep energy-saving measures	Conduct robust research and evaluation	Support the development of a diverse and strong energy efficiency workforce
One-stop-shop program models	Align utility and housing finance programs	Integrate direct-installation and rebate programs	Include quality control	
Market segmentation		Target high energy users and vulnerable households	Incorporate nonenergy benefits	
Fuel neutral programs		Incorporate new and emerging technologies in low-income programs		
		Effectively message programs in ways that provide clear value and actionable guidance		

Conclusions and Further Research

High energy burdens and energy insecurity are well-documented and pervasive national issues. Even in 2017, a time of economic prosperity, well over one-quarter of all U.S. households experienced a high energy burden. As this indicates, we need a renewed focus on equitable clean energy development and just energy transitions to ensure that investments in energy efficiency and renewable energy address energy insecurity. Climate change also underscores the urgency in addressing high household energy burdens. As temperatures continue to rise and heat waves become more common, access to clean, affordable energy is needed more than ever. We need cross-sectoral approaches that address the intersection of energy, health, and housing in the face of climate change.

Both nationally and in metro areas, this study finds that certain groups pay disproportionally more of their income on energy costs, including low-income households, communities of color, older adults, renters, and those residing in older buildings. Even though each metro area has a unique energy burden landscape, all cities have energy security inequities and can work to address them through collaborative policy and program decisions. Policymakers at the local, state, and utility levels can direct energy efficiency and renewable energy investments to disadvantaged and historically underinvested communities. They can then measure and ensure that these investments provide equitable benefits to local jobs, community health, and residential energy affordability.

Energy burdens are not the sole indicator of energy insecure households but rather provide one metric for determining energy insecurity. Further research is needed to identify the main physical drivers of high energy burdens, as well as the policies best suited to address the needs of the most highly energy burdened households. To better understand their communities' energy insecurity landscape, cities and states—and their energy, health, and housing agencies—as well as utilities are well-positioned to conduct detailed energy burden analyses, including qualitative data collection and interviews. Such studies would enable a first step toward setting more targeted energy affordability and energy burden goals and creating equitable, cross-sectoral policies and programs for achieving greater access to affordable energy for all.

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APPENDIX A.
Energy Burden Data

Appendix A.1—National Energy Burden Data

A1. National energy burden data including sample sizes, median energy burdens, median income, median monthly energy bills, and the percentage of households in each group with a high and severe burden

Subgroups	Sample size	Median energy burden	Median annual income	Median annual energy expenditures	High burden percentage (>6%)	Severe burden percentage (>10%)
All households	53,539	3.1%	$58,000	$1,800	25%	13%
Low-income (≤ 200% FPL)	16,685	8.1%	$18,000	$1,464	67%	40%
Low-income with adult over 65	6,018	9.3%	$15,000	$1,440	74%	47%
Low-income with child under six	2,665	7.1%	$26,400	$1,800	59%	33%
Low-income with disability	5,759	8.7%	$14,660	$1,344	69%	43%
Non-low-income (> 200% FPL)	36,854	2.3%	$84,005	$2,040	6%	1%
White (non-Hispanic)	33,219	2.9%	$65,000	$1,920	23%	11%
Black	7,747	4.2%	$36,000	$1,560	36%	21%
Hispanic	8,435	3.5%	$47,400	$1,680	28%	14%
Native American	1,003	4.2%	$40,000	$1,680	36%	19%
Older adults (65+ years)	15,750	4.2%	$40,015	$1,800	36%	19%
Renters	20,455	3.4%	$36,000	$1,320	30%	17%
Owners	33,082	3.0%	$75,000	$2,160	22%	11%
Single family	37,423	3.1%	$70,020	$2,160	24%	12%
Multifamily (5+ units)	9,936	2.4%	$35,450	$960	22%	12%
Low-income multifamily (5 + units, ≤ 200% FPL)	4,563	5.6%	$14,300	$960	47%	26%
Small multifamily (2–4 units)	3,708	3.4%	$34,700	$1,200	29%	17%
Manufactured homes	2,440	5.3%	$34,800	$1,800	45%	25%
Buildings built before 1980	28,013	3.4%	$50,040	$1,800	29%	15%
Buildings built after 1980	25,525	2.8%	$66,000	$1,920	21%	11%

Appendix A.2—Regional Energy Burden Data

A2.1. Regional energy burdens, including sample sizes for each region, median energy burdens, median monthly energy bill, and the percentage with high and severe burdens

Region	Sample size	Median energy burden	Median annual income	Median annual energy expenditures	Upper-quartile energy burden	High burden percentage (>6%)	Severe burden percentage (>10%)
East North Central	7,422	3.6%	$52,500	$1,920	6.8%	29%	15%
East South Central	2,177	4.4%	$39,400	$1,800	8.5%	38%	21%
Middle Atlantic	4,851	3.4%	$60,000	$2,040	6.8%	29%	16%
Mountain	3,932	2.9%	$57,625	$1,680	5.2%	21%	11%
New England	2,778	3.5%	$71,985	$2,640	6.7%	29%	15%
Pacific	11,177	2.3%	$69,800	$1,680	4.5%	18%	9%
South Atlantic	11,363	3.2%	$56,120	$1,920	6.2%	26%	14%
West North Central	2,412	3.1%	$55,100	$1,800	5.8%	25%	12%
West South Central	7,427	3.3%	$52,000	$1,800	6.0%	25%	13%
National	53,539	3.1%	$58,000	$1,800	6.0%	25%	13%

A2.2. Regional median energy burdens for income-based groups

Region	Low-income (≤200% FPL)	Low-income with older adults (65+)	Low-income with child under 6	Low-income with disability	Low-income multifamily (5+ units, ≤200% FPL)	Non-low-income (>200% FPL)
East North Central	9.1%	9.8%	8.2%	9.2%	6.0%	2.6%
East South Central	9.1%	10.0%	8.6%	9.9%	6.6%	2.9%
Middle Atlantic	9.4%	10.7%	7.9%	10.2%	6.9%	2.6%
Mountain	6.9%	8.4%	5.7%	7.7%	4.5%	2.2%
New England	10.5%	11.6%	9.6%	10.8%	5.6%	2.9%
Pacific	6.8%	7.5%	5.4%	6.9%	5.3%	1.7%
South Atlantic	8.4%	9.5%	7.7%	8.8%	5.8%	2.3%
West North Central	7.9%	9.1%	7.1%	7.9%	4.7%	2.5%
West South Central	7.7%	9.6%	6.6%	9.0%	5.8%	2.4%
National	8.1%	9.3%	7.1%	8.7%	5.6%	2.3%

A2.3. Regional median energy burdens based on race/ethnicity, age, and tenure status

Region	White (non-Hispanic)	Black	Hispanic	Older adults (65+ years)	Renter	Owner
East North Central	3.4%	5.1%	3.4%	4.7%	4.2%	3.3%
East South Central	4.0%	6.2%	5.0%	5.7%	5.3%	4.0%
Middle Atlantic	3.2%	4.4%	4.5%	4.8%	3.8%	3.2%
Mountain	2.6%	3.3%	3.7%	3.8%	3.0%	2.8%
New England	3.4%	4.0%	4.6%	4.8%	3.6%	3.5%
Pacific	2.1%	3.2%	3.0%	3.3%	2.5%	2.2%
South Atlantic	2.9%	4.0%	3.4%	4.4%	3.5%	3.0%
West North Central	3.0%	4.6%	3.3%	3.9%	3.9%	2.9%
West South Central	2.9%	4.0%	4.0%	4.4%	3.6%	3.1%
National	2.9%	4.2%	3.5%	4.2%	3.4%	3.0%

A2.4. Regional median energy burdens based on building type

Region	Single family	Multifamily (5+ units)	Low-income multifamily (5+ units, ≤200% FPL)	Built before 1980	Built after 1980
East North Central	3.6%	3.0%	6.0%	4.0%	2.9%
East South Central	4.3%	3.9%	6.6%	4.9%	3.9%
Middle Atlantic	3.5%	2.5%	6.9%	3.6%	2.9%
Mountain	2.9%	2.3%	4.5%	3.3%	2.7%
New England	3.6%	2.4%	5.6%	3.7%	3.1%
Pacific	2.4%	1.9%	5.3%	2.3%	2.3%
South Atlantic	3.2%	2.5%	5.8%	3.6%	2.9%
West North Central	3.1%	2.6%	4.7%	3.4%	2.7%
West South Central	3.3%	2.6%	5.8%	3.9%	3.0%
National	3.1%	2.4%	5.6%	3.4%	2.8%

A2.5. Regional upper-quartile energy burdens for income-based groups (25% of households in each group have a burden above the upper-quartile threshold)

Region	Low-income (≤200% FPL)	Low-income with older adults (65+)	Low-income with child under 6	Low-income with disability	Low-income multifamily	Non-low-income (>200% FPL)
East North Central	16.4%	17.6%	14.2%	15.9%	10.6%	3.9%
East South Central	15.7%	15.7%	18.7%	17.2%	12.0%	4.2%
Middle Atlantic	17.6%	20.1%	15.6%	18.5%	12.9%	4.0%
Mountain	12.0%	15.3%	9.6%	13.6%	8.4%	3.3%
New England	19.3%	21.7%	15.4%	19.2%	10.8%	4.5%
Pacific	12.0%	13.7%	10.2%	12.0%	9.2%	2.8%
South Atlantic	14.7%	15.9%	12.4%	15.7%	10.0%	3.6%
West North Central	14.1%	14.5%	13.7%	14.6%	8.7%	3.6%
West South Central	12.9%	17.5%	10.1%	16.5%	10.2%	3.5%
National	14.4%	16.3%	12.0%	15.6%	10.1%	3.6%

A2.6. Regional upper-quartile energy burdens based on race/ethnicity, age, and tenure status (25% of households in each group have a burden above the upper-quartile threshold)

Region	White (non-Hispanic)	Black	Hispanic	Older adults (65+ years)	Renter	Owner
East North Central	6.4%	10.0%	6.1%	8.4%	8.4%	6.1%
East South Central	7.4%	12.3%	9.2%	10.3%	10.9%	7.2%
Middle Atlantic	6.2%	9.8%	8.6%	9.3%	8.0%	6.1%
Mountain	4.8%	6.3%	6.2%	7.0%	5.7%	4.9%
New England	6.3%	8.1%	9.3%	9.5%	7.8%	6.0%
Pacific	4.1%	6.5%	5.6%	6.4%	5.1%	4.1%
South Atlantic	5.5%	8.0%	6.2%	8.4%	7.4%	5.5%
West North Central	5.5%	9.3%	6.1%	7.3%	7.8%	5.2%
West South Central	5.1%	7.6%	7.1%	8.6%	7.3%	5.4%
National	5.5%	8.4%	6.5%	8.1%	7.1%	5.4%

A2.7. Regional upper-quartile energy burdens based on building type (25% of households in each group have a burden above the upper-quartile threshold)

Region	Single family	Multifamily (5+ units)	Low-income multifamily (≤200% FPL, 5+ units)	Built before 1980	Built after 1980
East North Central	6.6%	6.5%	10.6%	7.4%	5.7%
East South Central	7.8%	8.2%	12.0%	9.6%	7.5%
Middle Atlantic	6.7%	6.5%	12.9%	7.0%	5.9%
Mountain	5.0%	4.7%	8.4%	5.9%	4.8%
New England	6.4%	6.1%	10.8%	7.2%	5.6%
Pacific	4.4%	4.3%	9.2%	4.7%	4.3%
South Atlantic	6.0%	5.3%	10.0%	7.2%	5.5%
West North Central	5.7%	5.5%	8.7%	6.4%	5.1%
West South Central	5.9%	5.4%	10.2%	7.4%	5.2%
National	5.8%	5.3%	10.1%	6.7%	5.3%

Appendix A.3—Metro-Level Energy Burden Data

A3.1. Metro-level energy burdens, including sample sizes for each city, median energy burdens, median monthly energy bill, and percentage with high burden and severe burden

Metro area	Sample size	Median energy burden	Median annual income	Median annual energy expenditures	Upper-quartile energy burden	High burden percentage (>6%)	Severe burden percentage (>10%)
Atlanta	1,957	3.5%	$60,000	$2,280	6.5%	28%	14%
Baltimore	1,741	3.0%	$75,100	$2,280	5.5%	23%	11%
Birmingham	1,755	4.2%	$53,300	$2,280	7.4%	34%	18%
Boston	1,728	3.1%	$81,925	$2,640	5.8%	24%	12%
Chicago	1,788	2.7%	$65,350	$1,800	4.8%	20%	10%
Dallas	2,472	2.9%	$60,000	$1,920	4.9%	19%	8%
Detroit	1,917	3.8%	$57,000	$2,160	6.9%	30%	16%
Houston	2,164	3.0%	$60,000	$1,800	5.3%	21%	11%
Las Vegas	1,968	2.8%	$54,700	$1,560	4.8%	18%	10%
Los Angeles	2,351	2.2%	$61,900	$1,440	4.4%	17%	9%
Miami	1,978	3.0%	$48,050	$1,440	5.5%	23%	12%
Minneapolis	1,943	2.2%	$81,000	$1,920	3.6%	12%	5%
New York City	1,510	2.9%	$67,500	$1,920	6.0%	25%	15%
Oklahoma City	2,111	3.3%	$52,000	$1,800	5.8%	24%	11%
Philadelphia	1,852	3.2%	$66,500	$2,160	6.3%	26%	14%
Phoenix	2,000	3.0%	$60,000	$1,800	5.2%	21%	10%
Richmond	1,933	2.6%	$69,000	$1,920	4.7%	17%	9%
Riverside	2,070	3.6%	$58,750	$2,160	6.7%	29%	15%
Rochester	1,807	3.8%	$56,000	$2,160	6.7%	29%	15%
San Antonio	2,014	3.0%	$55,000	$1,800	5.4%	22%	11%
San Francisco	1,950	1.4%	$100,000	$1,440	2.9%	10%	6%
San Jose	2,043	1.5%	$109,000	$1,560	2.9%	11%	6%
Seattle	2,162	1.8%	$79,800	$1,440	3.3%	11%	6%
Tampa	1,701	2.8%	$52,000	$1,560	5.3%	21%	11%
Washington, DC	2,214	2.0%	$100,000	$2,160	3.9%	14%	7%
National	53,539	3.1%	$58,000	$1,800	6.0%	25%	13%

A3.2. Metro-level median energy burdens for income-based groups

Metro area	Low-income (≤200% FPL)	Low-income with older adults (65+)	Low-income with child under 6	Low-income with disability	Low-income multifamily (5+ units, ≤200% FPL)	Non-low-income (>200% FPL)
Atlanta	9.7%	12.6%	8.1%	10.4%	6.6%	2.7%
Baltimore	10.5%	11.4%	7.8%	10.0%	7.5%	2.6%
Birmingham	10.9%	12.9%	9.3%	10.7%	6.8%	3.0%
Boston	10.1%	11.8%	9.5%	10.4%	6.6%	2.6%
Chicago	8.0%	9.5%	5.9%	8.0%	6.4%	2.1%
Dallas	6.7%	10.0%	6.0%	8.1%	5.0%	2.4%
Detroit	10.2%	12.0%	8.6%	10.7%	6.0%	2.8%
Houston	7.1%	9.9%	5.8%	9.6%	5.8%	2.2%
Las Vegas	6.5%	8.3%	5.0%	6.5%	5.3%	2.2%
Los Angeles	6.0%	6.4%	4.9%	6.1%	4.8%	1.6%
Miami	6.9%	8.0%	5.0%	7.6%	5.5%	2.1%
Minneapolis	6.6%	8.7%	4.7%	7.0%	4.3%	2.0%
New York City	9.3%	11.4%	7.5%	11.0%	8.0%	2.1%
Oklahoma City	7.8%	9.5%	6.1%	8.7%	6.5%	2.6%
Philadelphia	9.5%	10.4%	8.1%	10.1%	6.5%	2.4%
Phoenix	7.0%	8.3%	5.6%	7.3%	4.6%	2.4%
Richmond	8.2%	10.3%	6.9%	8.4%	5.0%	2.3%
Riverside	8.7%	10.6%	6.7%	9.6%	6.1%	2.7%
Rochester	9.5%	10.1%	7.9%	9.4%	6.0%	2.9%
San Antonio	7.4%	9.5%	6.0%	8.6%	4.8%	2.4%
San Francisco	6.1%	7.0%	4.7%	6.6%	4.9%	1.2%
San Jose	6.5%	8.1%	4.4%	7.6%	4.7%	1.2%
Seattle	6.0%	6.8%	4.4%	6.0%	4.1%	1.6%
Tampa	7.2%	8.0%	5.6%	8.0%	4.9%	2.1%
Washington, DC	7.5%	9.3%	5.9%	8.3%	5.2%	1.8%
National	8.1%	9.3%	7.1%	8.7%	5.6%	2.3%

A3.3. Metro-level median energy burdens based on race/ethnicity, age, and tenure status

Metro area	White (non-Hispanic)	Black	Hispanic	Older adults (65+)	Renter	Owner
Atlanta	3.1%	4.1%	4.7%	5.1%	3.7%	3.4%
Baltimore	2.8%	3.8%	3.3%	4.1%	3.2%	2.9%
Birmingham	3.8%	5.6%	4.8%	5.8%	5.2%	3.9%
Boston	3.0%	3.7%	3.6%	4.4%	3.2%	3.0%
Chicago	2.4%	4.1%	3.0%	3.7%	3.1%	2.5%
Dallas	2.6%	3.3%	3.8%	3.8%	2.9%	3.0%
Detroit	3.5%	5.3%	4.5%	5.2%	4.6%	3.6%
Houston	2.5%	3.5%	3.4%	4.1%	3.3%	2.7%
Las Vegas	2.7%	3.2%	3.0%	3.4%	3.0%	2.7%
Los Angeles	1.8%	3.6%	2.6%	3.2%	2.4%	2.1%
Miami	2.5%	3.4%	3.1%	4.2%	3.1%	2.8%
Minneapolis	2.2%	2.6%	2.7%	3.0%	2.3%	2.2%
New York City	2.6%	3.6%	3.8%	4.2%	3.3%	2.7%
Oklahoma City	3.1%	3.9%	4.2%	4.0%	3.9%	3.1%
Philadelphia	2.9%	4.4%	5.2%	4.4%	3.9%	3.0%
Phoenix	2.8%	3.2%	3.6%	4.0%	2.8%	3.1%
Richmond	2.4%	3.4%	2.9%	3.5%	2.9%	2.6%
Riverside	3.4%	3.9%	3.7%	5.1%	4.0%	3.4%
Rochester	3.6%	5.1%	5.4%	4.8%	4.3%	3.6%
San Antonio	2.7%	3.1%	3.4%	4.1%	3.1%	3.0%
San Francisco	1.2%	2.4%	1.2%	2.4%	1.4%	1.4%
San Jose	1.4%	1.8%	1.9%	2.4%	1.5%	1.5%
Seattle	1.8%	2.3%	2.0%	2.4%	1.8%	1.8%
Tampa	2.6%	3.6%	3.5%	3.8%	2.8%	2.9%
Washington, DC	1.7%	2.9%	2.7%	2.9%	2.0%	2.0%
National	2.9%	4.2%	3.5%	4.2%	3.4%	3.0%

A3.4. Metro-level median energy burdens based on building type

Metro area	Single family	Multifamily (5+ units)	Low-income multifamily (5+ units, ≤200% FPL)	Built before 1980	Built after 1980
Atlanta	3.7%	2.5%	6.6%	4.5%	3.3%
Baltimore	3.2%	2.5%	7.5%	3.6%	2.4%
Birmingham	4.1%	3.5%	6.8%	5.1%	3.6%
Boston	3.1%	2.2%	6.6%	3.2%	2.6%
Chicago	2.6%	2.7%	6.4%	2.9%	2.2%
Dallas	3.1%	2.2%	5.0%	3.5%	2.7%
Detroit	3.8%	2.5%	6.0%	4.3%	3.0%
Houston	3.0%	2.5%	5.8%	3.4%	2.7%
Las Vegas	2.8%	2.4%	5.3%	3.6%	2.7%
Los Angeles	2.3%	2.1%	4.8%	2.3%	2.1%
Miami	2.9%	2.9%	5.5%	3.3%	2.6%
Minneapolis	2.3%	1.8%	4.3%	2.5%	2.0%
New York City	3.0%	2.4%	8.0%	3.0%	2.4%
Oklahoma City	3.2%	3.3%	6.5%	3.8%	2.9%
Philadelphia	3.3%	2.7%	6.5%	3.6%	2.5%
Phoenix	3.1%	2.1%	4.6%	3.6%	2.8%
Richmond	2.6%	2.1%	5.0%	3.1%	2.3%
Riverside	3.5%	3.9%	6.1%	4.3%	3.3%
Rochester	3.7%	3.2%	6.0%	4.0%	3.4%
San Antonio	3.0%	2.6%	4.8%	3.9%	2.7%
San Francisco	1.5%	1.3%	4.9%	1.4%	1.4%
San Jose	1.6%	1.2%	4.7%	1.6%	1.3%
Seattle	1.9%	1.5%	4.1%	2.0%	1.7%
Tampa	2.8%	2.2%	4.9%	3.3%	2.5%
Washington, DC	2.2%	1.4%	5.2%	2.3%	1.9%
National	3.1%	2.4%	5.6%	3.4%	2.8%

A3.5. Metro-level upper-quartile energy burdens for income-based groups (25% of households in each group have a burden above the upper-quartile threshold)

Metro area	Low-income (≤200% FPL)	Low-income with older adults (65+)	Low-income with child under 6	Low-income with disability	Low-income multifamily	Non-low-income (>200% FPL)
Atlanta	16.2%	19.1%	12.8%	17.9%	11.7%	4.1%
Baltimore	21.7%	34.0%	10.9%	27.1%	5.5%	3.8%
Birmingham	18.3%	20.0%	17.1%	17.7%	13.9%	4.6%
Boston	18.6%	21.8%	16.0%	21.4%	11.7%	4.2%
Chicago	15.1%	17.5%	11.2%	13.2%	12.7%	3.1%
Dallas	11.4%	17.1%	8.5%	15.4%	7.9%	3.6%
Detroit	18.8%	21.2%	13.6%	19.8%	9.6%	4.3%
Houston	12.2%	20.2%	9.0%	22.0%	9.8%	3.2%
Las Vegas	13.8%	21.8%	8.0%	13.7%	10.9%	3.2%
Los Angeles	10.4%	11.4%	8.4%	11.2%	8.7%	2.6%
Miami	11.2%	13.3%	10.0%	13.0%	10.0%	3.0%
Minneapolis	12.2%	14.8%	6.9%	12.6%	7.7%	2.9%
New York City	16.8%	21.8%	14.1%	18.6%	15.0%	3.4%
Oklahoma City	12.5%	14.0%	9.9%	12.4%	10.2%	3.7%
Philadelphia	19.1%	24.9%	14.7%	20.0%	12.1%	3.8%
Phoenix	11.9%	15.3%	9.2%	12.7%	7.3%	3.5%
Richmond	15.6%	22.0%	10.4%	19.2%	8.8%	3.3%
Riverside	15.0%	16.6%	10.7%	16.5%	9.9%	3.9%
Rochester	15.9%	20.0%	14.0%	14.7%	9.9%	4.3%
San Antonio	13.3%	16.6%	9.2%	16.2%	9.2%	3.5%
San Francisco	14.3%	14.3%	8.5%	14.4%	11.0%	2.0%
San Jose	12.5%	14.9%	7.6%	14.9%	8.9%	2.0%
Seattle	10.9%	12.0%	9.2%	9.9%	6.8%	2.4%
Tampa	12.1%	12.1%	10.7%	12.7%	9.2%	3.2%
Washington, DC	13.5%	17.6%	8.9%	15.0%	9.1%	2.9%
National	14.4%	16.3%	12.0%	15.6%	10.1%	3.6%

A3.6. Metro-level upper-quartile energy burdens based on race/ethnicity, age, and tenure status (25% of households in each group have a burden above the upper-quartile threshold)

Metro area	White (non-Hispanic)	Black	Hispanic	Older adults (65+)	Renter	Owner
Atlanta	5.4%	8.1%	7.4%	9.8%	7.2%	6.2%
Baltimore	5.0%	8.3%	4.9%	8.0%	6.7%	5.1%
Birmingham	6.7%	11.8%	8.7%	10.7%	10.4%	6.8%
Boston	5.6%	8.1%	7.7%	9.0%	6.8%	5.6%
Chicago	4.2%	8.5%	4.9%	7.5%	6.0%	4.4%
Dallas	4.3%	5.8%	6.0%	7.0%	5.1%	4.8%
Detroit	6.3%	9.4%	7.2%	9.0%	8.9%	6.3%
Houston	4.4%	6.6%	6.1%	8.0%	6.2%	4.8%
Las Vegas	4.6%	6.1%	5.0%	6.1%	5.3%	4.3%
Los Angeles	3.6%	6.5%	5.0%	6.1%	5.1%	3.8%
Miami	4.4%	6.9%	5.8%	8.3%	6.4%	5.0%
Minneapolis	3.5%	4.4%	4.5%	5.4%	4.2%	3.5%
New York City	5.4%	8.2%	7.9%	10.1%	7.2%	5.3%
Oklahoma City	5.4%	7.4%	6.6%	7.7%	6.8%	5.2%
Philadelphia	5.2%	10.2%	9.2%	8.4%	7.9%	5.5%
Phoenix	4.8%	6.2%	6.0%	7.0%	5.2%	5.2%
Richmond	4.1%	7.0%	5.8%	6.8%	5.5%	4.4%
Riverside	6.7%	7.3%	6.9%	9.2%	7.2%	6.4%
Rochester	6.2%	11.6%	11.4%	9.0%	8.1%	6.1%
San Antonio	4.6%	5.2%	6.4%	7.9%	5.5%	5.3%
San Francisco	2.5%	5.3%	3.6%	4.7%	3.0%	2.8%
San Jose	2.8%	3.7%	3.4%	5.0%	3.1%	2.8%
Seattle	3.2%	4.5%	4.1%	5.1%	3.6%	3.2%
Tampa	5.0%	7.1%	6.3%	6.5%	5.6%	5.2%
Washington, DC	3.0%	5.1%	5.1%	6.0%	4.4%	3.6%
National	5.5%	8.4%	6.5%	8.1%	7.1%	5.4%

A3.7. Metro-level upper-quartile energy burdens based on building type (25% of households in each group have a burden above the upper-quartile threshold)

Metro area	Single family	Multifamily (5+ units)	Low-income multifamily (≤200% FPL, 5+ units)	Built before 1980	Built after 1980
Atlanta	6.6%	5.3%	11.7%	8.1%	5.8%
Baltimore	5.5%	5.5%	5.5%	6.9%	4.0%
Birmingham	7.3%	6.5%	13.9%	9.7%	6.3%
Boston	5.6%	5.6%	11.7%	6.2%	4.9%
Chicago	4.5%	5.3%	12.7%	5.5%	4.0%
Dallas	5.1%	4.2%	7.9%	6.0%	4.6%
Detroit	6.8%	6.0%	9.6%	7.5%	5.7%
Houston	5.1%	5.1%	9.8%	6.1%	4.8%
Las Vegas	4.7%	4.7%	10.9%	6.7%	4.4%
Los Angeles	4.4%	4.4%	8.7%	4.5%	4.1%
Miami	5.2%	5.5%	10.0%	6.2%	4.8%
Minneapolis	3.6%	3.3%	7.7%	3.9%	3.3%
New York City	6.3%	6.6%	15.0%	5.9%	6.4%
Oklahoma City	5.5%	6.8%	10.2%	6.9%	4.7%
Philadelphia	6.2%	5.8%	12.1%	7.0%	4.9%
Phoenix	5.1%	4.2%	7.3%	6.0%	4.6%
Richmond	4.7%	4.0%	8.8%	6.0%	3.9%
Riverside	6.5%	6.9%	9.9%	7.8%	5.8%
Rochester	6.5%	6.3%	9.9%	7.1%	5.9%
San Antonio	5.5%	4.3%	9.2%	7.5%	4.5%
San Francisco	3.0%	2.6%	11.0%	2.9%	2.8%
San Jose	3.0%	2.6%	8.9%	3.1%	2.5%
Seattle	3.2%	3.2%	6.8%	3.6%	3.1%
Tampa	5.2%	4.4%	9.2%	6.5%	4.5%
Washington, DC	4.0%	3.2%	9.1%	4.5%	3.2%
National	5.8%	5.3%	10.1%	6.7%	5.3%

APPENDIX B.
High and Severe Energy Burdens

This section includes 2017 population data from the American Housing Survey (AHS) Table Creator for both national and metropolitan statistical area samples. www.census.gov/programs-surveys/ahs/data/interactive/ahstablecreator.html.

Appendix B.1—National High and Severe Energy Burdens

B1.1. Total national households in each subgroup, and each subgroup's total households with a high energy burden (≥6%) and total households with severe energy burden (≥10%)

Category	Subgroup	Total households	Percentage highly burdened (≥6%)	Total highly burdened households (≥6%)	Percentage severely burdened (≥10%)	Total severely burdened households (≥10%)
Income	All households	121,560,000	25%	30,585,830	13%	15,861,674
	Low-income (≤200% FPL)	38,551,000	67%	25,776,144	40%	15,383,432
	Non-low-income (>200% FPL)	83,009,000	6%	5,214,246	1%	738,779
Race/ ethnicity	Black	16,552,000	36%	5,995,213	21%	3,469,788
	Native American	1,483,000	36%	541,155	19%	283,884
	Hispanic	16,496,000	28%	4,572,335	14%	2,250,966
	White (non-Hispanic)	80,550,000	23%	21,924,520	11%	10,485,640
Age	Older adults (65+)	34,929,000	36%	12,487,949	19%	6,701,933
Tenure	Renters	43,993,000	30%	13,218,332	17%	7,290,945
	Owners	77,567,000	22%	17,174,847	11%	8,431,501
Housing type	Low-income multifamily (5+ units) and low-income (≤200% FPL)	9,345,000	47%	4,413,429	26%	2,408,442
	Small multifamily (2–4 units)	8,363,000	47%	3,949,653	26%	2,155,356
	Manufactured homes	6,727,000	45%	2,999,580	25%	1,709,320
	Built before 1980	55,723,000	29%	15,911,480	15%	8,392,366
	Single family	85,791,000	24%	20,831,649	12%	10,476,575
	Multifamily (5+ units)	20,605,000	22%	4,572,668	12%	2,449,125
	Built after 1980	65,838,000	21%	14,114,223	11%	7,137,071

Appendix B.2—Regional High and Severe Energy Burdens

B2.1. Total households in each region, and each region's total households with a high energy burden (≥6%) and total households with severe energy burden (≥10%)

Region	Total households in region	Percentage highly burdened (≥6%)	Total highly burdened households (≥6%)	Percentage severely burdened (≥10%)	Total severely burdened households (≥10%)
East North Central	18,522,000	29%	5,371,380	15%	2,778,300
East South Central	7,417,000	38%	2,818,460	21%	1,557,570
Middle Atlantic	16,019,000	29%	4,645,510	16%	2,563,040
Mountain	8,916,000	21%	1,872,360	11%	980,760
New England	5,809,000	29%	1,684,610	15%	871,350
Pacific	18,305,000	18%	3,294,900	9%	1,647,450
South Atlantic	23,974,000	26%	6,233,240	14%	3,356,360
West North Central	8,527,000	25%	2,131,750	12%	1,023,240
West South Central	14,070,000	25%	3,517,500	13%	1,829,100
National	121,560,000	25%	30,585,830	13%	15,861,674

B2.2. Total low-income households in each region, and each region's total low-income households with a high energy burden (≥6%) and total low-income households with severe energy burden (≥10%)

Region	Total low-income households in region	Percentage highly burdened (≥6%)	Total highly burdened low-income households (≥6%)	Percentage severely burdened (≥10%)	Total severely burdened low-income households (≥10%)
East North Central	5,979,000	74%	4,424,460	45%	2,690,550
East South Central	2,976,000	74%	2,202,240	46%	1,368,960
Middle Atlantic	4,827,000	72%	3,475,440	48%	2,316,960
Mountain	2,719,000	58%	1,577,020	33%	897,270
New England	1,621,000	75%	1,215,750	52%	842,920
Pacific	5,064,000	57%	2,886,480	33%	1,671,120
South Atlantic	8,042,000	69%	5,548,980	41%	3,297,220
West North Central	2,297,000	66%	1,516,020	39%	895,830
West South Central	5,026,000	66%	3,317,160	36%	1,809,360
National	38,551,000	67%	25,776,144	40%	15,383,432

B2.3. Total Black households in each region, and each region's total Black households with a high energy burden (≥6%) and total Black households with severe energy burden (≥10%)

Region	Total Black households in region	Percentage highly burdened (≥6%)	Total highly burdened Black households (≥6%)	Percentage severely burdened (≥10%)	Total severely burdened Black households (≥10%)
East North Central	2,336,000	43%	1,004,480	25%	584,000
East South Central	1,595,000	51%	813,450	31%	494,450
Middle Atlantic	2,437,000	38%	926,060	25%	609,250
Mountain	359,000	27%	96,930	13%	46,670
New England	401,000	33%	132,330	17%	68,170
Pacific	1,077,000	26%	280,020	15%	161,550
South Atlantic	5,485,000	35%	1,919,750	20%	1,097,000
West North Central	585,000	40%	234,000	24%	140,400
West South Central	2,277,000	34%	774,180	19%	432,630
National	16,552,000	36%	5,995,213	21%	3,469,788

B2.4. Total Hispanic households in each region, and each region's total Hispanic households with a high energy burden (≥6%) and total Hispanic households with severe energy burden (≥10%)

Region	Total Hispanic households in region	Percentage highly burdened (≥6%)	Total highly burdened Hispanic households (≥6%)	Percentage severely burdened (≥10%)	Total severely burdened Hispanic households (≥10%)
East North Central	1,083,000	26%	281,580	12%	129,960
East South Central	197,000	38%	74,860	23%	45,310
Middle Atlantic	2,052,000	38%	779,760	22%	451,440
Mountain	1,721,000	27%	464,670	13%	223,730
New England	563,000	40%	225,200	23%	129,490
Pacific	4,466,000	23%	1,027,180	11%	491,260
South Atlantic	2,695,000	26%	700,700	12%	323,400
West North Central	360,000	26%	93,600	15%	54,000
West South Central	3,359,000	31%	1,041,290	15%	503,850
National	16,496,000	28%	4,572,335	14%	2,250,966

B2.5. Total older adult (65+) households in each region, and each region's total older adult (65+) households with a high energy burden (≥6%) and total older adult (65+) households with severe energy burden (≥10%)

Region	Total older adult (65+) households in MSA	Percentage highly burdened (≥6%)	Total highly burdened older adult households (≥6%)	Percentage severely burdened (≥10%)	Total severely burdened older adult households (≥10%)
East North Central	4,711,000	39%	1,837,290	20%	942,200
East South Central	1,902,000	49%	931,980	26%	494,520
Middle Atlantic	4,228,000	41%	1,733,480	23%	972,440
Mountain	2,258,000	30%	677,400	15%	338,700
New England	1,578,000	41%	646,980	24%	378,720
Pacific	4,328,000	27%	1,168,560	14%	605,920
South Atlantic	6,402,000	37%	2,368,740	21%	1,344,420
West North Central	2,202,000	32%	704,640	17%	374,340
West South Central	3,058,000	37%	1,131,460	21%	642,180
National	34,929,000	36%	12,487,949	19%	6,701,933

B2.6. Total renting households in each region, and each region's total renting households with a high energy burden (≥6%) and total renting households with severe energy burden (≥10%)

Region	Total renting households in region	Percentage highly burdened (≥6%)	Total highly burdened renting households (≥6%)	Percentage severely burdened (≥10%)	Total severely burdened renting households (≥10%)
East North Central	5,945,000	37%	2,199,650	21%	1,248,450
East South Central	2,458,000	46%	1,130,680	28%	688,240
Middle Atlantic	6,279,000	34%	2,134,860	21%	1,318,590
Mountain	3,091,000	24%	741,840	12%	370,920
New England	2,092,000	34%	711,280	19%	397,480
Pacific	7,910,000	21%	1,661,100	11%	870,100
South Atlantic	8,395,000	31%	2,602,450	17%	1,427,150
West North Central	2,616,000	34%	889,440	19%	497,040
West South Central	5,207,000	31%	1,614,170	17%	885,190
National	43,993,000	30%	13,218,332	17%	7,290,945

Appendix B.3—Metro Area High and Severe Energy Burdens

B3.1. Total households in each MSA, and each MSA's total households with a high energy burden (≥6%) and total households with severe energy burden (≥10%)

Metro area	Total households in MSA	Percentage highly burdened (≥6%)	Total highly burdened households (≥6%)	Percentage severely burdened (≥10%)	Total severely burdened households (≥10%)
Atlanta	2,108,800	28%	589,430	14%	287,711
Baltimore	1,047,600	23%	237,681	11%	120,345
Birmingham	447,000	34%	153,330	18%	80,995
Boston	1,853,800	24%	447,358	12%	230,652
Chicago	3,526,500	20%	704,117	10%	362,906
Dallas	2,564,700	19%	483,475	8%	216,838
Detroit	1,723,300	30%	518,698	16%	269,687
Houston	2,329,000	21%	499,379	11%	249,689
Las Vegas	798,600	18%	145,680	10%	80,347
Los Angeles	4,395,700	17%	768,453	9%	390,770
Miami	2,090,600	23%	476,674	12%	249,435
Minneapolis	1,379,600	12%	159,048	5%	71,714
New York City	7,428,000	25%	1,859,460	15%	1,111,740
Oklahoma City	515,900	24%	124,637	11%	57,920
Philadelphia	2,308,400	26%	609,507	14%	332,798
Phoenix	1,685,600	21%	351,448	10%	165,189
Richmond	489,500	17%	85,086	9%	46,342
Riverside	1,314,500	29%	382,285	15%	197,493
Rochester	439,700	29%	127,262	15%	64,726
San Antonio	805,700	22%	176,022	11%	88,011
San Francisco	1,706,200	10%	170,620	6%	100,622
San Jose	657,700	11%	71,468	6%	38,953
Seattle	1,485,700	11%	170,423	6%	83,837
Tampa	1,182,800	21%	248,937	11%	127,945
Washington, DC	2,178,800	14%	299,167	7%	149,583
National	120,062,818	25%	30,585,830	13%	15,861,674

B3.2. Total low-income households in each MSA, and each MSA's total low-income households with a high energy burden (≥6%) and total low-income households with severe energy burden (≥10%)

Metro area	Total low-income households in MSA	Percentage highly burdened (≥6%)	Total highly burdened low-income households (≥6%)	Percentage severely burdened (≥10%)	Total severely burdened low-income households (≥10%)
Atlanta	589,900	79%	466,021	48%	283,152
Baltimore	241,200	77%	185,724	52%	125,424
Birmingham	156,000	82%	127,920	54%	84,240
Boston	412,700	74%	305,398	51%	210,477
Chicago	1,025,400	68%	697,272	39%	399,906
Dallas	692,500	49%	339,325	31%	214,675
Detroit	551,700	80%	441,360	51%	281,367
Houston	731,100	61%	445,971	34%	248,574
Las Vegas	253,700	55%	139,535	33%	83,721
Los Angeles	1,371,300	50%	685,650	27%	370,251
Miami	820,900	57%	467,913	31%	254,479
Minneapolis	256,900	57%	146,433	32%	82,208
New York City	2,248,400	70%	1,573,880	48%	1,079,232
Oklahoma City	155,400	68%	105,672	37%	57,498
Philadelphia	652,300	74%	482,702	48%	313,104
Phoenix	507,800	59%	299,602	32%	162,496
Richmond	122,100	64%	78,144	40%	48,840
Riverside	453,700	71%	322,127	44%	199,628
Rochester	137,400	73%	100,302	46%	63,204
San Antonio	260,800	62%	161,696	35%	91,280
San Francisco	326,600	51%	166,566	32%	104,512
San Jose	121,500	54%	65,610	32%	38,880
Seattle	290,000	50%	145,000	28%	81,200
Tampa	377,900	61%	230,519	36%	136,044
Washington, DC	399,200	60%	239,520	36%	143,712
National	38,551,000	67%	25,776,144	40%	15,383,432

B3.3. Total Black households in each MSA, and each MSA's total Black households with a high energy burden (≥6%) and total Black households with severe energy burden (≥10%)

Metro area	Total Black households in MSA	Percentage highly burdened (≥6%)	Total highly burdened Black households (≥6%)	Percentage severely burdened (≥10%)	Total severely burdened Black households (≥10%)
Atlanta	789,500	36%	284,220	21%	165,795
Baltimore	324,100	34%	110,194	20%	64,820
Birmingham	137,000	47%	64,390	30%	41,100
Boston	157,900	32%	50,528	16%	25,264
Chicago	682,800	37%	252,636	21%	143,388
Dallas	466,000	25%	116,500	14%	65,240
Detroit	427,900	43%	183,997	23%	98,417
Houston	482,400	29%	139,896	15%	72,360
Las Vegas	112,600	26%	29,276	18%	20,268
Los Angeles	372,200	27%	100,494	15%	55,830
Miami	459,500	29%	133,255	18%	82,710
Minneapolis	113,000	15%	16,950	7%	7,910
New York City	1,459,600	32%	467,072	21%	306,516
Oklahoma City	61,000	32%	19,520	17%	10,370
Philadelphia	542,900	39%	211,731	25%	135,725
Phoenix	107,200	26%	27,872	15%	16,080
Richmond	153,500	28%	42,980	15%	23,025
Riverside	129,300	30%	38,790	17%	21,981
Rochester	48,000	44%	21,120	29%	13,920
San Antonio	61,500	20%	12,300	11%	6,765
San Francisco	157,900	24%	37,896	15%	23,685
San Jose	20,600	14%	2,884	11%	2,266
Seattle	94,100	14%	13,174	6%	5,646
Tampa	144,500	28%	40,460	18%	26,010
Washington, DC	631,200	21%	132,552	10%	63,120
National	16,552,000	36%	5,995,213	21%	3,469,788

B3.4. Total Hispanic households in each MSA, and each MSA's total Hispanic households with a high energy burden (≥6%) and total Hispanic households with severe energy burden (≥10%)

Metro area	Total Hispanic households in MSA	Percentage highly burdened (≥6%)	Total highly burdened Hispanic households (≥6%)	Percentage severely burdened (≥10%)	Total severely burdened Hispanic households (≥10%)
Atlanta	168,100	35%	58,835	14%	23,534
Baltimore	42,800	21%	8,988	8%	3,424
Birmingham	14,400	40%	5,760	18%	2,592
Boston	184,900	30%	55,470	17%	31,433
Chicago	561,600	19%	106,704	9%	50,544
Dallas	592,600	25%	148,150	10%	59,260
Detroit	55,200	38%	20,976	15%	8,280
Houston	706,000	25%	176,500	11%	77,660
Las Vegas	186,600	18%	33,588	10%	18,660
Los Angeles	1,589,200	20%	317,840	10%	158,920
Miami	884,800	24%	212,352	12%	106,176
Minneapolis	60,500	16%	9,680	10%	6,050
New York City	1,544,500	33%	509,685	19%	293,455
Oklahoma City	52,300	29%	15,167	16%	8,368
Philadelphia	154,100	45%	69,345	24%	36,984
Phoenix	378,300	25%	94,575	11%	41,613
Richmond	25,100	24%	6,024	11%	2,761
Riverside	579,000	31%	179,490	15%	86,850
Rochester	25,500	44%	11,220	26%	6,630
San Antonio	400,900	27%	108,243	14%	56,126
San Francisco	284,300	12%	34,116	8%	22,744
San Jose	139,200	13%	18,096	7%	9,744
Seattle	109,600	15%	16,440	7%	7,672
Tampa	188,300	27%	50,841	16%	30,128
Washington, DC	252,700	19%	48,013	6%	15,162
National	16,496,000	28%	4,572,335	14%	2,250,966

B3.5. Total older adult (65+) households in each MSA, and each MSA's total older adult (65+) households with a high energy burden (≥6%) and total older adult (65+) households with severe energy burden (≥10%)

Metro area	Total older adult (65+) households in MSA	Percentage highly burdened (≥6%)	Total highly burdened older adult households (≥6%)	Percentage severely burdened (≥10%)	Total severely burdened older adult households (≥10%)
Atlanta	490,700	44%	215,908	24%	117,768
Baltimore	107,700	34%	36,618	18%	19,386
Birmingham	127,800	48%	61,344	27%	34,506
Boston	516,400	38%	196,232	22%	113,608
Chicago	976,800	31%	302,808	16%	156,288
Dallas	540,500	29%	156,745	17%	91,885
Detroit	493,400	41%	202,294	22%	108,548
Houston	503,200	34%	171,088	20%	100,640
Las Vegas	204,400	26%	53,144	15%	30,660
Los Angeles	1,184,600	26%	307,996	14%	165,844
Miami	712,800	35%	249,480	20%	142,560
Minneapolis	339,300	22%	74,646	10%	33,930
New York City	2,162,800	39%	843,492	26%	562,328
Oklahoma City	123,800	35%	43,330	17%	21,046
Philadelphia	674,400	37%	249,528	21%	141,624
Phoenix	502,700	30%	150,810	14%	70,378
Richmond	131,100	29%	38,019	15%	19,665
Riverside	368,300	42%	154,686	24%	88,392
Rochester	133,600	39%	52,104	20%	26,720
San Antonio	188,100	35%	65,835	18%	33,858
San Francisco	498,900	18%	89,802	10%	49,890
San Jose	171,000	20%	34,200	11%	18,810
Seattle	361,100	19%	68,609	9%	32,499
Tampa	402,500	30%	120,750	14%	56,350
Washington, DC	546,800	25%	136,700	14%	76,552
National	34,929,000	36%	12,487,949	19%	6,701,933

B3.6. Total renting households in each MSA, and each MSA's total renting households with a high energy burden (≥6%) and total renting households with severe energy burden (≥10%)

Metro area	Total renting households in MSA	Percentage highly burdened (≥6%)	Total highly burdened renting households (≥6%)	Percentage severely burdened (≥10%)	Total severely burdened renting households (≥10%)
Atlanta	794,400	31%	246,264	16%	127,104
Baltimore	369,100	30%	110,730	16%	59,056
Birmingham	141,700	47%	66,599	28%	39,676
Boston	715,000	28%	200,200	15%	107,250
Chicago	1,238,200	26%	321,932	14%	173,348
Dallas	1,060,200	20%	212,040	10%	106,020
Detroit	527,300	40%	210,920	21%	110,733
Houston	896,000	27%	241,920	14%	125,440
Las Vegas	400,900	21%	84,189	12%	48,108
Los Angeles	2,280,900	21%	478,989	11%	250,899
Miami	853,900	27%	230,553	15%	128,085
Minneapolis	407,700	14%	57,078	7%	28,539
New York City	3,643,800	29%	1,056,702	19%	692,322
Oklahoma City	169,200	30%	50,760	15%	25,380
Philadelphia	614,800	35%	215,180	19%	116,812
Phoenix	593,300	21%	124,593	10%	59,330
Richmond	174,500	23%	40,135	13%	22,685
Riverside	479,300	33%	158,169	16%	76,688
Rochester	144,300	36%	51,948	20%	28,860
San Antonio	305,300	22%	67,166	11%	33,583
San Francisco	375,100	13%	48,763	8%	30,008
San Jose	272,200	12%	32,664	7%	19,054
Seattle	613,600	13%	79,768	7%	42,952
Tampa	418,000	23%	96,140	13%	54,340
Washington, DC	801,800	17%	136,306	8%	64,144
National	43,993,000	30%	13,218,332	17%	7,290,945

APPENDIX C.
City- and State-Led Actions to Address High Energy Burdens

C1. City-led actions to reduce high energy burdens

Metro area	Strategy/action	Year enacted	Description	Data source
Atlanta	Plan with energy burden strategy	2017	The Clean Energy plan includes energy burden as a key strategy for achieving the city's clean energy future.	City of Atlanta 2019
	Plan with energy burden goal	2017	The Resilience Strategy includes action to lift energy burden on 10% of Atlanta households.	City of Atlanta 2017
Cincinnati	Plan with energy burden goal	2018	The Green Cincinnati Plan set a goal to reduce household energy burdened by 10% compared to current levels.	City of Cincinnati 2018
	City-led program to reduce energy burdens	2020	The city partnered with Duke Energy Ohio to address the high energy burdens by launching a low-income multifamily energy efficiency pilot program called Warm Up Cincy.	City of Cincinnati 2020
Houston	Plan with energy burden strategy	2018	The Climate Action Plan includes a goal to promote weatherization programs to reduce residential energy consumption and focus on reducing energy burdens of low-income populations.	City of Houston 2020
Minneapolis	Plan with energy burden goal	2013	The Climate Action Plan states that the city will prioritize neighborhoods with high energy burdens for strategy implementation.	City of Minneapolis 2013
	Equity indicator	2013	Climate Action Plan reporting should also include equity indicators to measure whether energy burden reductions are equitable.	
New Orleans	Plan with energy burden goal	2017	The Climate Action Plan includes two strategies to reduce the high energy burdens of the city's residents.	City of New Orleans 2017
Oakland	Equity indicator	2018	Oakland includes energy cost burden as a metric in its 2018 Equity Indicators report.	City of Oakland 2018
Philadelphia	Plan with energy burden goal	2018	The Clean Energy Vision Plan set a goal to eliminate the energy burden for 33% of Philadelphians.	City of Philadelphia 2018
Pittsburgh	City-led program to reduce energy burdens	2019	As part of the Bloomberg Mayor's Challenge, the city created Switch PGH to address high burdens through a civic engagement tool.	City of Pittsburgh 2019
Saint Paul	Plan with energy burden goal	2017	The city set a goal to reduce resident energy burden within 10 years so that no household spends more than 4% of its income on energy bills.	City of Saint Paul 2017

See Appendix for data sources

C2. State-led actions to reduce high energy burden

State	Strategy/action	Year enacted	Description	Data source
Colorado	Demonstration project/pilot program	2018	The Energy Office awarded GRID Alternatives a $1.2 million grant to launch a project to reduce the energy burden of 300 low-income households through renewable energy and energy efficiency investments.	Cook and Shah 2018
New Jersey	State legislation	2020	The NJ Clean Energy Equity Act (S. 2484) aims to use solar, storage, and energy efficiency to bring low-income households and environmental justice communities within or below the state's average energy burden.	New Jersey Legislature 2020
New York	Governor-led executive order	2016	Governor Andrew M. Cuomo issued the Energy Affordability policy to work toward a goal of no New Yorker spending more than 6% of their household income on energy.	New York 2016
Oregon	Governor-led executive order	2018	In response to Governor Kate Brown's Executive Order 17-20, the Oregon Department of Energy, the Oregon Public Utility Commission, and the Oregon Housing and Community Services Department conducted an assessment and created a 10-year plan to reduce energy burdens in Oregon affordable housing.	OR DOE, OR PUC, and OHCS 2018
Pennsylvania	Public Utility Commission study	2019	The Pennsylvania PUC released a report that assessed home energy affordability for low-income customers in the state.	Pennsylvania Public Utility Commission 2019
	Public Utility Commission policy	2020	The Pennsylvania PUC set a new policy to direct utilities to ensure that low-income customers spend no more than 10% (6% for lowest-income customers) of their income on energy bills.	Pennsylvania Public Utility Commission 2019
Washington	Governor-led executive order	2019	As part of Governor Jay Inslee's Clean Energy Transformation Act, the Washington Department of Commerce assessed the energy burdens for low-income households and the energy assistance offered by electric utilities.	Washington State Department of Commerce 2020

APPENDIX D.
Low-Income Energy Efficiency Program Best Practices

This section contains short descriptions of some best practices for low-income energy efficiency programs: coordination, collaboration, and segmentation; funding and financing; effective measures and targeting; evaluation and quality control; and coordination of energy efficiency and renewable energy investments.

Coordination, collaboration, and segmentation

Community engagement and participatory planning can ensure that programs are designed to meet community needs and build trust. By involving the community in the planning process, energy efficiency programs create outcomes that best meet community needs, leverage community networks to achieve higher program participation, and improve visibility and support within the community for program implementers (e.g., a utility or local government). Participatory planning requires effort from program planners, who can follow a set of best practices for optimal success.[21] For example, Professor Tony Reames conducted a community engagement study of Kansas City, Missouri, to understand barriers that low-income households face in participating in weatherization. This stakeholder engagement led to the development of innovative strategies to overcome barriers, such as hiring an all-African American staff to help build trust within the local community.[22]

Statewide coordination models enable consistent low-income program delivery across utilities, WAP implementers, and local jurisdictions. Some states have one implementer for the state's low-income programs who ensures that similar program offerings are available to all customers in the state. States such as California, New Jersey, New York, Colorado, and Massachusetts offer statewide low-income program models that aim to coordinate resources from multiple sources through a single program. For example, California's Energy Saving Assistance Program is offered by all regulated investor-owned utilities across the state. Massachusetts is served by the Low-Income Energy Affordability Network (LEAN), which includes community action agencies, public and private housing owners, government organizations, and public utilities that all work together to provide low-income efficiency solutions in the state.

One-stop-shop program models minimize barriers and allow low-income households to access all available resources in one place. The models provide a single point of contact, universal intake applications, comprehensive technical assistance, and streamlined access to program resources.[23] One-stop-shop models should be replicated in various locations and combine each location's available offerings. Through its Energize Delaware program model, for example, the nonprofit Delaware Sustainable Energy Utility (DESEU) offers a one-stop-shop resource that focuses on a whole-building approach and consolidates available resources directed at both low-income customers and owners of affordable multifamily buildings.

Market segmentation designs programs to meet the specific needs of subsets of highly burdened households, such as people living in affordable multifamily buildings or manufactured housing. Low-income customers are a diverse segment with diverse energy needs. By segmenting customers by key demographic categories, program designers can then work to identify a specific customer segment's energy usage characteristics and program needs. This can lead to more impactful outreach, relationship building, program design, and results. For instance, Eversource partnered with Oracle Utilities–Opower to develop a first-of-kind approach to digitally characterizing and targeting customers that require assistance. This analytical approach can guide utilities in creating programs that are specific to a resident subset or area.[24]

Fuel-neutral programs allow energy efficiency measures to be completed simultaneously in a home regardless of the electric and/or natural gas utilities that service it. This is critical for addressing the high costs associated with delivered fuels (oil, propane) and for coordinating across electric and natural gas utilities. For example, New York's Clean Energy Fund, designed to deliver on the state's Reforming the Energy Vision (REV) commitments, implements energy efficiency initiatives on a fuel-neutral basis. By taking a fuel-neutral approach, New York State can increase energy efficiency at the lowest cost, enable greater greenhouse gas reductions, and stimulate local economic development.[25]

[21] Calvert, K., I. McVey, and A. Kantamneni. 2017. "Placing the 'Community' in Community Energy Planning. Prepared for *Guelph's Community Energy Initiative Task Force* by the Community Energy Knowledge-Action Partnership. DOI: 10.13140/RG.2.2.22817.30562. www.researchgate.net/publication/319141113_Placing_the_'Community'_in_Community_Energy_Planning.

[22] Reames, T. 2016. "A Community-Based Approach to Low-Income Residential Energy Efficiency Participation Barriers." *The International Journal of Justice and Sustainability* Vol 21. www.tandfonline.com/doi/abs/10.1080/13549839.2015.1136995.

[23] Energy Efficiency for All, *One-Stop Shops for the Multifamily Sector*. assets.ctfassets.net/ntcn17ss1ow9/30B8LUDt8GTegjPE8clalF/8c5e68405c9692afb9f11fe898b8653e/EEFA_OneStopShop_Fact_Sheet__2_.pdf.

[24] Lin, J., K.M. Rodgers, S. Kabaca, M. Frades, and D. Ware. 2020. "Energy Affordability in Practice: Oracle Utilities Opower's Business Intelligence to Meet Low and Moderate Income Need at Eversource." *The Electricity Journal*. 33 (9): 1–11. doi.org/10.1016/j.tej.2019.106687.

[25] NYSERDA. Reforming the Energy Vision: Clean Energy Fund, Frequently Asked Questions. www.nyserda.ny.gov/-/media/Files/About/Clean-Energy-Fund/clean-energy-fund-qa.pdf.

Funding and financing

Leveraging diverse funding sources allows programs to address health and safety issues and include greater investment and available measures. Funding for low-income energy efficiency programs often comes from electric and natural gas utility ratepayer dollars, federal WAP and LIHEAP funds, state and local funds, nonprofit resources, and other private funding sources. Leveraging funding from various sources can give program implementers greater flexibility, as some federal and utility funding sources limit the types of measures they fund. Leveraging diverse funding sources can lead to a more comprehensive program outcome that has the flexibility to address health and safety issues and incorporate more complex sets of energy efficiency investments.

Inclusive financing models, such as no-interest loans, loan guarantees, and the elimination of credit requirements, are designed to help low-income households overcome up-front cost barriers to accessing traditional private financing options. Inclusive financing options include Pay As You Save (PAYS) programs and on-bill tariff models, which allow low-income households to install energy efficiency investments that are paid off over time on the customer's bill.[26] In the low-income multifamily sector, limiting or eliminating up-front costs to building owners can help them undertake more substantial energy efficiency projects and overcome barriers related to the competition for scarce funding for capital projects. Low-interest financing and on-bill repayment can help owners spread out their energy efficiency project costs over time.

Align utility and housing finance programs to encourage energy efficiency upgrades in low-income multifamily buildings. Incorporating utility-customer funding in the current climate of affordable housing refinance and redevelopment can yield deeper, more comprehensive energy efficiency improvements. These extensive renovations may involve replacing outdated building systems, and utility-customer funds can be used to help cover the incremental cost of installing more-efficient equipment than would otherwise be required. For example, the Connecticut Green Bank coordinates closely with the state's energy efficiency initiatives led by the state agencies and local utilities to align incentives for affordable financing for both energy efficiency upgrades and rooftop solar installations. The Connecticut Green Bank's financing opportunities complement the available funding for energy efficiency upgrades from the Connecticut Housing Finance Authority and the Connecticut Department of Housing.[27]

Effective measures, messaging, and targeting

Include health and safety measures and healthier building materials to reduce deferral rates and improve indoor air quality, comfort, and long-term health outcomes for program participants. Programs often address health and safety concerns through leveraged funds. However, rather than disqualifying households due to building health and safety issues such as structural problems, mold, or asbestos, utilities and program implementers can combine funding streams to provide health and safety services. For example, the Bronx Healthy Buildings Program aims to reduce asthma-related hospital visits and address the social determinants of health through education, organizing, workforce development, and building upgrades. Energy audits, building inspections, and tenant organizing aim to identify needed repairs and opportunities for energy efficiency improvements.[28]

Prioritize deep energy-saving measures through a single program and/or engagement to achieve high levels of energy savings. Using trusted contractor networks to deliver programs that include savings-based incentives lets contractors focus on deep savings rather than limiting projects to simple direct-install measures. For example, Oncor's Targeted Weatherization Low-Income program first prioritizes deep energy-saving measures such as building-shell weatherization and air sealing, and then focuses on additional measures such as air-conditioning, refrigeration, and lighting.[29]

Integrate direct-installation and rebate programs to encourage more extensive improvements. For low-income single and multifamily projects, direct-installation programs that offer no-cost energy efficiency measures can provide an opportunity to connect with building owners, complete an on-site energy assessment, and encourage owners to take advantage of rebates for more extensive improvements such as HVAC upgrades, weatherization, common-area lighting retrofits, and other building-shell improvements.

Targeting high energy users and vulnerable households to generate the greatest energy savings and impact. By using utility data to identify households with the highest energy use, energy efficiency providers can achieve the greatest energy savings. Even so, energy use should be looked at in combination with other factors

[26] For more information on inclusive financing options, see SEE Action, 2017. *Energy Efficiency Financing for Low- and Moderate Income Households: Current State of the Market, Issues, and Opportunities.* emp.lbl.gov/sites/default/files/news/lmi-final0811.pdf.

[27] See ACEEE's 2018 report, *Our Powers Combined: Energy Efficiency and Solar in Affordable Multifamily Buildings*. aceee.org/research-report/u1804.

[28] buildhealthchallenge.org/communities/awardee-bronx-nyc/.

[29] Gilleo, A., S. Nowak, and A. Drehobl. 2017. *Making a Difference: Strategies for Successful Low-Income Energy Efficiency Programs.* Washington, DC: ACEEE. aceee.org/sites/default/files/publications/researchreports/u1713.pdf.

that lead to household energy vulnerability. Although high energy use can lead to high savings, households with lower energy use can still experience high energy burdens. Efficiency Vermont, for example, changed its program qualification to focus on low-income households with high energy burden rather than low-income households with high energy use. This let the program qualify more customers and target needs to the most vulnerable households.[30]

Incorporate new and emerging technologies in low-income programs. Expanding the technology scope of low-income energy efficiency programs to technologies they do not traditionally incorporate—such as solar PV, smart meters, energy storage, and electric vehicles—can significantly improve energy affordability and equitable access to these technologies for low-income households.[31] Unless we ensure that new technologies are available to low-income and underinvested communities, inequities in access to these technologies will continue to grow. Programs that incorporate these emerging technologies can address access barriers for low-income communities and ensure more equitable distribution of their benefits.

Effectively message programs in ways that provide clear value and actionable guidance. Effective messaging helps achieve high program participation and builds trust and understanding of program benefits. Investing in energy efficiency often takes time and resources for both single and multifamily building owners. Although programs typically focus on energy savings and energy cost reductions benefits, programs must also market the many nonenergy benefits that result from energy efficiency improvements. Further, they should include actionable guidance—that is, clear steps that residents and building owners can take to learn more about program services and enroll in the program.

Evaluation and quality control

Collect and share metrics on program outcomes, equity impacts, and other tracked data to hold implementers accountable to program requirements and goals. These metrics can include factors such as race and/or ethnicity, income status, property ownership, energy burden, and energy vulnerability. Often, program implementers publish demand-side management reports that include metrics on low-income program savings, spending, and customers served. Implementers can report additional equity factors such as energy burden data, demographic data, and participation distribution. For example, VEIC published the *State of Equity Measurement: A Review of Practices in the Clean Energy Industry*, a guide that offers an overview of energy industry metrics for measuring program equity.[32] These include metrics to define target populations, determine disparate impacts, and include representative voices in program design, implementation, evaluation, and oversight.

Conduct robust research and evaluation to assess achieved reductions in energy usage. Such evaluations help document and clarify program performance. Impact evaluations measure the direct and indirect benefits from programs, while process evaluations provide systematic assessments of how programs operate. By completing robust evaluations, program planners can determine how to best improve their programs for greater impact and efficiency, and better meet the needs of the target community.

Include quality control as a core element of the services to ensure that energy efficiency services are effective, and homes are left in a safe condition. Many program implementers incorporate ongoing training for contractors and quality control professionals, viewing this as critical to program success and devoting project funding to regular trainings. Some program administrators also include strict quality control requirements for all projects rather than for a sample, which helps incentivize contractors to perform high-quality work. For example, Ouachita Electric Cooperative's HELP PAY program, a tariff-based residential energy efficiency financing program, evaluates every project after completion and facilitates trainings for its contractors in quality control techniques to ensure that all contractors understand the assessment methodologies.[33]

Incorporate nonenergy benefits into testing. Without monetizing nonenergy benefits, utility-operated low-income energy efficiency programs cost more to implement per household—and are less cost effective by traditional measures—than utility-operated energy efficiency programs serving higher income groups. However, low-income energy programs deliver benefits beyond energy savings to low-income households that are not typically incorporated into traditional cost-effectiveness testing methods. The *National Standard Practice Manual* discusses how low-income program benefits can be considered at the societal level.[34] States can decide to adjust cost-effectiveness tests for

30 Efficiency Vermont. 2020. *Targeted Communities Program Update*. www.efficiencyvermont.com/trade-partners/targeted-communities-program-update.

31 Brown, M., A. Soni, M. Lapsa, and K. Southworth. 2020. *Low-Income Energy Affordability: Conclusions from a Literature Review*. ORNL/TM-2019/1150. info.ornl.gov/sites/publications/Files/Pub124723.pdf.

32 Levin, E., E. Palchak, and R. Stephenson. 2019. *The State of Equity Measurement: A Review of Practices in the Clean Energy Industry*. Winooski, VT: VEIC. www.veic.org/Media/default/documents/resources/reports/equity_measurement_clean_energy_industry.pdf.

33 Gilleo, A., S. Nowak, and A. Drehobl. 2017. *Making a Difference: Strategies for Successful Low-Income Energy Efficiency Programs*. Washington, DC: ACEEE. aceee.org/sites/default/files/publications/researchreports/u1713.pdf.

34 National Efficiency Screening Project. 2017. *National Standard Practice Manual*. nationalefficiencyscreening.org/wp-content/uploads/2017/05/NSPM_May-2017_final.pdf. Page 58: Societal Low-Income Impacts.

low-income programs to incorporate these additional benefits. For example, Vermont uses the societal cost test as its primary test and incorporates a 15% adder for nonenergy benefits for low-income customers in its cost-effectiveness screening tool. Similarly, Colorado uses the total resource cost test and includes a 50% adder to account for the benefits from low-income programs.

Renewables and workforce

Integrate energy efficiency and solar program offerings to maximize participant benefits. To do this, combined renewable and energy efficiency programs should first invest in energy efficiency to reduce the home's overall energy needs, and then invest in renewable energy so that individual households can install the right size solar system or many households can access community solar options. For example, the Connecticut Green Bank collaborates with PosiGen, a private company, to deliver both solar and energy efficiency to low-income customers. The Green Bank helps PosiGen generate capital to provide 20-year solar leases combined with energy efficiency upgrades to program participants, leading to the most cost-effective investment.[35]

Support the development of a diverse and strong energy efficiency workforce that represents the local community. Ensure that training opportunities are linked to high-quality, well-paid, and stable careers in the energy efficiency and clean energy workforce sector. States and local governments, utilities, and other program implementers can focus on diversifying suppliers, increasing the worker pipeline by offering training for both contracting firms and students, and partnering with skills-training providers and state agencies—all while working to overcome barriers faced by historically excluded community members. Implementers can also co-deliver training for energy efficiency and renewable energy technologies. For example, the Chicago-based nonprofit Elevate Energy coordinates a Clean Energy Jobs Accelerator that trains individuals from economically excluded communities for careers in solar and energy efficiency.

[35] EDF (Environmental Defense Fund) and APPRISE (Applied Public Policy Research Institute for Study and Evaluation). 2018. Low-Income Energy Efficiency. New York. www.edf.org/sites/default/files/documents/liee_national_summary.pdf.

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