Energy Inequity and Burden in Vermont

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Introduction

Vermont has positioned itself as a national leader for clean energy. As the state continues to envision its energy future, it becomes abundantly clear that a truly sustainable Vermont will not only be clean and renewable, but also more just and equitable. Historically, both nationally and in Vermont, the energy system has systematically benefitted wealthier residents while disadvantaging the very communities who most need energy relief. As the search continues for solutions for our climate crisis, it's imperative to recognize that not everyone interacts with energy in the same fashion. For some, energy is so affordable and ingrained in daily life that it's used without thought. For others, being able to afford and access energy is a burden that occupies most financial, residential, familial, and personal-health decisions.

The Vermont Law School study and other important energy burden studies in Vermont inspired interest in further examining energy inequities in the state and exploring the disproportionate consequences for already marginalized communities. Using US Census Bureau household data,[1] new analysis completed for this report determined that lower-income Vermonters consistently have lower energy expenditures than higher-income households but experience higher energy burdens that manifest in health and financial consequences. In Vermont, more low-income people die from excess winter deaths, primarily caused by fuel poverty, than die from car crashes.[2] Furthermore, income and housing tenure affect the types of fuel available for households. Lower-income households use fuel oil and electricity disproportionately more frequently and utility gas and wood disproportionately less frequently than higher-income households. Such disproportionalities raise compelling questions about how renewable fuels are used: do low-income households remain saddled with the most expensive and least efficient types of thermal "renewable" heat while new, more cost and energy efficient technologies are only available to households that already have the lowest energy burdens? While this analysis focuses primarily on income-based energy inequities, the report also provides a preliminary exploration of racial energy inequities. In order to create a comprehensive

[1] US Census Bureau, 2018 American Community Survey; US Census Bureau, 2013-2017 American Community Survey
[2] Energy Security and Justice Program of Vermont Law School, 2014

understanding of energy inequities in Vermont, future work should include race as a consideration. Ultimately, solutions to energy, income, and climate inequities are intertwined.

What is energy burden, and how is it measured?

Energy burden, the primary metric used in this paper, is a method of addressing how income affects households' energy hardships. Energy burden is the calculation of energy expenditure as a percentage of total household income.[3] Other methods of measuring energy hardship used in this paper include energy insecurity, a metric that includes physical, social, and emotional burden in addition to financial burden,[4] and fuel poverty, the threshold at which households are not able to provide adequate fuel for a safe environment at a reasonable price, often defined as 10% of household income.[5]

Who is most affected by energy burden?

Income, energy burden, and emissions are interrelated and compound to result in additional hardships for already vulnerable populations. Income is the single most important determinant of energy burden, and higher income inequality in societies has been linked to higher CO_2 emissions.[6] Lowest-income and minority households tend to purchase the least amount of energy, have fewest emissions, but feel the highest effects of energy burden and climate.[7]

Energy consumption and emissions are each directly affected by income.[8] By one account, the poorest 10% of households are responsible for less than half of the emissions of the wealthiest 10% of households.[9] However, despite lower energy consumption and fewer emissions overall, lower-income and minority households tend

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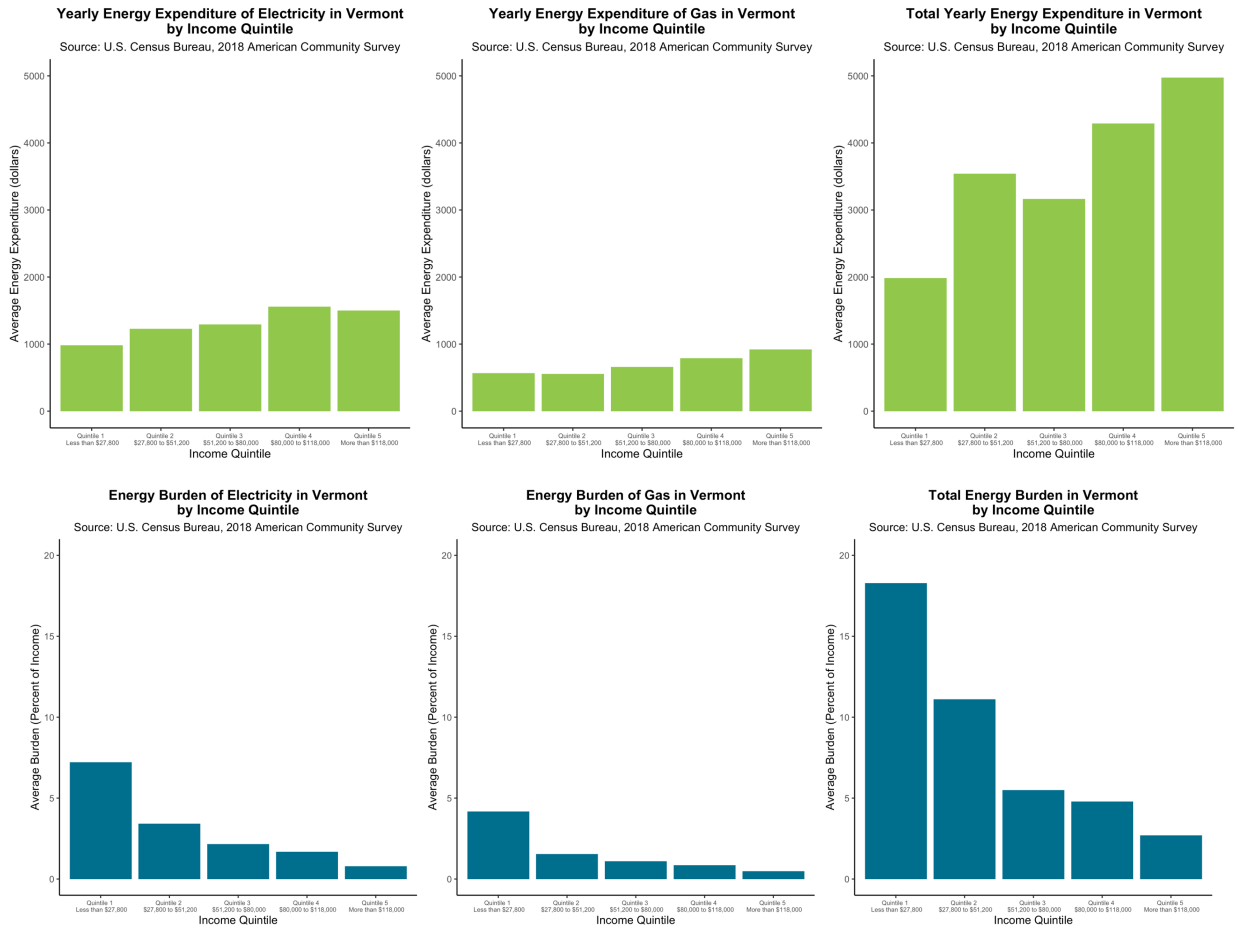
[3] Energy Security and Justice Program of Vermont Law School, 2014
[4] Lewis et al., 2020
[5] Energy Security and Justice Program of Vermont Law School, 2014; Walker et al., 2014
[6] Sears and Lucci, 2019; Galvin and Sunikka-Blank, 2018
[7] Lewis et al., 2020
[8] Galvin and Sunikka-Blank, 2018
[9] Roberts, 2008

to pay higher prices per unit of energy due to less efficient homes.[10] This effect is further exacerbated when the benefits of new clean technologies and energy efficiency programs don't reach the heaviest-burdened, marginalized communities who most need relief.[11]

Vermont is no exception to these troubling global trends; in fact, energy burden seems to be an ever-increasing hardship for Vermonters. Fuel poverty in the state increased by 76% between 2000 and 2012, with 1 in 5 Vermonters being considered fuel poor in 2012.[12] In 2019, the average energy burden was estimated at 10%, meaning a large percentage of Vermont households fall significantly above the fuel poverty threshold with transportation and thermal energy being the two largest drivers of energy burden.[13]

Figure 1



[10] Bednar et al., 2017
[11] Lewis et al., 2020; Walker et al., 2014
[12] Energy Security and Justice Program of Vermont Law School, 2014
[13] Sears and Lucci, 2019

Figure 1 examines Vermont households' energy expenditure compared to energy burden by income quintile. The highest-income households purchase more electricity, gas, and total energy than their lower-income counterparts, while the lowest-income households face the highest burdens across the three categories. The income-based difference in total burden is the most apparent in the lowest two income brackets. Households in the lowest income quintile pay on average 18.3% of total income on energy costs. In other words, in Vermont households with incomes below $27,800 pay roughly 7 times the portion of income than households with incomes above $118,000.

Effects of High Energy Burden

Financial

Compared to the rest of New England, Vermont has an especially high level of energy burden and fuel poverty.[14] The effects of energy burden for Vermonters reach beyond energy-related impacts, influencing economic and health aspects of daily life. First, high energy burden is a self-reinforcing condition. Spending almost a fifth of all household income for energy creates a steep financial burden, making it difficult to accumulate the wealth necessary to escape fuel poverty.[15] Experiencing energy poverty can also lead to cognitive biases such as present bias and loss aversion that keep households with high energy burdens in energy poverty. Greater energy burden can cause higher financial stress and a decreasing sense of security and trust in the future. This can cause households to treat losses as more impactful than equivalent gains and choose immediate, smaller benefits over long-term benefits with greater rewards, leading burdened households to make decisions that aren't financially beneficial in the long run.[16] Additionally, highest-burden households are the most sensitive to fuel price changes and are more likely to experience housing instability and homelessness.[17]

[14] Energy Security and Justice Program of Vermont Law School, 2014
[15] Energy Security and Justice Program of Vermont Law School, 2014
[16] DellaValle, 2019
[17] Charlier and Kahouli, 2019; Hernandez and Bird, 2012

Health

Poor health and safety are serious side effects of high energy burdens. High financial burdens can cause low-income households to make dangerous choices for all members of the household, leading to uncomfortable or even unsafe living conditions.[18] With expensive energy efficiency upgrades seemingly out of reach, low-income households often face a "heat or eat" dilemma, leading to increased food insecurity and/or unsafe alternative heat options, such as using the stove or oven for space heating (measures which also tend to negate or even reverse any financial savings from reduced traditional heat consumption).[19] Threat of utility shut offs create unreliable heating situations for higher-burden homes who are more likely to experience extreme home temperatures, especially in winter months when heat is more expensive and crucial for household safety.[20] In Vermont, there are more excess winter deaths, caused primarily by fuel poverty, than deaths due to car crashes.[21] In addition to higher levels of gas leaks, dampness, mold and humidity, Vermonters experiencing fuel poverty are also at higher risk for strokes, heart attacks, pulmonary embolism, influenza, pneumonia, arthritis, asthma, and mental health concerns such as chronic stress, anxiety, and depression.[22] For households with children, high energy burdens can place additional stress on parents who fear that Child Protection Services may view fuel poverty as grounds to deem their home unsafe for children.[23] Additionally, children who grow up in high-burden households are more likely to have health complications, hospitalizations, and food insecurity. They are also more likely to face high energy burdens and debt later in life, resulting in an intergenerational component to the negative health and financial effects of high energy burden.[24]

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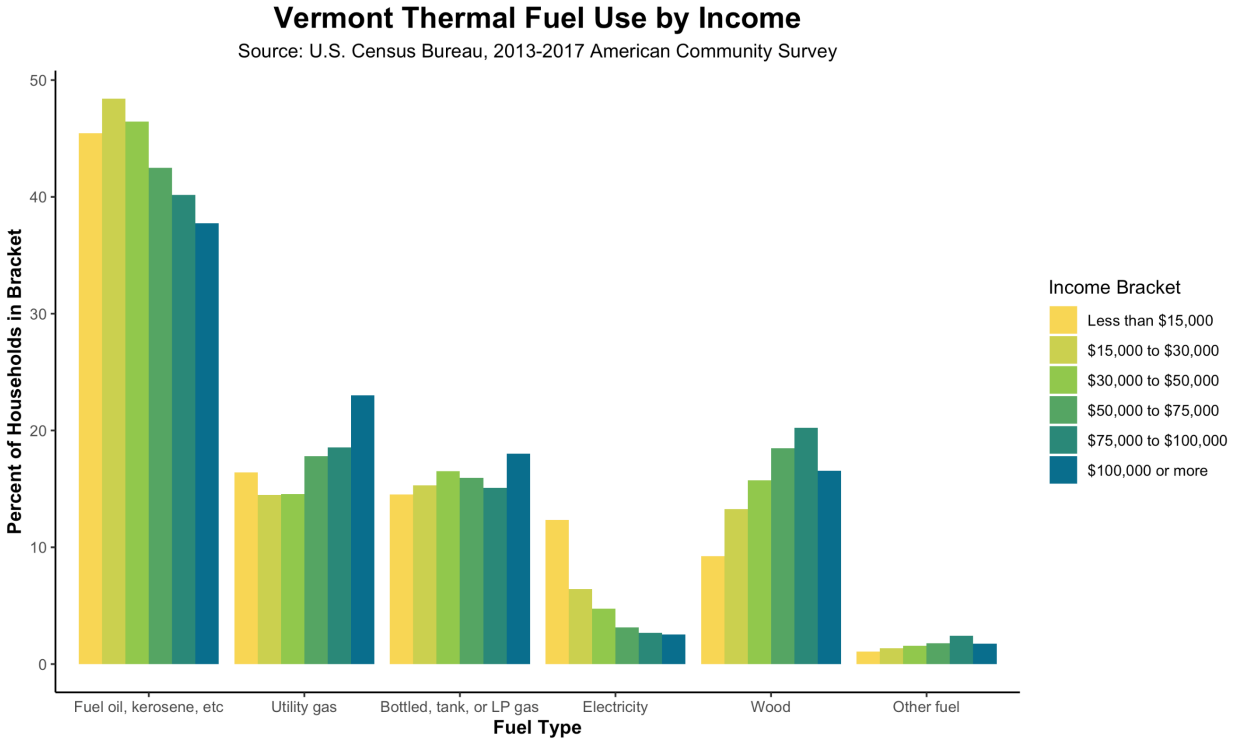
[18] Hernandez, 2016; Hernandez and Bird, 2012; Lewis et al., 2020
[19] Lewis et al., 2020; Hernandez, 2013; Hernandez, 2016
[20] Hernandez, 2013; Hernandez, 2016
[21] Energy Security and Justice Program of Vermont Law School, 2014
[22] Hernandez, 2013; Energy Security and Justice Program of Vermont Law School, 2014
[23] Hernandez, 2016
[24] Hernandez, 2013; Hernandez and Bird, 2012; Lewis et al., 2020

Income-Based Thermal Fuel Use Inequities

Figure 2



In addition to facing larger energy burdens, lower-income households also find themselves with unequal choice and access to certain fuel types. *Figure 2* shows the percentage of households in each income bracket broken up by the main type of fuel used for household heat. If there were no income-based factors affecting home heating fuel type, one would expect to see roughly the same percentage of users for each fuel type across each income bracket. However, although larger fuel-use trends remain constant (e.g., fuel oil being the most commonly used fuel type across income brackets), strong income-based trends emerge within users of the same home heating fuel. Lower-income households use fuel oil and electricity disproportionately more frequently than higher-income households and use utility gas and wood disproportionately less frequently than higher-income households.

Such trends have tangible effects on household finances. Disproportionate access to certain fuel types can lead to an additional financial burden on households already

struggling to meet energy needs costing nearly a fifth of their annual incomes. Since Vermont only has one utility that provides natural gas and it services primarily wealthier areas,[25] natural gas (the cheapest home heating fuel as of 2016[26]) is disproportionately used by wealthier Vermonters. These households are least in need of the lower costs and purchase the most energy – meaning these trends exacerbate energy burden inequity.

A slightly more complicated story emerges when examining electricity use. While electricity is the least frequently used of the shown fuel types, it is also the fuel type with the most striking differences across income brackets. While only 2.5% of higher-income households use electricity as a main source of heat, 12.4% of lowest-earning households use electricity, roughly 6 times that of the wealthiest households. In addition, the cost and efficiency of electricity for heating varies dramatically depending on how it is used. Electric heat pumps are one of the most efficient, clean, and cost-effective ways to heat a home, but upfront purchase and installation costs are barriers for lower-income households.[27] On the other hand, electric resistance heating is the most expensive way to heat a home, yet it has very low upfront purchase and installation costs[28]. These differences in upfront costs may well explain the income disparity in the use of electric heating. Without the ability to pay upfront for more efficient and cost-effective heat pump systems, lowest-income households appear to be more likely to use lower-upfront cost electric resistance heating systems that cost up to twice as much as heat pumps in the long run.

Tenure (Renting versus Owning) as a Barrier to Affordable Fuel

An additional explanation for fuel use trends by income may be a split incentive for heating investments between landlords and tenants. Split incentives occur when a landlord is responsible for installation and weatherization of residential heating but does not pay the utility bill. Given that roughly three quarters of the nation's renters pay

[25] *Natural Gas*, State of Vermont Department of Public Service
[26] Vermont Fuel Price Report, 2016
[27] Walczyk and Cadmus, 2017
[28] Vermont Fuel Price Report, 2016

their own energy bill, split incentives are a common occurrence nationwide.[29] In Vermont, around half of low-income households rent their homes and lack control over energy investments, resulting in split incentives.[30] Split incentives encourage underinvestment by landlords, resulting in lower energy efficiency and higher costs per unit of energy for tenants, thereby increasing the burden on lower-income populations who already face the largest energy burdens. In one national study, tenants affected by split incentives paid 2% higher energy bills.[31] Split incentives especially burden low-income renters, since they have to manage issues specific to low-income energy burdens at the same time as managing the additional energy burdens specific to renters. The lowest-income renters have the highest energy burden but get the lowest amount of energy per dollar spent.[32] In addition to further financial burden on low-income renters, split incentives lead to high amounts of unnecessary energy use (and emissions) due to lower energy efficiency. According to one study, nearly 2% of all U.S. energy use and 8.6% of residential energy use can be attributed to split incentives. Correcting split incentives could reduce national energy use and save high burden, lower-income households between 4 and 11 billion dollars per year.[33]

[29] Melvin, 2018
[30] Allen, 2015
[31] Melvin, 2018
[32] Hernandez and Bird, 2012
[33] Hernandez and Bird, 2012

Figure 3

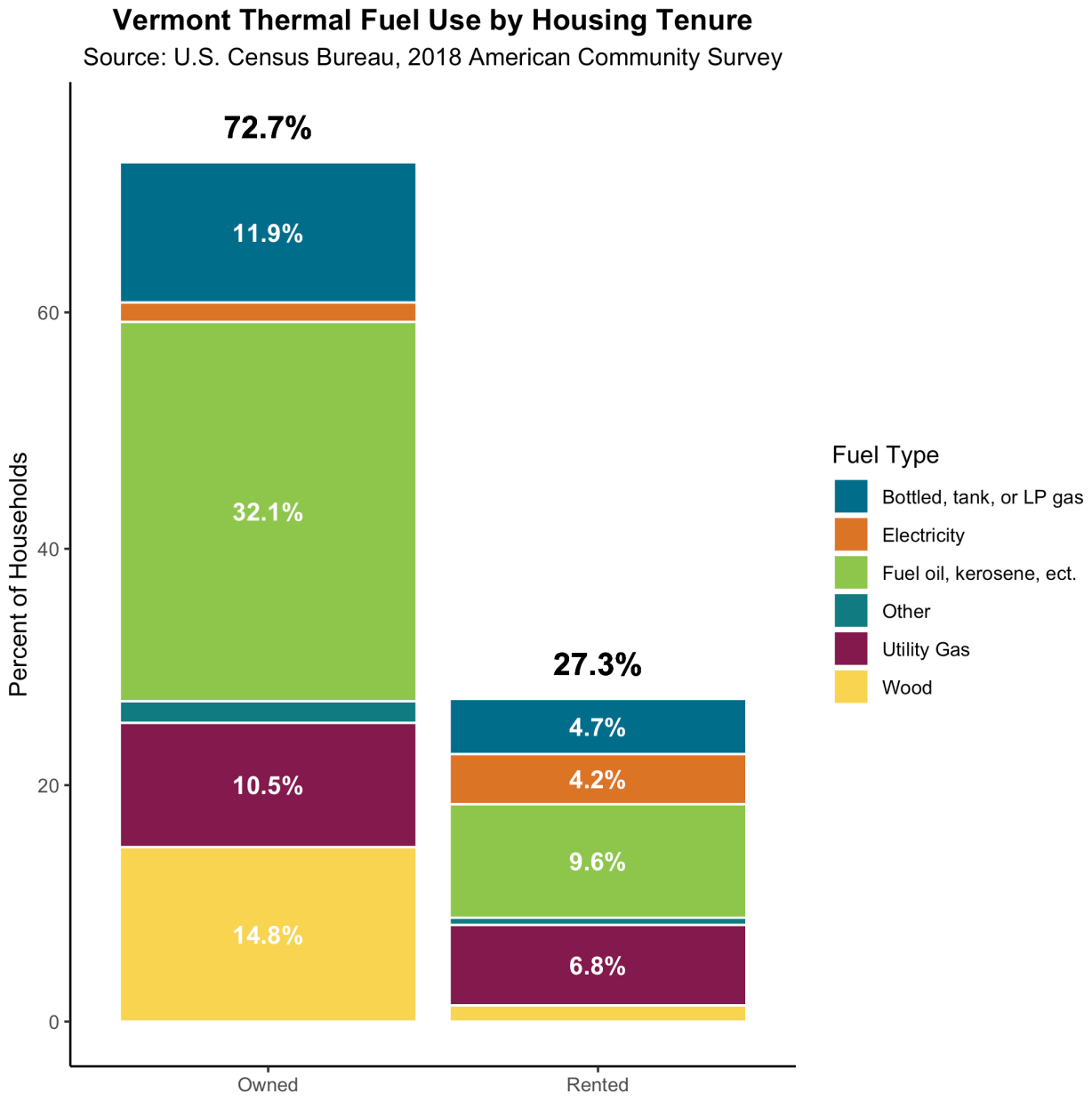
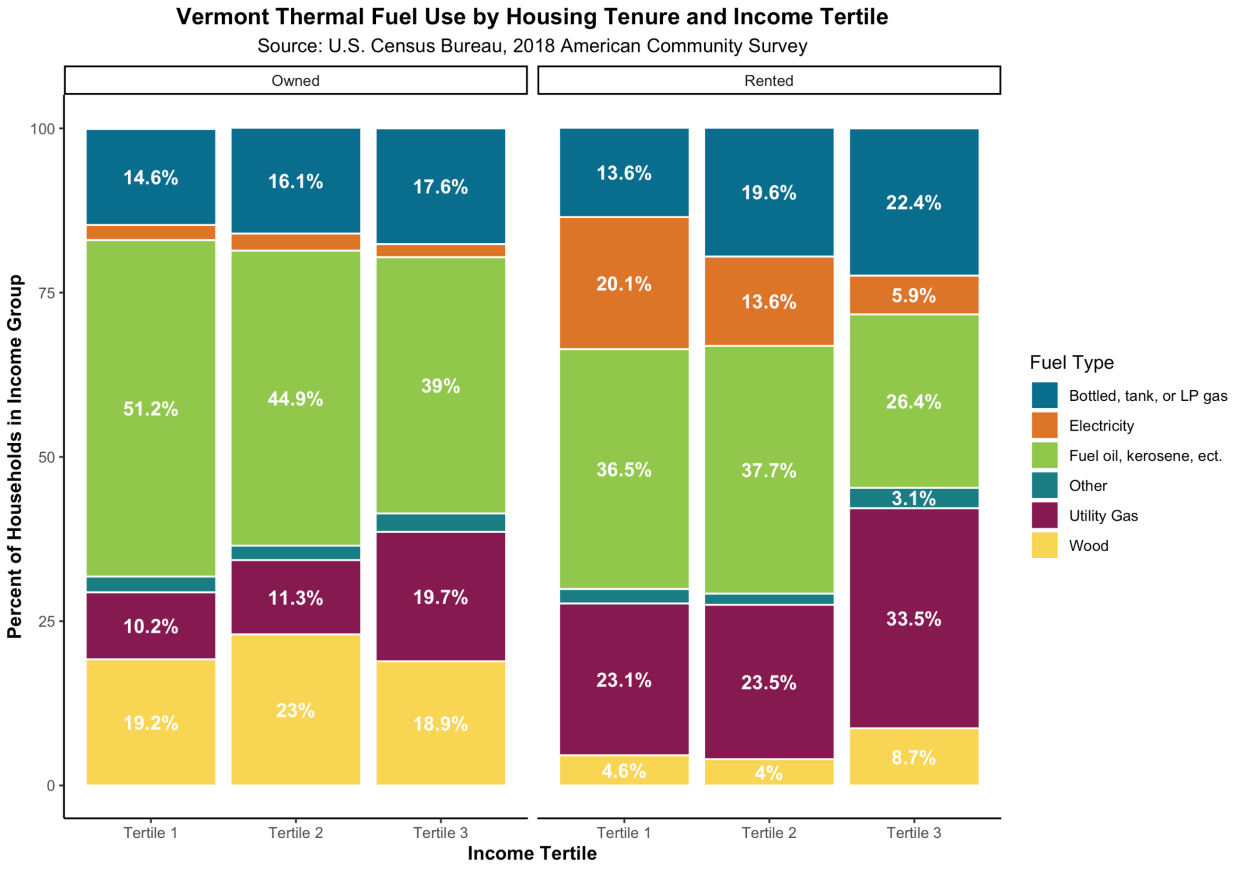

Vermont Thermal Fuel Use by Housing Tenure
Source: U.S. Census Bureau, 2018 American Community Survey
72.7%
11.9%
32.1%
10.5%
14.8%
27.3%
4.7%
4.2%
9.6%
6.8%
Percent of Households
0
20
40
60
Owned
Rented
Fuel Type
Bottled, tank, or LP gas
Electricity
Fuel oil, kerosene, ect.
Other
Utility Gas
Wood

Figure 4



Since 42% of all residential energy consumption is due to space heating,[34] it's important to examine how the use of heating fuels varies depending on tenure (i.e., on whether a home is owned or rented). *Figure 3* shows the percentage of Vermont households that use each fuel type by tenure status. Figure 4 provides the percentage of households using each fuel type normalized by income tertile and tenure status. The Figures show that the majority of electricity used for heat is used by renters, not owners. Additionally, among renters, households in the lowest-income tertile are more likely to use electricity than the highest-income renters. This indicates that, since landlords have no financial incentive to install new systems, split incentives and low installation costs of resistance heating cause the lowest-income renters to disproportionately have the highest heat costs resulting from the use of older electric resistance heating systems.

[34] Melvin, 2018

Examining housing tenure also provides insight into another phenomena: higher-income households use wood for fuel disproportionately more often than lower-income households (see *Figure 1*). While it is not certain why income would cause this trend, *Figure 3* demonstrates that almost all wood heating is by homeowners, not renters. When assessed by tenure and income (see *Figure 4)*, no income-driven effect is found, indicating that lower-income households are less likely to use wood for fuel purely because they are more likely to rent their home.

Racial Energy Equity

While this study focuses primarily on energy inequity in Vermont by income, it is important to recognize that income is not the only driver of energy inequity. While race was not included in this study, the structural inequality in the traditional U.S. energy system places greater energy burdens on BIPOC (Black, Indigenous, and people of color) households and communities.[35] It has been demonstrated in multiple national assessments that energy insecurity disproportionately affects BIPOC households, and Black households in particular, with lasting, generational effects.[36] Black Americans are more likely to live in older, less energy efficient homes and tend to pay more for less reliable energy.[37] Historic systems placing Black communities in "sacrifice zones" for the benefit of others, disinvestment in racially segregated neighborhoods, forced relocation due to gentrification after energy upgrades, and intentional, historic barriers to home ownership for Black people create an additional, racially based, and even higher energy burden for Black low-income households compared to low-income households in general.[38] While Vermont is a predominantly white state, that does not mean that racial inequities are not at play. To more fully understand energy inequity in Vermont, further state-specific research on racial energy inequities should be done in the future.

[35] Baker, 2019
[36] Lewis et al., 2020; Bednar et al., 2017
[37] Lewis et al., 2020
[38] Lewis et al., 2020; Bednar et al., 2017; and Baker, 2019

Clean Energy and Equity Solutions as Reciprocal Tools

While energy systems and income inequity can negatively impact one another, clean energy can also help rectify systemic issues of income inequity. Increased renewable energy consumption can stabilize and decrease energy costs for lower-income households, create more jobs per unit of energy produced, and lower energy costs, thereby providing relief to households with the highest energy burdens.[39] Additionally, increased use of renewable energy can lower income inequality. Investing in energy efficiency, geothermal systems, heat pumps, and solar has proven to reduce energy burden, income inequality, energy expenses, and increase thermal comfort, health, and safety.[40] In addition, policies that address poverty have been shown to reduce CO2 emissions.[41]

During this period of transition to a sustainable, just, and affordable clean energy economy, the use of energy policy "levers" has the potential to redistribute power by race and class and decrease vulnerability throughout the entire energy system.[42] However, this transition will continue to require thoughtful evaluation of past injustices in order to be effective. Pressure to act quickly against climate change encourages the reuse of methods that created the original energy system that disproportionately harms vulnerable communities by limiting access to only the most expensive, least efficient, and at times most dangerous types of energy. Attempting to make policies that emphasize resilience of the current structure only strengthens dynamics that continuously oppress individuals already shouldering the heaviest burdens. [43] A "justice-blind" energy solution leaves out BIPOC, low-income, and rural populations, and so cannot be a comprehensive solution. Given the income-based energy inequities outlined in this report, any future energy policies should further consider the nuanced effects of energy burden and income-based heating fuel accessibility.

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[39] Topcu and Tugcu, 2019
[40] Topcu and Tugcu, 2019; Begay, 2018
[41] Charlier et al., 2018
[42] Baker, 2019
[43] Baker, 2019

Conclusion

Although Vermont is a leader in renewable energy, the state is experiencing an increase in energy inequity[44]. Low-income households find themselves at great risk: they purchase the least amount of energy, have the highest energy burden, and suffer the most intensely from energy burden and climate effects. Low-income households don't have the same access to efficient and affordable heating fuels, placing already burdened households at the mercy of some of the highest and least efficient ways to heat their homes. When advocating for clean thermal energy, lower-income households must have the same access to clean sources and systems. A system where lower-income households only have access to expensive, inefficient, and at times unsafe heat such as electric resistance heating and outdated wood stoves while the least-burdened households are retrofitted with the most recent and efficient systems may be considered clean, but is not just. A truly sustainable system is one that does not place additional burdens on those who are already the most-burdened.

Clean energy policies need to address those who are most marginalized, provide communities direct access to decision-making that affects their people and lands, and be careful to avoid sanctioning large burdens on certain communities for the benefit of others. With these goals in mind, implementing equity considerations can fundamentally alter the current harmful structure to create lasting, clean, sustainable, and just future energy systems that benefit all Vermonters.[45] Further research should examine Vermont's racial energy inequity and how the distribution of clean heating systems that vary dramatically by energy efficiency and cost is determined by income and race. Vermont has an obligation to continue improving its energy system and the opportunity to use that transition to ensure that the next system does not disproportionately burden the most vulnerable – instead benefiting them, in the interest of "a more just, thriving, and sustainable future for Vermonters".

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[44] Energy Security and Justice Program of Vermont Law School, 2014
[45] Baker, 2019

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