The Persistence of Residential Energy Insecurity in Manufactured Housing of Minnesota: A Grounded Theory Study of the Social, Policy, and Structural Dimensions

A Plan B Paper

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Dedication

This effort would not have been possible without a number of people who supported me personally or academically, before and throughout graduate school.

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Abstract

In the United States, residents of manufactured homes built before 2000 have, on average, an energy burden range that is double that of residents for all other housing types built before 2000 (7.15% - 8.94% compared to 4.00% - 4.44%, respectively) ("2009 Residential Energy Consumption Survey Microdata," 2013). This disproportionately high average energy burden, in combination with a higher average energy expenditure and consumption per square foot, represent disparities in energy equity for low-income Americans. Given that household energy is a necessity, these disparities place manufactured home residents at a greater risk of being unable to affordably and efficiently heat, cool, and power their home, which is part of a phenomenon referred to as Residential Energy Insecurity. Direct and indirect strains stemming from this have severe health consequences like choosing between heating a home or buying food, a concept referred to as "heat or eat" (Hernández, Aratani, & Jiang, 2014; Brunner et al., 2012; Harrison & Popke, 2011). For more than three decades, two federal programs (the Low-Income Home Energy Assistance Program and the Weatherization Assistance Program) have addressed these dimensions of energy insecurity, yet the disparity in energy burdens persists.

The purpose of this study is to better understand what contributes to the persistence of this higher energy burden, and more broadly, to residential energy insecurity in man21ufactured housing of Minnesota. An interpretivist, grounded theory approach (Glaser & Strauss, 1967; Charmaz, 2006; Creswell, 2013) was used to code data from sixteen semi-structured interviews of Minnesota Community Action Partnership workers and other manufactured housing service providers. The interview data revealed interactions that described how this high energy burden for MH persists (see Figure 5.1). The data revealed three major themes: 1) the social, 2) policy, and 3) manufactured housing structural conditions. Between these conditions, three interactions formed: 1) social and policy; 2) social and MH structure; and 3) policy and manufactured housing structure (see Figure 5.1). Using information about these themes, a number of recommendations for program changes that reduce Residential Energy Insecurity in pre-2000 MH are proposed (see Table 6.3).

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List of Acronyms

CAP	Community Action Partnership
DOE	Department of Energy
EB	Energy Burden
LIHEAP	Low-Income Home Energy Assistance Program
MH	Manufactured Home/Housing
MHFA	Minnesota Housing Finance Agency
REI	Residential Energy Insecurity
RLP	Rehabilitation Loan Program
SBH	Site-Built Home/Housing
SFD	Single-Family Detached (Home/Housing)
WAP	Weatherization Assistance Program

Chapter 1 – Background:
Residential Energy Insecurity and Energy Inequities in the U.S.

1.1 Residential Energy Insecurity

Energy is vital for heating, cooling, and powering a home. However, for low-income Americans who live in inefficient substandard housing, coping with energy costs can become unmanageable to the point of jeopardizing their health and safety. In 2009, the average household annual energy expenditure in the U.S. was $1,797 per household, which represented 16.6% of the income for an individual at the federal poverty level or 8.1% of the income for a family of four at the federal poverty level[1] ("2009 RECS Survey," 2013). Considering 12 million (10%) Americans pay 50% or more of their income towards rent or mortgage alone, these additional home operating expenses for necessities, like energy, become even more crushing ("Affordable Housing," (n.d.). Specifically, the weight of these costs on basic needs can have many detrimental outcomes, sometimes forcing decisions between food, medicine, and heat (Hernández, Aratani, & Jiang, 2014; Brunner et al., 2012; Harrison & Popke, 2011). When a household struggles to afford the energy to power their home or maintain a comfortable and healthy indoor temperature, they experience Residential Energy Insecurity.

1.2 Residential Energy Insecurity as a Conceptual Framework

Residential Energy Insecurity (REI) is a complex phenomenon due to the many ways it can manifest. Generally, REI occurs when a household cannot affordably and efficiently maintain a comfortable indoor temperature and/or meet its electricity needs. A recent conceptual framework proposed by Hernández, Aratani, and Jiang (2014) expands this phenomenon into three dimensions: 1) Physical REI; 2) Economic REI; and 3) Coping REI. Physical REI is represented by a substandard energy inefficient dwelling and/or appliances. Some examples of Physical REI include leaking roofs or windows and the presence of mold anywhere in the home. Economic REI relates to the energy affordability, where a high percentage of annual income goes toward energy costs, also referred to as a high energy burden (EB). Boardman (1991) considered 10% of income spent on fuel as too high, but that chosen percentage was arbitrary. For this study, instead of arguing for an exact percentage that constitutes an energy burden that is 'too high,' I argue comparing the average energy burdens based on housing type. Therefore, by high, I refer to an EB that is above the average energy burden when comparing groups of housing types. Coping REI is when a household uses behaviors to mitigate an energy-related issue that severely inhibits daily life. For instance, if a resident keeps the temperature of their home at an uncomfortably low or high level that stops the person from inviting guests. Any or all of these may indicate REI, which is why it is difficult to quantify in its entirety. Currently, federal programs addressing REI narrowly use income eligibility guidelines as the primary indicator of need.

1.3 Federal Programs that Address Residential Energy Insecurity

For over three decades, two federal programs have addressed REI through two of the three dimensions: Economic REI and Physical REI. Addressing Economic REI, the Low-Income Home Energy Assistance Program (LIHEAP) was enacted in 1981 through the U.S. Department of Health and Human Services, "...to assist low-income households...in meeting their immediate home energy needs" through the use of grants ("LIHEAP Statute and Regulations," 2012). The household income eligibility was at or below 150% of the poverty line or at or below 60% of the state median income. Addressing Physical REI, the Weatherization Assistance Program (WAP) was enacted in 1976 through the Department of Energy in order to "...increase the energy efficiency of dwellings owned or occupied by low-income persons..." by improving the housing structure ("Weatherization assistance for low-income persons," n.d.). The income eligibility guideline for WAP was at or below 200% of the poverty line. The federal budget for FY 2015 was $3.39 billion for LIHEAP and $191.8 million for WAP with these funds divided among Community Action Partnership networks in each state through block grants ("LIHEAP and WAP Funding," 2015). Using income as the primary criteria for eligibility, LIHEAP and WAP address Economic

[1] Percentages calculated using the poverty income data from: ("The 2000 HHS Poverty Guidelines," 2009).

REI and Physical REI. However, not all low-income households, as determined by each program's income eligibility requirements, are the same. For instance, there are a number of different housing types with physical characteristics that can impact energy-related needs and issues.

1.4 U.S. Housing Unit Types

In the 2009 Residential Energy Consumption Survey, housing units (also called dwellings) were broken into two major types: single-family or multi-family. Single-family units have the distinguishing characteristic of an independent outside entrance and can be attached or detached. Examples of detached units are single site-built homes (also called stick built or wood frame home; referred to as SBH) and manufactured homes (also called mobile homes; referred to as MH). Examples of attached single-family units include townhouses and rowhouses. Multi-family housing units have the distinguishing characteristic of a shared outside entrance in buildings with either 2-4 units or 5 or more units. Examples of multi-family housing units are apartments, condos, duplexes, triplexes, and quadplexes. Given the variety of housing types, a more accurate way to assess the need for energy-related assistance is not through a general income guideline, like the current federal programs do, but through a theoretical framework based on energy equity. For instance, an apartment that shares a wall with other units would likely have less energy needs than a freestanding detached home with four outer walls exposed to weather.

1.5 Energy Equity as a Theoretical Framework

Energy in the home is necessary for healthy and productive lives across the world and, therefore, should be distributed equitably. While providing universal energy access is the focus in developing countries, I emphasize reducing disparities in the relative cost and efficiency of residential energy use for low-income households in the United States. Energy equity, a theoretical framework rooted in distributional justice, can be expressed in many ways by altering the allocation of energy-related assistance based on considerations between the needs, efforts, and ability of people to pay for these services (Deutsch, 1985). To balance the necessity of residential energy services with the costs to distribute it, I take the position described in educational equality literature that Jencks (1988) describes as "weak humane justice." By this, I mean that for distributing energy services, people who have a greater share of hardships, relative to other housing types, should receive more than their proportionate share of assistance to meet their energy needs.

1.5.1 *Source of Energy Data*

The energy data to identify potential energy inequities comes from the most recently available Residential Energy Consumption Survey conducted by the U.S. Energy Information Administration in 2009 and released in 2013, which I refer to as ("2009 RECS Survey Data", 2013). In addition to the energy data, I used this source for information on incomes, ownership rates, and public assistance usage for consistency. The values were presented directly in the report unless a figure is cited as ("2009 RECS Microdata," 2013), which denotes that I calculated those values based on the publicly available microdata file using the specified weights. There are limitations to relying so heavily on one source, such as if there were a measurement error, it would bias the data and not be an accurate representation.

1.5.2 Overview of Energy Inequity Indicators: Affordability and Efficiency

Since heating, cooling, and electricity are necessary and essential for everyday life, I argue that energy equity is achieved when all housing types have a similar average energy burden range. There are many other variables besides housing type to take into account, like the costs and efficiencies of different energy sources, the size of the home, or how much energy people are using. To take these into account at a systemic level, I used normalized indicators to compare all housing types on a common scale. At the group-level, an indicator may signal a systemic energy-related inequity if the average indicator for one housing-type group is higher than other groups. I used one indicator for energy affordability: the percentage of annual income spent on energy, also called the Energy Burden (EB). Then, I used two indicators for energy efficiency: the energy expenditure (in U.S. dollars) per square foot and the energy consumption (in British

thermal units or Btus) per square foot of a dwelling. By standardizing energy expenditure and consumption by square foot, differences that may have been masked by varying housing sizes become clearer. In general, larger homes will use and pay more for energy in absolute terms, but that masks energy issues for smaller homes that are less efficient and relatively more expensive.

These indicators are not perfect representations of REI by themselves so it is worth noting some weaknesses. A weakness of the EB is that lower income households will automatically have a higher EB, all other things being equal, so this alone does not sufficiently demonstrate prohibitive energy costs. Also, the energy expenditure per square foot is not a perfect indicator because different energy sources have different costs and different households use different energy mixes (i.e. may contain combinations of coal, natural gas, wood, propane, etc...). Therefore, a more complete picture is to use the average energy expenditure per square foot in combination with the average energy consumption per square foot by housing type. However, higher levels of these also do not indicate a problem because some households may choose to use more energy on non-essential services. So with all of the variations among individual households, a combination of group-level indicators would be a better signal that there may be an energy-related issue with a particular type of housing. Comparisons within housing types can also be used to signal an individual household experiencing energy-related inequities, but this is beyond the scope of this study.

1.5.3 Energy Inequity Indicator 1: Energy Burden – Dimension of Affordability

The Energy Burden (EB), a type of Economic REI, refers to the proportion of income a household spends on fuel and electricity to heat, cool, and power a dwelling. A higher EB indicator alone does not necessarily signal a problem, but may indicate that the current programs aimed to reduce the EB directly or indirectly are not adequately serving this population. The housing type with the highest average EB range is the manufactured home (Figure 1.1).

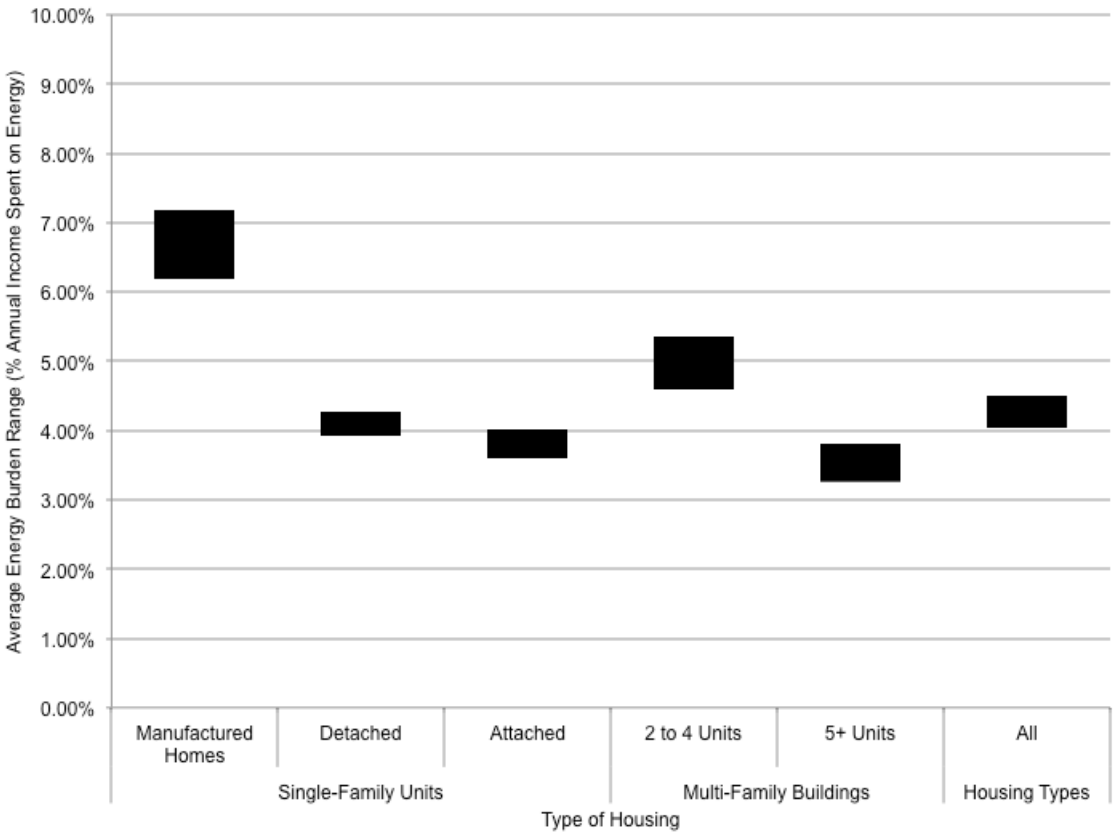

Figure 1.1. Average energy burden ranges by housing type for all construction years. Calculated from "2009 RECS Microdata," 2013, *U.S. Energy Information Administration.*

1.5.4 Energy Inequity Indictor 2: Energy Expenditure per Square Foot – Dimension of Efficiency
To complement the EB, another way to examine disparities in energy equity is through energy efficiency indicators. The two relative indicators I use are the energy expenditures and energy consumption per square foot of housing. These both are a partial measure of the energy efficiency of a housing structure for a couple of reasons. For instance, dwellings use different energy sources, which have varying costs, so it is important to see what households are actually paying, on average. Also, the consumption patterns only partially measure the efficiency of a dwelling because some of this could be attributed to the resident's lifestyle choices (i.e. residents choosing to keep their homes warmer or cooler and thus consuming more energy). MH residents spend $1.65 per square foot on energy—which is 1.5 times the average for all housing types (Figure 1.2). The greatest disparity is between MH and SBH residents, where MH residents spend 1.7 times that of SBH residents (Figure 1.2).

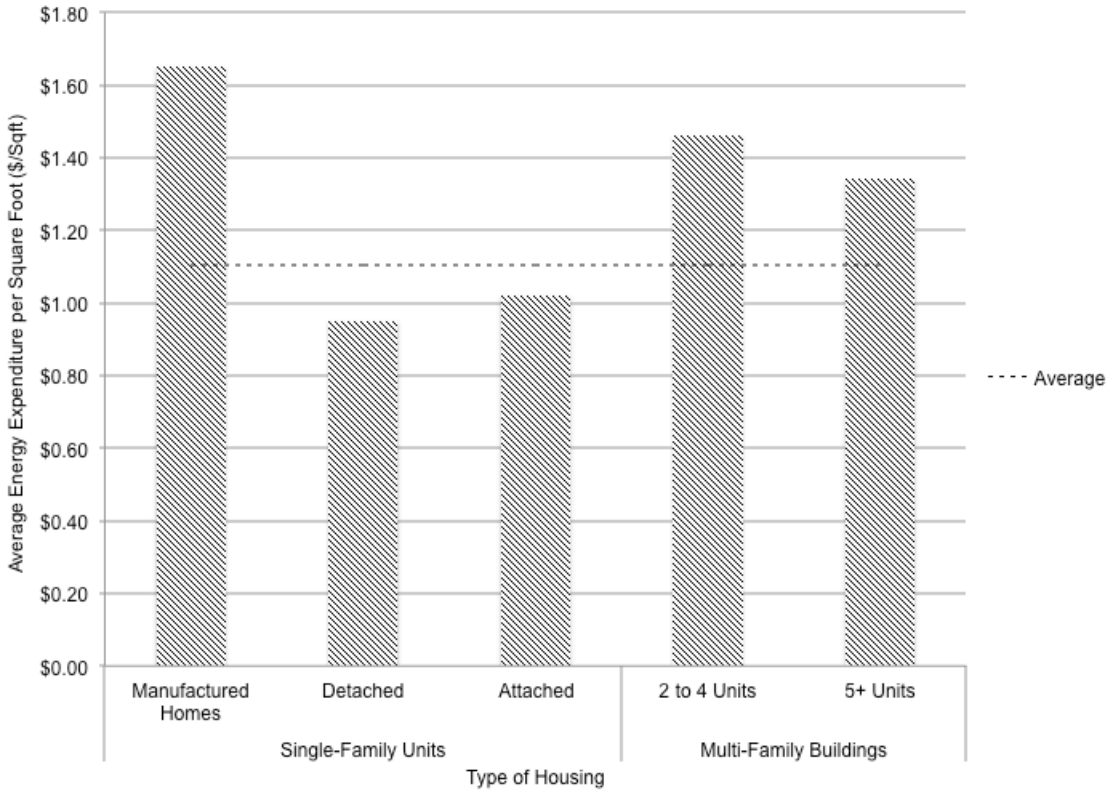

Figure 1.2. Average energy expenditures in dollars per square foot by housing type for all construction years. Adapted from "2009 RECS Survey Data," 2013, *U.S. Energy Information Administration.*

1.5.5 Energy Inequity Indicator 3: Energy Consumption per Square Foot – Dimension of Efficiency

The second efficiency indicator for a systemic energy inequity is the average household energy consumption per square foot. Residents of apartments in buildings with 2-4 units consumed the most energy per square foot at 69,200 British thermal units per square foot—1.4 times the average for all housing types (Figure 1.3). MH residents consumed 62,500 Btus per square foot —1.3 times the average for all housing types (Figure 1.3). What is interesting is that residents of apartments in buildings with 2-4 units used relatively more energy per square foot than MH residents (69,200 Btus compared to 62,500 Btus), but their costs were less per square foot—only 0.88 times that of MH residents (Figures 1.2 and 1.3). There are a number of reasons to explain this difference like MHs may use more expensive forms of energy, on average, compared to apartments or have a less efficient housing structure.

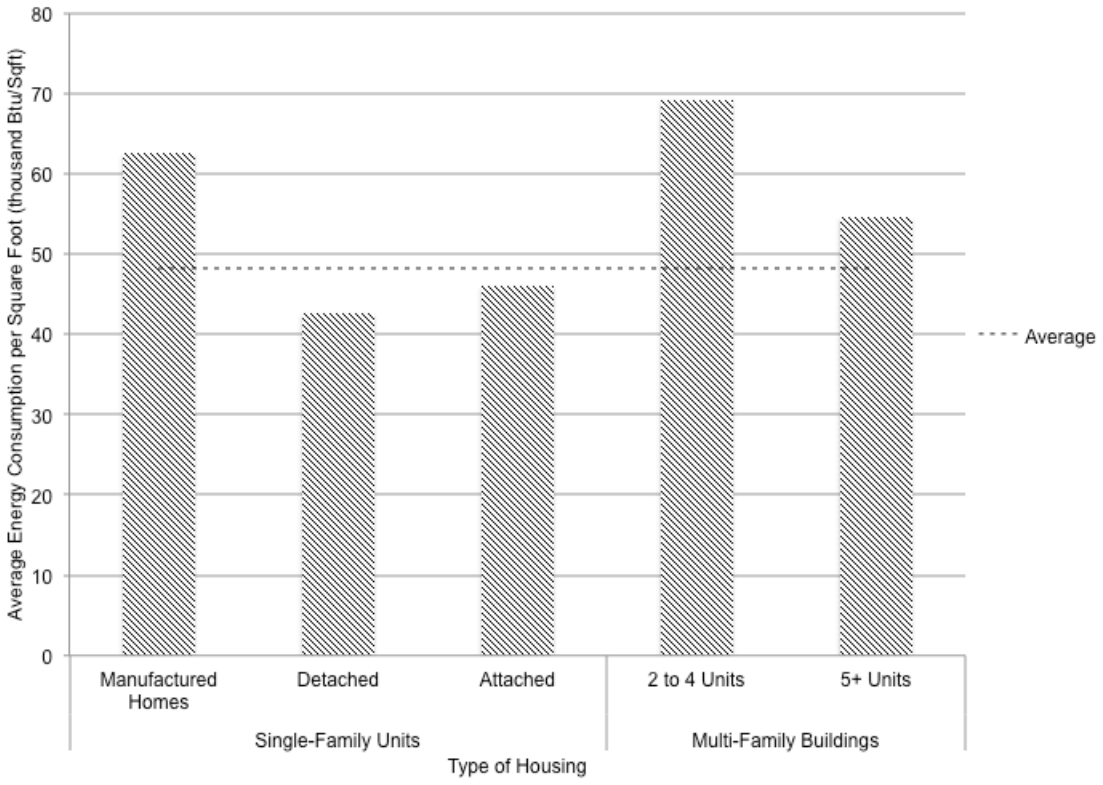

Figure 1.3. Average energy consumption in thousands of British thermal units per square foot by housing type for all construction years. Adapted from "2009 RECS Survey Data," 2013, *U.S. Energy Information Administration.*

1.5.6 Relative Hardships by Housing Type

For a more complete picture of systemic energy inequities associated with each housing type, it is worth noting other measures of relative hardships like the responsibilities of home ownership, the average income range, the proportion of residents receiving housing assistance, food assistance, or living in or near poverty.

Between housing types, there are two broad distinctions in general responsibilities and constraints. For instance, residents who own their home are directly responsible for the ongoing maintenance costs, whereas renters are not. Therefore, the housing types with the highest ownership rates will have more responsibilities for performing and/or paying for the ongoing maintenance of their home. The housing types with the highest relative ownership rates, and thus, responsibilities associated with maintenance would be single-family detached homes (88% ownership) and mobile homes (80% ownership) (Figure 1.4). Also, the average income range profile of residents by housing type gives a sense of the financial constraints for the average household living in a particular type of housing. Residents in manufactured homes have the lowest average income profile at $25,000 to $30,000 (Figure 1.5). Although MH residents and SFD residents have similar relative home ownership rates, SFD residents have more than double the average income range at $55,000 to $60,000 (Figure 1.5). Clearly, MH residents have significant responsibilities owning their homes, and constraints by making the lowest average income of any housing type, on average.

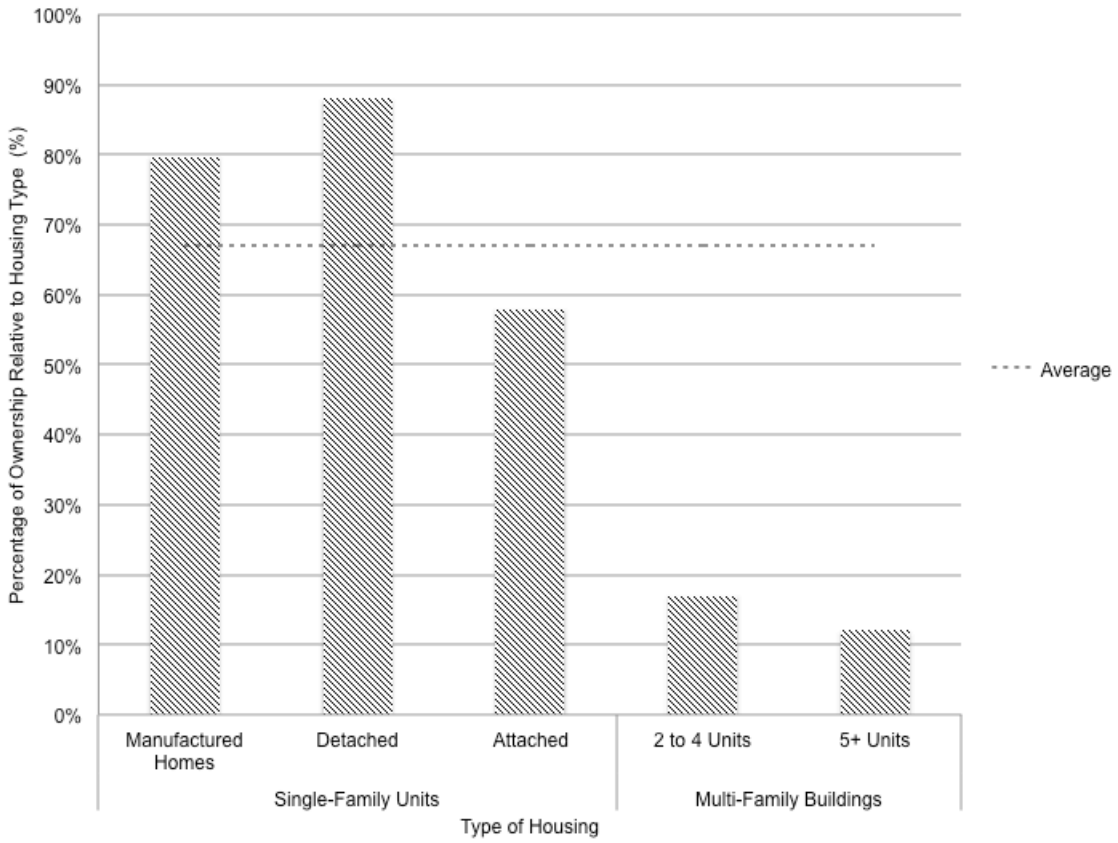

Figure 1.4. Relative home ownership rates by housing type for all construction years. Adapted from "2009 RECS Survey Data," 2013, *U.S. Energy Information Administration.*

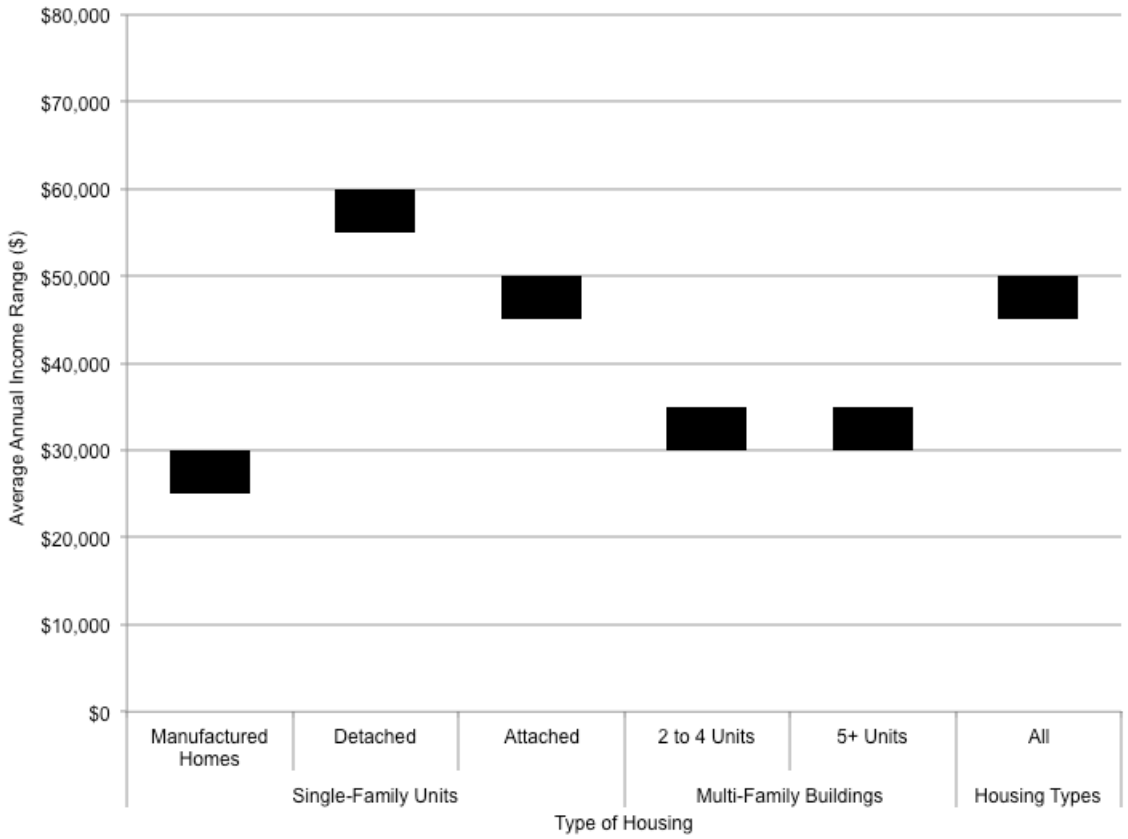

Figure 1.5. Average annual income ranges by housing type for all construction years. Calculated from "2009 RECS Microdata," 2013, *U.S. Energy Information Administration.*

MH residents did not receive any rental assistance compared to the average rate of assistance for all housing types—5.7% (Figure 1.6). Residents of apartments in buildings with 5 or more units had the largest relative housing assistance rates—22% (Figure 1.6). This makes sense since most MHs were owned and would not receive rental assistance and are not considered public housing.

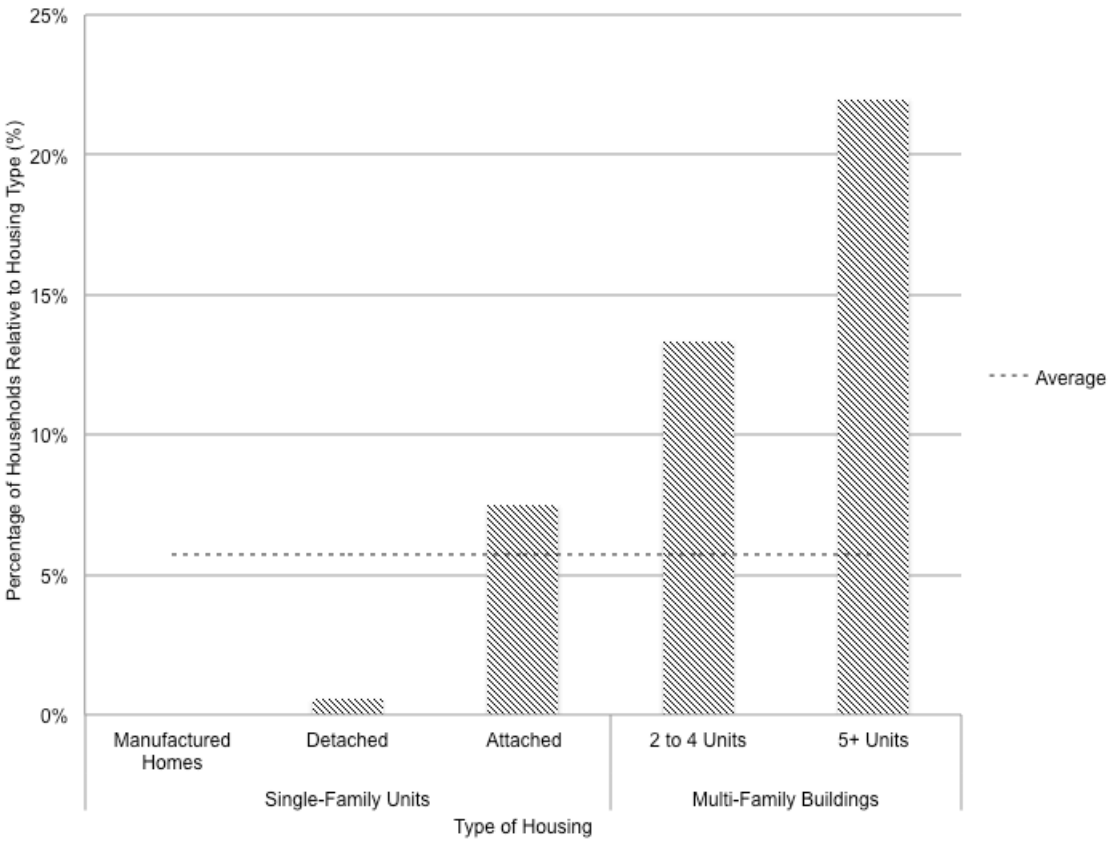

Figure 1.6. Relative housing assistance rates by housing type for all construction years. Adapted from "2009 RECS Survey Data," 2013, *U.S. Energy Information Administration.*

Although MH residents were the least subsidized for housing costs, they had a high relative food assistance rate at 23.2%, which is more than twice the percentage (11.1%) for the average household and more than three times the percentage of SFD households (7.1%) (Figure 1.7). The relative food assistance rate of MH residents is close to that of residents of apartments in buildings with 2-4 units at 22.2% (Figure 1.7).

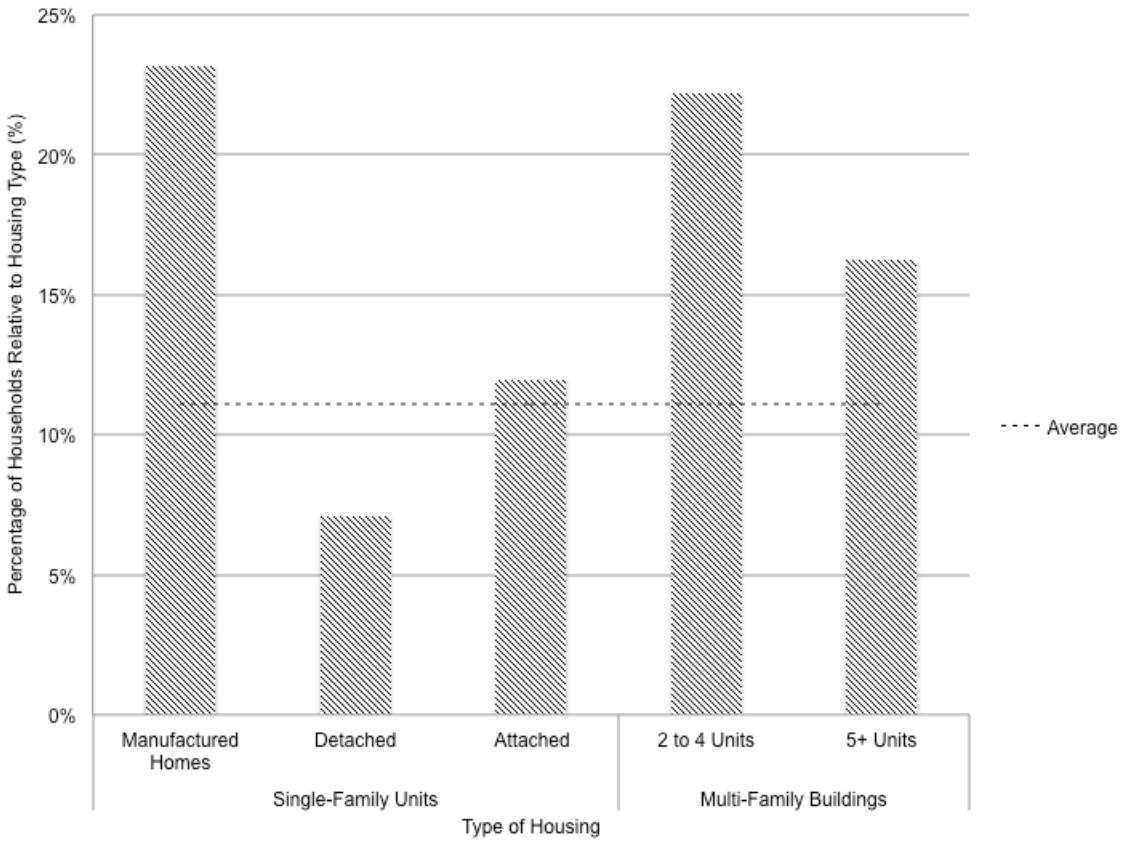

Figure 1.7. Relative food assistance rates by housing type for all construction years. Adapted from "2009 RECS Survey Data," 2013, *U.S. Energy Information Administration.*

Another way to see relative hardship by housing type is to examine the relative poverty rate (at or below 150% of the poverty line) (Figure 1.8).

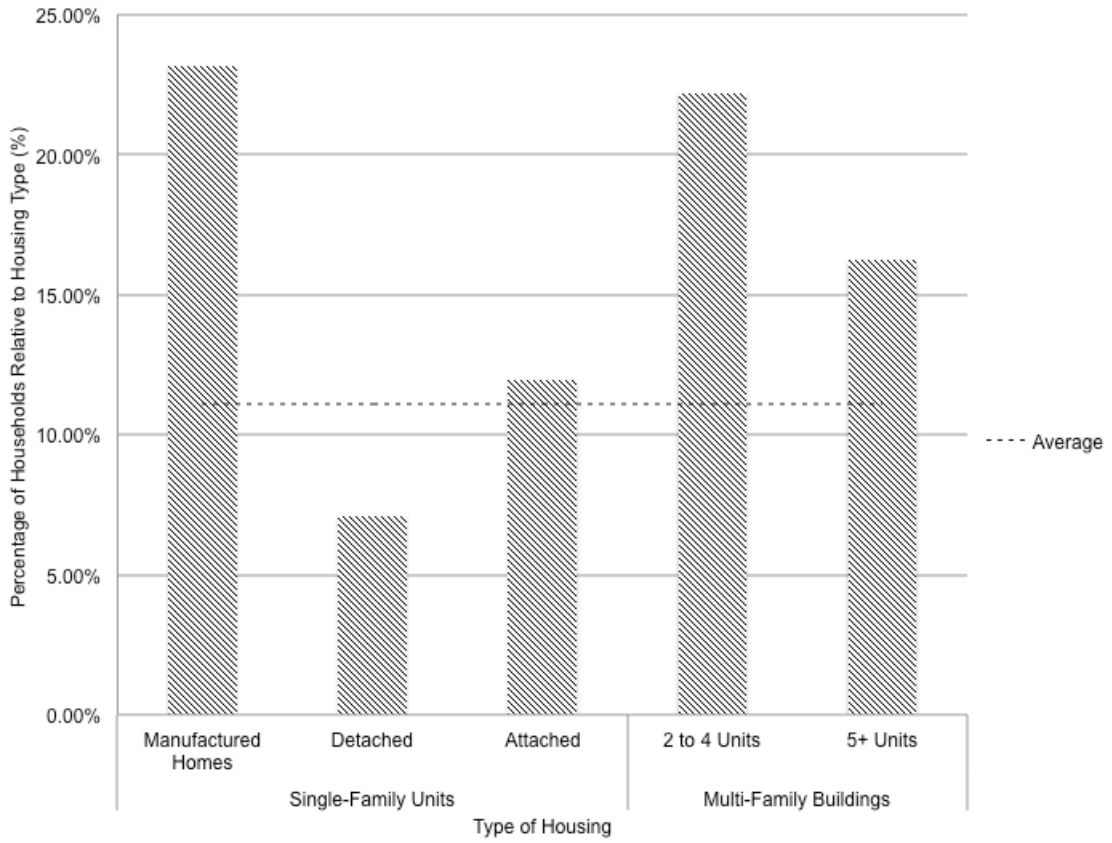

Figure 1.8. Relative poverty rates (at or below 150% of poverty line) by housing type for all construction years. Adapted from "2009 RECS Survey Data," 2013, *U.S. Energy Information Administration.*

1.6 Examining Energy Inequities in Manufactured Housing

By the previously described indicators, MH had a higher average EB range and a higher average energy expenditure and consumption per square foot than almost all housing types. These disproportionate weights for energy costs and inefficiency put pre-2000 manufactured home residents at a greater risk of Residential Energy Insecurity. MH residents also experienced other relative hardships with a high level of responsibility and constraints with a high home ownership rate, but the lowest average income range of all housing types. It is important to note that while the mobile home ownership rate looks similar to single-family detached homes, the income profile looks more like multi-family units. Therefore, there are higher constraints for manufactured home owners with low-incomes, on average. The energy inequities and other constraints on MH residents, place this population at a greater risk for REI and warrants further investigation.

Chapter 2 – Research Focus:
Residential Energy Insecurity in Manufactured Housing of Minnesota

Building on the energy equity information presented in Chapter 1, a type of housing with prominent energy inequities and residents who experienced a number of other hardships was the manufactured home (MH). First, it is important to understand what a manufactured home is and a brief history of the policies for housing type. Then, I introduce the setting of my study in Minnesota followed by how the program information in Minnesota. Lastly, I introduce my research focus of residential energy insecurity in manufactured housing of Minnesota.

2.1 Manufactured Homes

Manufactured (or mobile) homes are entirely prefabricated homes on a steel chassis that are transported by roadway before being placed on a foundation and connected to utilities at a site. The site can be owned by the homeowner or land leased in a manufactured home park. A distinct feature of manufactured homes is the underbelly or bellypan (see Appendix A for MH diagram). The underbelly houses the ductwork, plumbing, and insulation underneath the flooring but above the ground. To protect it, there is siding around the bottom perimeter of the MH called skirting. Although the bellypan is integral for weatherization efforts, it is susceptible to damage, especially when the skirting is compromised. Another distinct feature of MH is the absence of an attic. Unlike site-built homes (SBH), manufactured homes (MH) do not have attics that can be weatherized by simply filling them with insulation.

2.2 Terminology – Mobile Home versus Manufactured Home

Technically, the term mobile home refers to a prefabricated home built approximately between 1960 and 1976. At this time, there were no universal construction standards for mobile homes. About two million of the current seven million combined mobile and manufactured homes were built before 1976 and have been described by affordable housing experts as the "worst housing stock" in the U.S. ("Energy use in mobile homes," 2009). The quality and safety of mobile homes built during this era was shoddy, making them susceptible to catastrophic damage from fire or collapsing under high winds (Venoila, 2005). To improve the quality and safety of newer prefabricated homes, the Department of Housing and Urban Development (HUD) enacted construction standards in 1976. Prefabricated homes built after 1976 under the Housing and Urban Development (HUD) codes are referred to as "manufactured homes." The HUD codes have been revised throughout the years with the most recent changes in the Manufactured Housing Improvement Act of 2000. Given that quality and safety of these newer MH built in 2000 or later would be significantly better than the older MH, I separate out MH build before 2000, where appropriate, so any systemic energy inequities will not be masked.

2.3 U.S. Housing Stock by Housing Types Built before 2000 or 2000 and later

In 2009[2], all manufactured homes, including mobile homes, comprised 6.9 million units (6%) of the 113.6 million total housing units in the U.S. (see Figure 2.1). Approximately 98.1 million (86%) of all U.S. housing units were built before 2000 and 6 million (87%) of the nearly 7 million MHs were built before the construction and safety codes enacted in 2000 and warrant further examination for systemic energy inequities.

[2] To keep the data as consistent as possible, I used the results from most recently available Residential Energy Consumption Survey conducted in 2009, and released in 2013. Figures cited as ("2009 RECS Microdata," 2013) represent data I calculated from the publically available 2009 RECS microdata with the specified weights so I could separate measures by years of housing. Figures cited ("2009 RECS Survey Data," 2013) were from summarized tables in the reports and are not separated by housing unit construction year.

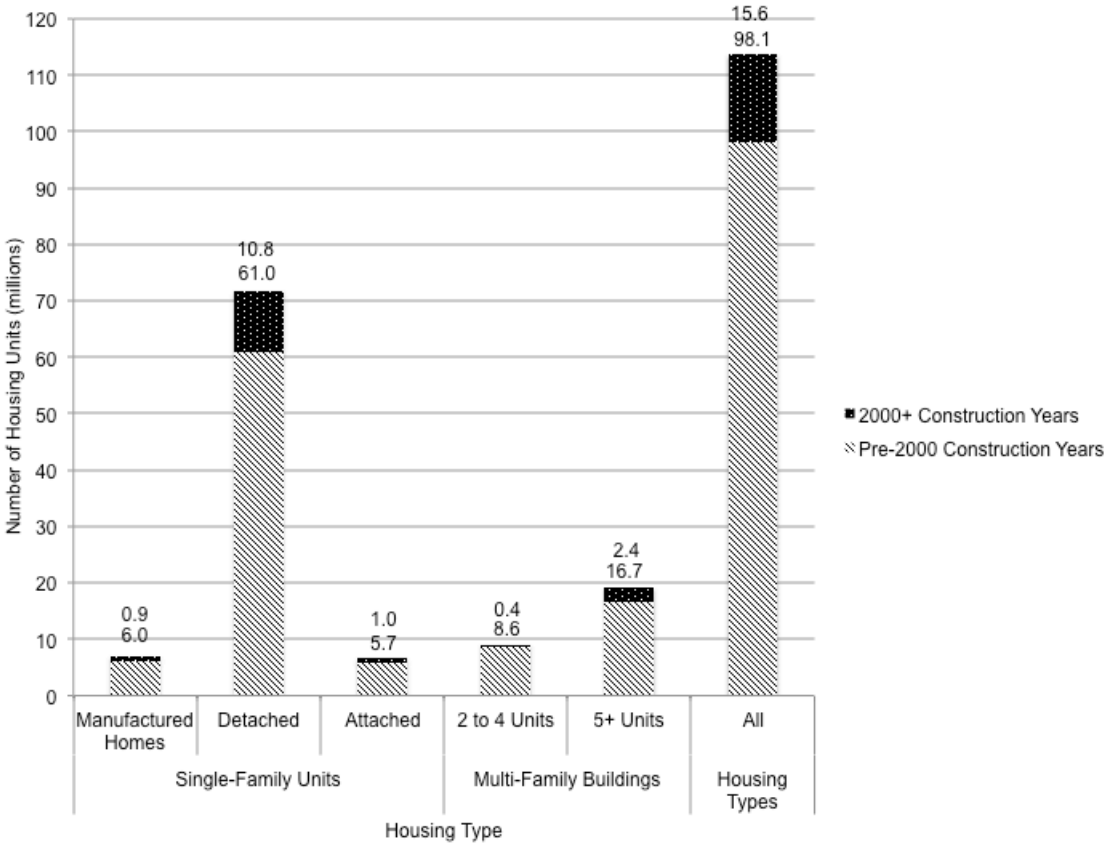

Figure 2.1. Amount of dwellings in millions by housing type for construction years before and after 2000. Calculated from "2009 RECS Microdata," 2013, *U.S. Energy Information Administration.*

2.4 Energy Inequities in MH built before 2000

Revised Energy Inequity Indicator 1: Energy Burden for pre-2000 Homes – Dimension of Affordability

To see if the newer MHs built 2000 or later were masking energy issues with the older MHs, I separated out the energy data for all pre-2000 housing types. The average EB range for MHs of all years was about 6%-7% (Figure 1.1), but when I removed the newer, more efficient MHs, the average EB range increased to about 7%-9% (Figure 2.2). With the newer MH removed, the average EB range for MH is approximately double that of the average for all housing types (Figure 2.2).

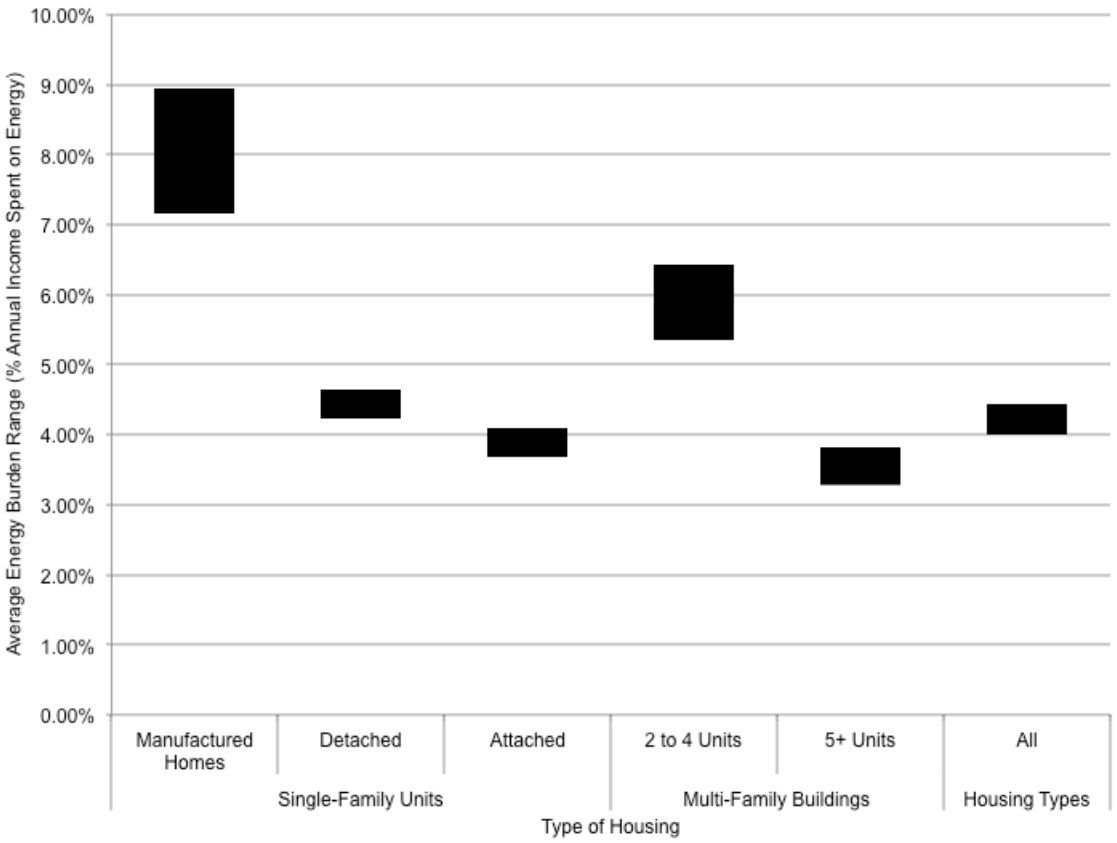

Figure 2.2. Average energy burden by housing type for dwellings built before 2000. Calculated from "2009 RECS Microdata," 2013, *U.S. Energy Information Administration.*

Residents of MH built before 2000 have, on average, an EB range that is 1.8 to 2.0 times[3] that of the average for residents of all other housing types built before 2000 —7.15% to 8.94% compared to 4.00% to 4.44%, respectively[4] (Figure 2.2). Additionally, MH residents in homes built before 2000 had the lowest annual income range of $20,000 to $25,000 (see Figure 2.3). In combination, the energy and other relative hardships on MH residents in homes built before 2000 make this an important population to study REI.

[3]Divided MH range by the Total range. Divided high MH/high Total and low MH/low Total: 7.15/4=1.78; 8.94/4.44=2.01. Then, I rounded to the nearest tenth.

[4]The 2009 Residential Energy Consumption Survey (n=12,083) used weights to represent the total U.S. housing stock. To calculate the average energy burden range, I took the average of the annual energy expenditures and divided it by the average annual income range by housing type for homes built before 2000 with listed weights and by removing outliers. Microdata file can be found here: https://www.eia.gov/consumption/residential/data/2009/index.cfm?view=microdata

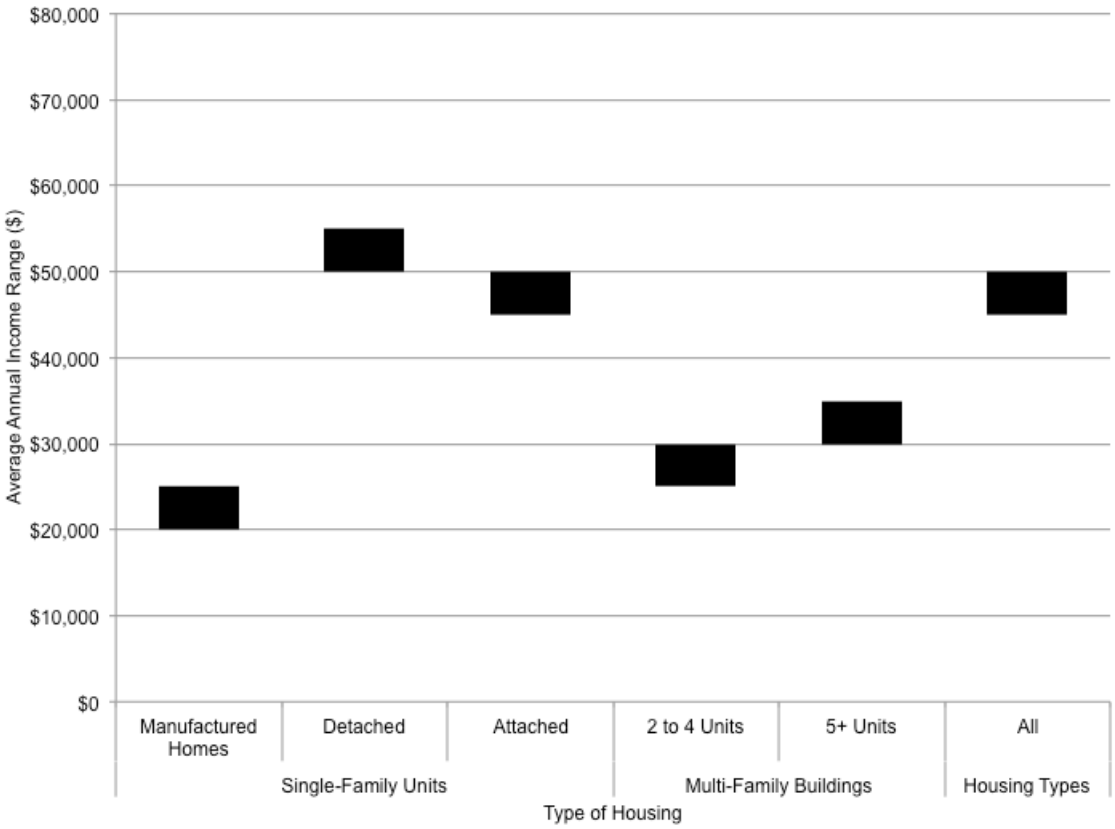

Figure 2.3. Average income ranges by housing type for dwellings built before 2000. Calculated from "2009 RECS Microdata," 2013, *U.S. Energy Information Administration.*

2.5 Minnesota

Minnesota is a valuable location to study REI in manufactured housing. In 2013, manufactured homes (including mobile homes) made up about 3.9% of the Minnesota housing stock ("Percent of housing units that are mobile homes by state," 2004). Since climate has an effect on energy-use, an additional reason to study Minnesota is the continental climate with annual temperature extremes. To get a broad idea of the climate differences compared to the U.S., the average temperature is 38.6°F compared to 52.5°F for the U.S. ("Minnesota: State profile and energy estimates," n.d.). Minnesota has an average temperature of 70°F in the summer and the average temperature of 6°F in the winter with recorded temperature extremes of -60°F and 114°F ("Climate," 2013). These extremes place a need for more energy to maintain a comfortable and safe indoor temperature. The average annual household energy expenditures for the U.S. were $2,024 with the Midwest at $1,981 ("2009 RECS Survey Data," 2013). This number is probably lower for the Midwest, and Minnesota, despite the cold winters because the primary energy source of heating for 68% of homes ("Minnesota residential energy consumption," 2015), natural gas, is cheaper in Minnesota than in 39 other states ("Rankings: Natural Gas Residential Prices," 2015). Lastly, Minnesota is also an important place to study because in 2014 there were 605,761 people in poverty (11.5%) ("Poverty status in the past 12 months," n.d; "Quick Facts Minnesota," n.d.). Compared to the U.S. in 2014, there were 47.2 million people in poverty (14.8%) ("Quick Facts United States People 2," n.d.; "Quick Facts United States," n.d). Generally, Minnesota has lower levels of poverty and a smaller relative number of MH compared to the U.S. as a whole, which is why energy-related housing issues could be hidden or not well understood. Together, these characteristics make Minnesota a valuable location to study REI in MH.

2.6 Programs that Address Residential Energy Insecurity in Minnesota
In addition to the two federal programs, LIHEAP and WAP, that directly address REI, there was a state program that indirectly addressed Physical REI by repairing structural issues. This program is administered through the Minnesota Housing Finance Agency and is called the Rehab Loan Program (RLP).

2.6.1 LIHEAP in Minnesota
To be eligible in Minnesota, a household income needs to be at or below 50 percent of the state median income ("Energy Assistance Program," n.d.), or $43,300 ("HUD Median Income for Minnesota," 2015). Minnesota's funding for FY 2015 was 3.4% of the federal budget ("Final Release of FY 2015 LIHEAP Regular Block Grant Funds," 2015). In FY 2014, LIHEAP in Minnesota served 156,068 households with heating assistance ("LIHEAP: Fighting Poverty in Minnesota," n.d.). That amounts to 22% of eligible homes receiving assistance out of a total of 786,331 households in Minnesota that were income eligible for LIHEAP ("LIHEAP Home Energy Notebook for Fiscal Year 2009," 2011). This low percentage may be because income-eligible households are not aware of these programs to pursue assistance. Also, the programs are funded through block grants where a limited annual amount is awarded to a state and administered locally by Community Action Partnership (CAP) agencies. Once the limited funds are spent, no more households can be assisted that year.

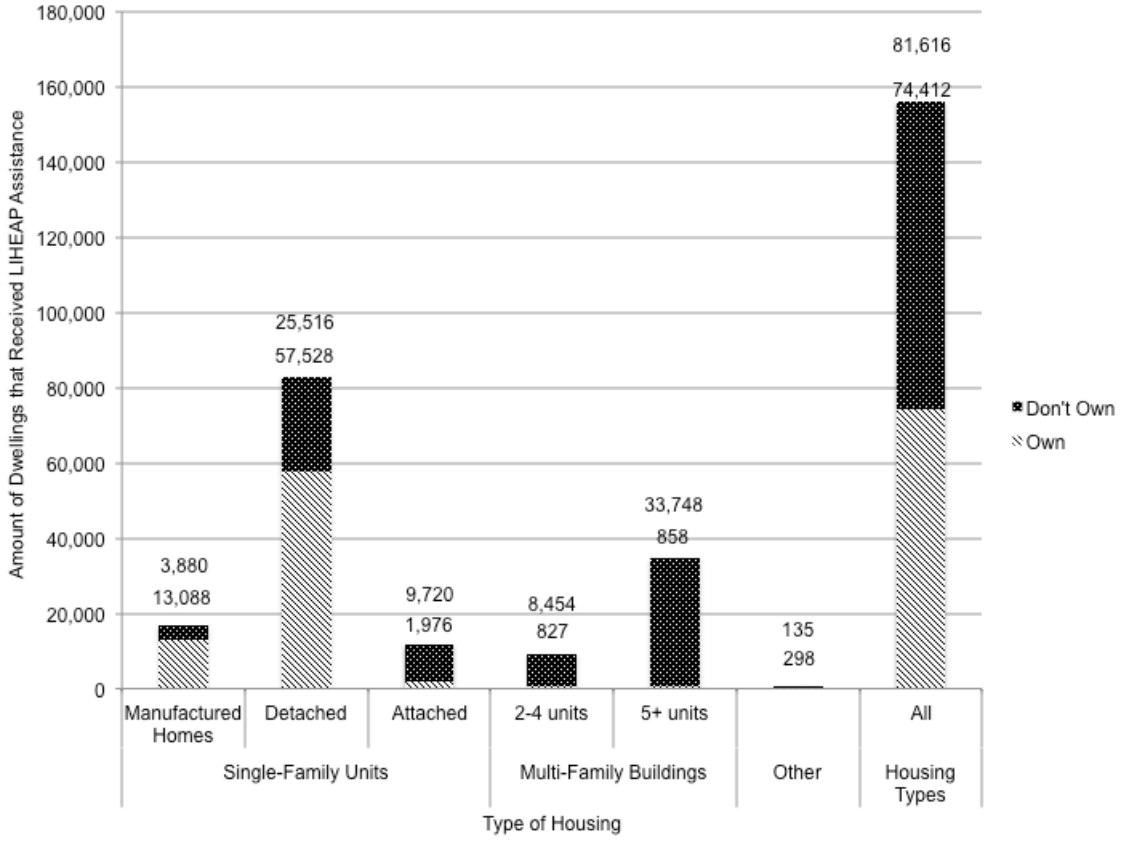

Figure 2.4. Amount of dwellings that received LIHEAP assistance by housing type in Minnesota during FY 2014, n=156,028. From Minnesota Department of Commerce, personal communication.

Roughly half of LIHEAP recipients own their home and the others do not. Of the homes that receive LIHEAP and own their home, the highest numbers live in MH and single-family detached (SFD).

2.6.2 WAP in Minnesota

Minnesota received $7.7 million (4.27%) from the federal WAP budget in FY 2014 ("Weatherization Program Notice 15-2," 2015). For a resident to be eligible in Minnesota, households need to be at or below 200% of the federal poverty level. Approximately 1,425,046 Minnesota households were eligible for WAP funding in 2014 based on the income eligibility guidelines ("Poverty Status in the Past 12 Months," 2014). However, only 1,783 or 0.13% of income eligible homes received assistance in FY 2014. There are a number of reasons why so few homes are able to receive assistance, but what is worth noting there is a sizeable gap between the income eligible homes and the rate that homes receive assistance every year.

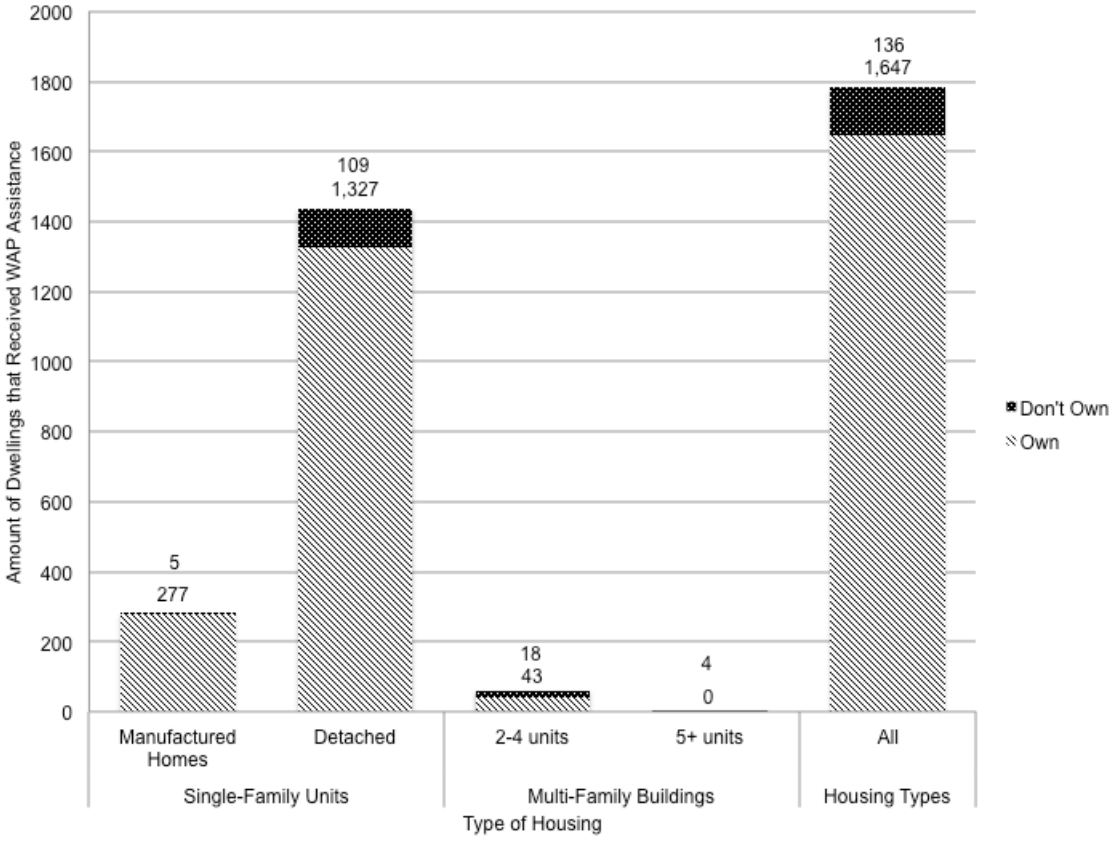

Figure 2.5. Amount of dwellings that received WAP assistance by housing type in Minnesota during FY 2014, n=1,784. From Minnesota Department of Commerce, personal communication.

2.6.3 RLP in Minnesota – State Program that Indirectly Addresses REI

The Minnesota Housing Finance Agency (MHFA) focuses on preserving and financing affordable housing. The Rehabilitation Loan Program (RLP) provides funds for, "...basic improvements that directly affect the safety, livability, or energy efficiency of the home" ("Rehabilitation Loan/Emergency and Accessibility Loan Program," n.d.). To qualify, a household income needs to be at or below 30% of the Minneapolis/St. Paul area median income, or $29,050 ("HOME Investment Partnerships Program," n.d.) for FY 2014 ("Home Improvement Program Income Limits," n.d.). Also, assets cannot exceed $25,000, applicant has to own and occupy the property, be current on property taxes and mortgage, and gave homeowner's insurance. The maximum loan amount is $27,000 with loan terms of 15 years for properties taxed as real property and 10 years for homes taxed as personal property. In 2014, $754 million was used through all MHFA programs to help 59,000 households. For October 1, 2013 to September 30, 2014 there were 211 loans granted through a total amount of $4,711,744. The average loan was $21,417 and the median income for borrowers was $14,314 or 19% of the statewide median income ("2016 Affordable Housing Plan," 2015).

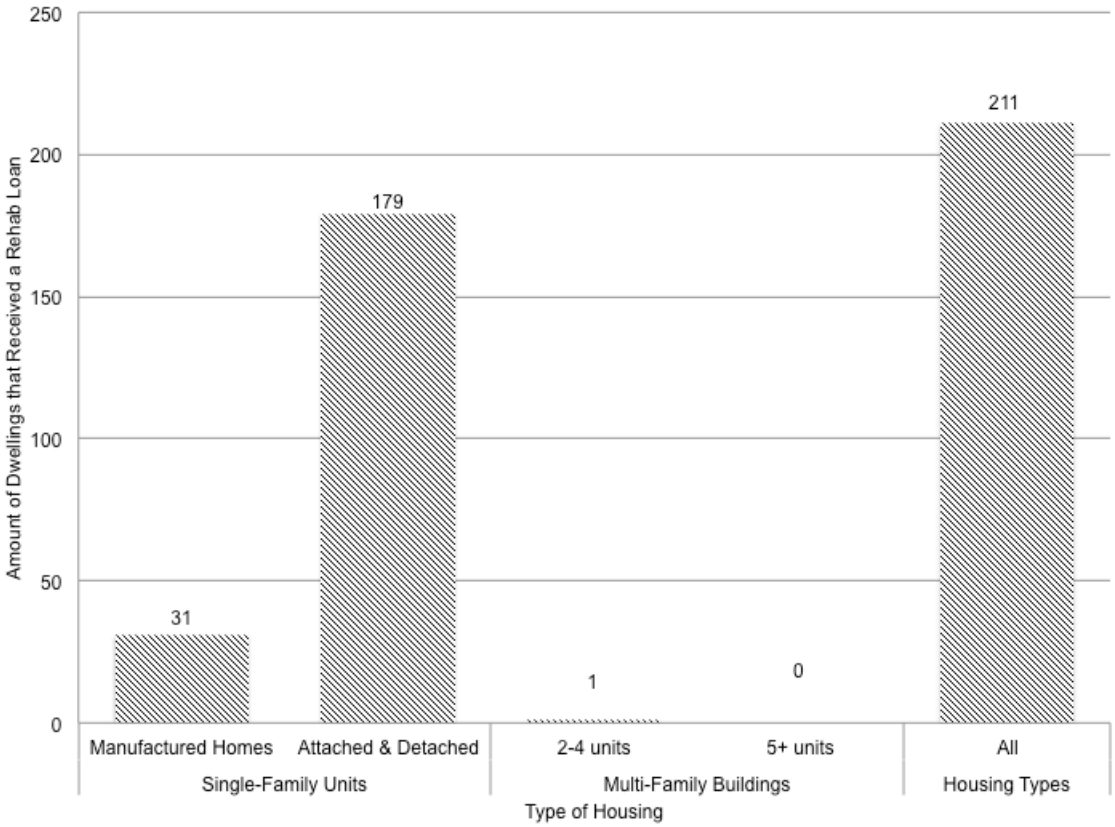

Figure 2.6. Amount of dwellings that received RLP loans by housing type in Minnesota during FY 2014, n=211. From Minnesota Housing Finance Agency, personal communication.

2.7 Purpose

The purpose of this study is to understand how the disproportionately high energy burden for manufactured housing residents persists despite LIHEAP and WAP. I accomplished this by interviewing manufactured housing service providers in Minnesota on their perspectives and experiences with energy issues. Broadly, service providers are workers that interact with or administer a program to MH residents on energy-related issues. This population was chosen to see how this issue is socially constructed in manufactured housing as a public issue. Coding of interview data using a grounded theory, interpretivist approach (Glaser & Strauss, 1967; Charmaz, 2006; Creswell, 2013) resulted six major themes: social; policy; and the manufactured housing stock conditions; and the consequences of interactions between the social and policy; social and manufactured housing stock; and policy and manufactured housing stock conditions. Using the information on these factors, recommendations to reduce the disproportionate average energy burden for pre-2000 manufactured housing residents are presented.

2.8 Overview

The remaining chapters of this study are structured into the following topics. To give more background on other academic research on Residential Energy Insecurity, Chapter 3 provides a literature review of other recent studies. Chapter 4 describes the methodology and research design of my study. Then, the findings from my analysis of my data are presented in Chapter 5. Lastly, Chapter 6 provides a summary, recommendations, and concluding remarks on how to reduce Residential Energy Insecurity in manufactured housing.

Chapter 3 - Literature Review: Residential Energy Insecurity

Household energy is integral to everyday life. It is necessary to maintain a healthy and comfortable indoor temperature, provide electricity for lighting and electronics, and to fuel appliances for water heating and cooking. In 2014, 46.7 million Americans (14.8%) were in poverty ("Poverty," n.d.), where necessities like energy are unaffordable and often compromised (Hernández and Bird, 2010; Brunner, Spitzer & Christanell, 2012; Murray & Mills, 2012; Thomson & Snell, 2013). One way to examine the affordability of energy costs is the household energy burden, which is the percentage of the annual income spent on energy. A disproportionately high energy burden[5] is one manifestation of a concept called Residential Energy Insecurity. To better understand this and other related concepts, a literature review of Residential Energy Insecurity (REI) is presented that describes the definition, concept, and measures of REI; the household characteristics associated with REI; and the health and behavioral reactions to REI.

I present a literature review on REI broadly because no studies solely studied REI in manufactured housing. Within Google Scholar, I chose articles that were published in peer-reviewed journals within the last five years (2010 to 2015). The only exception was the seminal book, *Fuel Poverty,* by Brenda Boardman, which was published in 1991. Next, the articles I selected had one of the following phrases in the title or keywords: "energy security," "energy insecurity," "energy poverty," "energy burden," or "fuel poverty." Also, the articles had to be research-based, empirical studies using qualitative, quantitative, or mixed methods approaches. One exception to these studies was a policy brief that I included because it presented a new foundational framework for conceptualizing REI, otherwise I omitted strictly theoretical, descriptive, or review articles. There were not enough studies in the U.S. so I expanded the locations to countries in the European Union. Four studies were located in the U.S., four were located in the U.K., and one was located in Austria.

3.1 Residential Energy Insecurity

There were variations of the definition of Residential Energy Insecurity[6] in the literature. The most comprehensive definition was when a household could not maintain a comfortable indoor temperature (heating and/or cooling) or power other amenities such as water heating, cooking, lighting, and/or electricity for appliances (Murray & Mills, 2012). A complement to this definition, is a multifaceted conceptual framework of REI proposed by Hernández, Aratani, and Jiang: 1) Physical REI; 2) Economic REI; and 3) Coping REI (2014). Physical REI relates to an energy inefficient housing structure; Economic EI is a low-income household with a high energy burden; and Coping EI is the behavior of residents to deal with energy-related issues. Coping EI would include behaviors that are extreme and done out of necessity (i.e. a person may choose to be frugal with heating expenses but is not experiencing Coping REI if they could afford to comfortably heat their home without sacrificing other necessities but choose to keep it at a lower temperature to save money). Some specific examples of Coping REI would be a resident using their oven or a portable space heater for room heating if their furnace malfunctions and they cannot afford to repair it. Another way Coping EI is shown is through the hyper-vigilance of maintaining an uncomfortably low or high indoor temperature because the resident cannot afford to heat or cool their home to their comfort.

Most of the literature looks at REI through the conceptual lens of Fuel Poverty, a type of Economic REI, but there was variation even within the definition of this more established

[5] The gauge how high a household's energy burden is, it is compared to the average energy burden of all housing types as well as the average annual energy burden for a similar housing type.

[6] Although no article or book used the term "Residential Energy Insecurity," I decided to use it over "Energy Insecurity" to highlight the scale of my study because "Energy Insecurity" can also refer to different concepts at a national scale.

conceptual term. The broadest definition of Fuel Poverty focused on "affording adequate warmth" (Boardman, 1991; Waddams Price, Brazier & Wang, 2012; Gilbertson, Grimsley, & Green, 2012; Brunner et al., 2012). Thomson and Snell (2013) expanded the definition beyond affording fuel for warmth to "affording adequate services" that also include water heating, lighting and energy for appliances and cooking. However, there was much debate on what 'adequate' meant (Boardman, 1991). Fuel Poverty was also described using behavioral measures like coping with low-incomes and/or cold homes in the winter (Anderson, White, & Finney, 2012) or worries, events, or behavior that disrupt energy use (Murray & Mills, 2014). Harrison and Popke (2011) used Energy Poverty synonymously with Fuel Poverty but defined it as maintaining a household temperature for a healthy lifestyle. Fuel Poverty was the most established way to approach REI but there was a lot of variation even within this term.

In addition to the conceptual definitions, there were two main categories of operational, or measurable, definitions of REI: 1) expenditure-based (quantitative) or 2) consensual-based (qualitative). Expenditure-based REI was an objective measure where the percentage of income spent on energy services, also referred to as the energy burden, was above a predetermined level (Hernández & Bird, 2010). The most common expenditure-based threshold to indicate REI was a household spending 10% or more of their annual income on energy services - known as Expenditure-Fuel-Poor (EFP) (Boardman, 1991; Waddams Price et al., 2012; Gilbertson et al., 2012). On the other hand, consensual-based REI was a subjective measure where a resident was asked about their perceptions of feeling able to adequately heat their home - known as Feeling-Fuel-Poor (FFP) - or if their home had characteristics that were associated energy inefficiency. A few consensual-based indicators of energy insecurity were if a resident disclosed that they: 1) felt unable to afford keeping their home adequately warm; 2) had arrears on utility bills within the last 12 months; or 3) had a leaky roof, damp walls/floors/foundation, or rot in the window frames or floor (Thomson & Snell, 2013; Anderson et al., 2012). Waddams Price et al. (2012) found a strong correlation between the consensual-based measure of FFP and EFP. However, the correlation was not perfect because there were instances where people were less likely to FFP even if they were EFP (Waddams Price et al., 2012). Among the many ways to measure EI in expenditure-based or consensual-based ways, there was not an agreement on the best way to measure this complex phenomenon.

3.2 Household Characteristics of REI

Harrison and Popke (2011) described the following characteristics of REI households: individual biographies (health problems, isolation); energy situation (high electricity rates); housing situation (older energy inefficient homes, energy inefficient mobile homes, and inability to perform upkeep and maintenance of housing). Households with any of the following characteristics made up a higher proportion of households that experience REI: larger families (Waddams Price et al., 2012; Anderson et al., 2012), how households paid for electricity (pre-paid generally had higher fees but more flexibility than paying upon receipt) (Anderson et al., 2012); a Black as compared to White head of household, headed by a single mother, or had lower incomes (Murray & Mills, 2014; Murray & Mills, 2012). Generally, if a household was receiving assistance through other welfare programs, there was a higher probability that the household would be energy insecure (Murray & Mills, 2012; Murray & Mills, 2014; Waddams Price et al., 2012). In the U.S., Murray & Mills (2014) found that suburban households were more energy insecure than rural households, possibly because rural residents tend to live in their homes longer and therefore may invest more in weatherization efforts. However, Thomson and Snell (2013) reported the opposite in the E.U. where living in a rural location increased the odds of energy insecurity. Households located in the colder climates of the U.S. were more energy insecure despite a higher likelihood of Low-Income Home Energy Assistance Program (LIHEAP) participation (Murray & Mills, 2014). In Boston, about 80% of the 72 low-income households that were interviewed had problems affording utilities with the striking exception of housing projects where heating was included in the rent (Hernández & Bird, 2010). Mobile homes were not found to have a statistically significant difference in REI compared to single family homes, but apartments were found to be more energy secure compared to single family homes (Murray & Mills, 2014). Harrison and Popke (2011) tangentially noted the Weatherization Assistance Program (WAP) recipients they interviewed

spoke of challenges living in a mobile home in North Carolina. Highlighting the complexity REI, there were a number of characteristics associated with households experiencing REI.

3.3 Mental Health Associations with REI

In addition to the characteristics of households experiencing REI were a resident's health and behavioral associations with REI. There were mental health associations of living in an energy insecure household (Hernández & Bird, 2010). In Great Britain, 55% of low-income households surveyed said that a cold home made them feel miserable (Anderson et al., 2012). Higher stress levels were associated with poor living conditions which included: drafty homes, condensation in the home, problems paying heating bills, reporting the living room or bedroom as too cold, or being dissatisfied with the current heating system (Gilbertson et al., 2012). Surprisingly, the most stressed respondents were over 20 times more likely to have low mental health scores or problems with anxiety or depression (Gilbertson et al., 2012). Conversely, significantly lower stress levels were reported among people who reported higher comfort in their home (Gilbertson et al., 2012). Where people received heating and insulation measures, Gilbertson et al. (2012) reported lower measures of anxiety, depression, and thermal discomfort. Compared to residents who were not experiencing REI, those who were experiencing REI were more likely to have negative mental health associations.

3.4 Behavioral Associations – Coping with REI

Households affected by REI continuously coped with limited financial resources using many strategies. In 2008, 70% of low-income households surveyed used one or more of the following strategies to pay bills: reduced spending, earned more money, or borrowed money (Anderson et al., 2012). Although borrowing money was mentioned as a strategy, it was mostly from family or friends and non-commercial borrowing. There was a common desire among low-income households to avoid commercial borrowing due to a negative previous experience or in the pride of having no debt (Anderson et al., 2012; Brunner et al., 2012). Some items people reduced spending on were: non-essentials, food, heating, or unspecified other essentials (Anderson et al., 2012). Of households cutting back on heating, 65% were also cutting back on food (Anderson et al., 2012). This phenomenon where a household chooses between heating their home or food was referred to as "heat or eat" (Hernández, Aratani, & Jiang, 2014; Brunner et al., 2012; Harrison & Popke, 2011). An additional way households cope with a low-income is to use less-efficient appliances for longer before replacing them or to buy them from second-hand stores (Brunner et al., 2012). Other ways to cut costs were to reduce electricity expenses by using fewer light bulbs in fixtures, using a television as a source of light, or only lighting one room (Brunner et al., 2012; Harrison & Popke, 2011). To improve lighting efficiency affordably, most households used some sort of energy-saving light bulbs (Brunner et al., 2012). Housing instability, namely utility shut-offs or moving because of high energy costs, was also associated with a high energy burden (Hernández & Bird, 2010). Households experiencing REI employed many coping strategies to deal with the constraint of having a low-income.

Households affected by REI also often cope with having a cold home. Nearly half of low-income households surveyed indicated that their homes were colder than they preferred with 18% feeling their homes were much colder than preferred (Anderson et al., 2012). Brunner et al. (2012) identified strategies of efficiency or sufficiency used to cope with a cold home. Strategies for efficiency included making improvements to the home like sealing windows, getting more efficient appliances, or to preserve heat by sitting in front of the radiator (Brunner et al., 2012). Strategies for sufficiency were about cutting back on energy use like heating only one room, keeping the temperature lower than preferred, or wearing extra clothes (Brunner et al., 2012). Harrison and Popke (2011) reported some coping strategies WAP recipients used for dealing with cold homes that ranged from using a stove or electric heater as the primary source for heat to staying under blankets in bed all day. An additional association of homes that were too cold was a risk for isolation where 26% of low-income households did not feel able to invite friends or family to their home (Anderson et al., 2012). Households experiencing EI use many ways to cope with having a cold home.

3.5 Summary

A literature review was presented on REI that described the definition, concept, and measures of REI; household characteristics of REI; and the health and behavioral associations with REI. Energy services are paramount to a household's quality of life by maintaining a comfortable and healthy indoor temperature and by powering appliances for water heating, cooking, and electricity. A household experiences REI when it cannot meet any of those needs. REI was also expressed in three different ways: 1) Physical REI; 2) Economic REI; and 3) Coping REI. Physical REI represented a substandard, energy inefficient home. Economic REI represented a high energy burden where a disproportionate amount of a household's income went toward energy costs. Coping REI represented the intentional behavioral ways a resident manages energy-related issues. Two ways REI were measured were in expenditure-based or consensual-based ways. Expenditure REI, also called Fuel Poverty, occurred when a household spent 10% or more of their annual income on energy costs (Expenditure Fuel Poor). Consensual REI was how the resident felt about being able to heat their home (Feeling Fuel Poor), if they had a late utility bill payment in the past year, or had a leaking roof or water damage to their home. There were a number of household characteristics associated with REI. Mental health problems like higher stress or feeling miserable were associated with poor living conditions of REI. There were two kinds of behavioral associations with REI: coping with low-incomes and coping with a cold home. Residents coping with a low-income had multiple strategies to pay utility bills with one choosing between necessities like heating or eating. Residents coping with a cold home had multiple strategies like wearing extra clothes, sitting in front of a radiator, or isolating themselves from the social pressure to maintain their home at a certain temperature. The recent literature on REI has evolved to an integrated framework that addresses the structural and cost issues of homes, incomes, and energy alongside the impacts on health and behavioral associations for residents experiencing REI.

3.6 Gaps

A clear and standardized definition of REI in the U.S. was lacking, although there seem to be some recent conceptual developments by incorporating Physical REI and Coping REI. Also, there were not many studies in the U.S. that examined REI. There was also a noteworthy lack of any academic research on manufactured housing. Lastly, studies on REI generally interviewed or surveyed low-income households but did not include the service providers that implement LIHEAP or WAP.

3.7 Contribution

My study contributes to the literature on REI in a few ways. First, my study describes REI in manufactured housing, which until now has only been done tangentially. Also, the perspective of service providers has not been examined to give more insight into how LIHEAP and WAP could be improved. This study is also located in Minnesota to describe the experiences of REI in a climate with both cold and hot weather extremes. Furthermore, this research contributes to the scant literature on REI in the U.S. With an aging housing stock becoming less energy efficient and millions of Americans in poverty, understanding REI is an important step to improve the quality of life for many vulnerable families. Lastly, on a theoretical level, this study applies a grounded theory interpretivist approach to better understand the intersection of social and energy issues.

Chapter 4 – Methods

Despite current programs geared at reducing energy bills or improving the energy efficiency of a home, residents of manufactured homes (MH) built before 2000 have, on average, an energy burden that is double to all other housing types built before 2000 ("Residential Energy Consumption Survey," 2013). To better understand why this disparity in energy burdens persists, I asked the following research question: 1.) What contributes to energy-related issues for MH residents? To study this question, I used a nonlinear process, as appropriate in inductive analysis and grounded theory development, of moving back and forth between the initial questions, the data collection instruments you developed to pursue those questions, the probes you used to discover themes in the data, and additional data collection and methods I used to provide more robust data to test emerging themes.

4.1 Research Aim and Objectives

The aim of this study was to better understand how a disproportionately higher energy burden persists in pre-2000 manufactured homes, despite the current energy-related assistance programs. For my study, I explore REI through a modified version of the conceptual framework proposed by Hernández et al. Specifically, I define a household as experiencing REI if any one or more of these criteria are met: 1) live in a structurally deficient home (Physical REI); 2) are a relatively low-income household, meaning a household's income is at or below half of the state median income (Economic REI); and/or 3) use extreme behavioral strategies to manage energy issues (Coping REI).

Specifically, the research objectives to achieve this aim were:

1.) Identify how Residential Energy Insecurity is defined and measured in the literature.
2.) Investigate how service providers describe their experiences with manufactured housing residents facing an energy-related issue.
3.) Formulate recommendations to address the main problems.

4.2 Overview of Research Design

A qualitative research approach is the most appropriate to understand the nature of Residential Energy Insecurity in manufactured homes. It has not been explicitly studied in the literature so an exploratory study is warranted to illuminate potential factors for future study.

The philosophical worldview utilized in this study is interpretivism. Interpretivists believe there are no absolute truths with reality being a subjective and complex human creation with many meanings. These meanings are influenced by personal, social, historical, cultural and political factors including the biases of the researcher and participants. There is a focus on perceptions, interpretations, and interactions, objects or social problems, because people inherently seek an understanding of their world (Creswell, 2013; Creswell, 2014; Leedy & Ormrod, 2013).

This study describes the conditions of energy issues in manufactured housing and the programs that address it (LIHEAP, WAP, RLP). I performed semi-structured interviews to collect data on the professional experiences and opinions of MH service providers of these programs and other workers that interact with manufactured housing residents. The narrative data were transcribed, coded, and categorized into six major themes (see Figure 5.1).

4.3 Role of Researcher

Under the interpretivist view, I acknowledge and disclose my biases and how it will shape the study. This is important to note because I co-construct the meaning of the interviews within the context of my identity and experiences, unlike other research approaches. My personal experience spending the first 18 years of my life growing up in a substandard 1971 singlewide Marshfield mobile home was the initial inspiration of this work.

I saw my parents struggle to keep up with repairs and make ends meet as our home fell apart around us. My father was and still is very handy at home repairs but was unable to fulfill the unreasonable demands necessary to maintain this type of housing. I would help him seal the seams in the roof every couple of years but it would still leak. Crises were common from the pipes bursting multiple times to the ceiling leaking and slowly caving in and exposing the insulation, to multiple holes and soft spots in the floor that my 6'3" tall brother would have to be careful to avoid. The toilet sat at almost a 45°angle downward as it slowly sank into the floor. Late at night in the winter, I often grabbed a blanket and sat on the heating vent closest to the furnace for warmth, "You're taking all the heat," I was scolded if I was caught. On the other temperature extreme in August, I vividly remember being drenched in sweat as I practiced my clarinet in my bedroom because we only had two window air conditioning units: one in the living room and one in my parent's bedroom.

Mold coated the area around the bathtub and the sheetrock my father used to remodel two bedrooms, including my closet and window that eventually crumbled into sections of a black, chalky mess. I had trouble breathing in my early teens that doctors diagnosed as sports asthma and prescribed me an inhaler. My mother was also diagnosed with asthma and was prescribed two different inhalers to breathe clearly, while my father had constant unexplained migraines that he treated with multiple over-the-counter medications.

My parents lived in that home from 1983 until 2010 and were then only able afford a foreclosed site-built house due to the housing bubble collapse in 2008. They were forced to demolish their mobile home before they were allowed to move out of the park, and needed to charge the over $3,000 expense to their credit card. My parents never went to college, but I graduated at the top of my high school class and was determined to continue my education. I left for college in 2003 where the guilt of having a more comfortable life than my family living in a shared dorm room complicated the other social changes I was experiencing. Now, in graduate school and having lived in a site built house for years, I feel confident exploring the complex interactions of society and policy at a distance using my academic training guided by my personal experiences.

My mother is still hyper-vigilant about the indoor temperature in her new home to minimize heating bill costs but it is still a fraction of what they would pay in the mobile home. Their mortgage, including taxes and insurance, is only about $100 more per month than what they paid in lot rent for their mobile home alone. Five years later, and twelve years for me, we still reminisce about how horrible the conditions were living in "the trailer."

These experiences may have biased my interpretation of the data in a few ways. One bias could have stemmed from my own personal experiences with societal stereotypes and prejudice against MH residents, particularly towards residents who live in MH parks. I may have overstated or seen evidence of this in the interviewee responses when it was not intended. Another bias could have stemmed from my natural inclination to empathize with MH residents experiencing REI, as a former one myself. In summarizing what people generally experience in older MH living conditions, I may have overstated the severity because the conditions I grew up in were so dilapidated. Also, I've faced structural disadvantages within bureaucratic systems that were designed by middle or upper class people—sometimes through programs designed for the poor—that often ignored the realities of the working poor class or assumed that everyone would be treated fairly and impartially when navigating that system. This bias may have led to an emphasis on the structural issues of the programs, while understating the role and responsibility of MH residents to address the factors of Residential Energy Insecurity (i.e. maintenance and repair of their homes). To address the impact these biases may have on my analysis, I describe strategies to address issues of trustworthiness of the study in Section 4.11.

4.4 Setting

I conducted phone interviews with service providers across Minnesota in August and September 2015. Minnesota is a valuable location to study REI because of the extreme changes in weather each year where a resident will need to heat and cool their home (see Section 2.5). Each

interview lasted approximately 30 minutes with the shortest lasting 15 minutes and the longest lasting 60 minutes. The most common service providers were Community Action Partnership (CAP) agency workers that administer LIHEAP and WAP. The 1964 Economic Opportunity Act established the National Community Action Partnership to provide assistance to low-income Americans and helps remove barriers to economic security and reduce poverty ("Minnesota Community Action Annual Report," 2015). These agencies are nonprofit-private and public organizations with approximately 1,000 agencies across the United States. In Minnesota, there are 25 Community Action Agencies (CAA) and 11 Tribal Governments receiving funding. In 2013, CAA in Minnesota provided services to 233,394 families or 587,878 individuals ("Minnesota Community Action Annual Report," 2015). Information on other organizations is not described to protect the anonymity of respondents. Generally, there were also service providers from Community Development Agencies (CDA), the Minnesota Housing Finance Agency (MHFA), energy non-profit, a manufactured housing non-profit, a utility company, a manufactured housing repair company.

4.5 Participants - Sampling

I initially followed purposeful sampling by targeting CAP workers that administered LIHEAP or WAP or provided other services to manufactured home residents within the past five years. A senior administrator had sent my recruitment email to LIHEAP and WAP workers across Minnesota, where I secured workers for 9 interviews. From those interviews, I was also able to recruit 4 more people by asking for referrals at the end of interviews, also known as snowball sampling. Then, convenience sampling was used to find 3 additional research participants. An Internet search yielded contact information of workers from a directory of conference attendees on energy affordability that resulted in two interviews and an additional referral. A total of 16 interviews were conducted with 19 people. All interviews were one-on-one with the exception of one interview with four people that was logistically more favorable to the respondents and lasted 60 minutes.

4.6 Participants - Characteristics

I focused on the interviewee's professional experiences and opinions and not the participants themselves. Therefore, I did not collect demographic data, although some information was inferred. Of 16 people interviewed, I inferred that 14 were male and 2 were female based on the name and voice of respondents. 9 people worked for a CAP agency, 2 worked for a CDA, 1 worked for the MHFA, 1 worked for an energy non-profit, 1 worked for a manufactured housing non-profit, 1 worked for a manufactured housing repair company, and 1 worked for a utility provider. Of the main programs interviewees mentioned, 7 predominantly worked within WAP, 1 worked within LIHEAP, 4 worked within rehab home loans, and 4 did not work under these programs. 8 people worked within the seven-county metro area, 5 people worked in Greater Minnesota, 2 worked for organizations that served multiple states, and 1 worked for a statewide program. The seven-county metro area includes Hennepin, Ramsey, Anoka, Washington, Dakota, Scott, and Carver counties with a population of approximately 3 million in 2014 ("Community Profile for Twin Cities Region," n.d.). Greater Minnesota has 80 counties with approximately 2.4 million people. 9 respondents had 10 or less years of experience in their field and 7 respondents had more than 10 years of experience in their field. The interviewee's professional experience ranged from 1.5 years to 30 years.

4.7 Measurement Instrument

4.7.1 Semi-Structured Interviews

The semi-structured interview script can be found in Appendix E. I emailed the questions to respondents at least 24 hours before the interview (Appendix D). At the beginning of the interview, respondents were informed the phone call would be recorded. I also provided assurance that their answers would be anonymous and participation was voluntary while being able to freely withdraw at any point.

Open-ended questions with neutral terms (i.e. "energy-related issue" rather than the negatively charged "energy insecurity") were used to gather information on however the interviewee

interpreted the question. The questions were broadly divided into three categories: 1) factors of energy issues in manufactured housing (Question 2); 2) service delivery (Questions 3 and 4), and 3) the professional opinions regarding the current programs and policies (Questions 5 through 7).

Question 1 was a warm-up question about the interviewee's professional experience and organization. Next, Question 2 directly asked for what factors contributed to energy-related issues for manufactured housing residents. A common follow up question was to ask how MH residents coped with the energy issues before receiving assistance. Question 3 tried to better understand the process a resident would go through to receive assistance. I often followed up with a question asking about their level of interaction if the initial response wasn't clear to get a better idea of how closely they have worked with residents (i.e. over the phone vs. visiting the home). Next, I asked the respondents to share a memorable interaction about a MH resident experiencing an energy-related issue. This was to see what stood out with energy issues and see what patterns emerged during these interactions. Last, a series of questions relating to the strengths, barriers, and recommendations of current policies or programs was asked.

4.8 Data Collection

Phone interviews were audio recorded and transcribed. Notes and personal reflections were written throughout and after the interview.

4.9 Data Analysis

NVivo for Mac 10 was used to organize and code each transcript using a Grounded Theory approach as described by (Glaser & Strauss, 1967; Charmaz, 2006; Creswell, 2013). This is an inductive analysis where a theory emerges from the data. This is in contrast to the deductive approach used in quantitative research where a theory or hypothesis is proposed before any data is collected, is unchanging, and guides the study.

First, the interview data was categorized by question in NVivo. Throughout the process, I wrote memos within NVivo documenting what I was doing along with personal reflections. Then, I used a progressive, multi-stage coding technique to examine the interview transcripts for patterns. The first stage of coding broke the data into subthemes within each question. Next, I reviewed the data at the global level by trying to find the larger story the codes explained along with underlying assumptions within and between themes. The broad social and political categories emerged within a number of subthemes. For the second stage of coding, I performed a more focused, or axial coding, as I went through the data again to see how these themes related to each other. I drafted a basic figure (see Figure 5.1) to explain the data before going through the data one last time. During the third stage of coding, I compared to see if the data fit into my basic theory and refined it further as I went. Throughout the coding stages, I worked closely with a professor experienced in Grounded Theory for feedback where she would review my themes and the associated data listed in printouts.

4.10 Ethical Considerations

The main ethical consideration specific to this study was how asking questions to the service providers may cause feelings of discomfort. Specifically, the service providers may feel stress or worry about compromising their job if they don't answer in a particular manner. Also, the service providers may have negative feelings about sharing experiences with a vulnerable group, namely low-income families. To address this, I sent out a statement of informed consent within the recruitment email and repeated it verbally before the interviews where I received positive verbal consent to continue. I also ensured confidentiality by removing any identifiers or references of traceable organizations. Since I was interviewing people on their professional opinions, I did not need to receive Institutional Review Board approval, but I did receive an exemption (see Appendix G).

4.11 Issues of Trustworthiness

There are three criteria to evaluate the quality, or trustworthiness, of qualitative research: 1) credibility, 2) dependability, and 3) transferability (Lincoln & Guba, 1985). Credibility is a measure

of how accurately the researcher expressed the true thoughts, feelings, and/or actions of the participants. Dependability is a gauge of how well another person can follow the processes and procedures to collect and analyze the data. Transferability is an assessment of how the lessons and/or processes from this study could be applied to other settings. These concepts are parallel to, but not the same as, the criteria of quality in quantitative research of: 1) validity, 2) reliability, and 3) generalizability.

4.11.1 Credibility Strengths

There are a number of strategies to strengthen the credibility of qualitative research including the disclosure of personal biases, using multiple data sources, presenting discrepancies, and using peer debriefing. In Section 4.3, I disclosed my own experiences with the topic of my research. My own biases related to being a former MH resident who experienced REI might have influenced the interpretations of my data. For instance, I might be particularly sensitive to certain statements, which could lead to an overstatement of the issues. To address this, I reflected on my own subjective experiences in research notes after every interview and in a research journal throughout the coding process. For example, within the interpretation of the statement "People do take advantage…" I explained that my impression was a negative connotation towards the MH residents in parks, but also that the statement doesn't necessarily have a negative connotation (see Section 5.3.3). I also used multiple data sources, called data triangulation, to strengthen the credibility of this study. Specifically, I used a triangulation of sources where multiple types of service providers were interviewed (LIHEAP, WAP, RLP, MH non-profit; energy non-profit, MH repair worker; utility company) and in different areas (Greater Minnesota versus Metropolitan Area). This provides a more robust picture of why energy-related issues persist in MH of Minnesota compared to only using one type of service provider in one location. Additionally, I presented discrepancies when service providers had differing opinions on issues. For instance, I described how some service providers distinguished between MH clients and SBH clients in terms of chronic poverty versus temporary poverty, while other service providers did not notice any differences (Section 5.3.1). Also, in interpreting a quote from a weatherization worker with more than 5 years experience on the societal stigma of trailer parks, I also noted that some service providers did not mention any sort of stigma (Section 5.3.3). Lastly, I used "peer debriefing" with a professor experienced with grounded theory approaches over the period of approximately three months during bi-weekly 40-minute meetings. I would summarize the approach I had taken and the coding categories I had developed. Then, I would show the professor a printout of the codes and the associated transcript data to review. During this review process, we would discuss the appropriateness of the codes and data.

4.11.2 Credibility Weaknesses

Some credibility weaknesses of my study were that I did not perform "member checks," I didn't build a relationship with the service providers, and that I didn't use multiple methods of data collection. A "member check"—allowing the interviewees to review the transcript of their interview or a summary of it—would give the interviewee a chance to clarify or confirm the meaning of their answers and reduce any individual bias of the researcher. Due to time and privacy concerns, I did not perform these, so my analysis relies heavily on my own interpretation. To address this, I disclose my experiences with the research topic that could bias my interpretations in Section 4.3. Also, due to time and resource limitations, I was unable to build a long-term relationship with the service providers. This likely reduced the level of trust and openness of the service providers in communicating their experiences with me. To address this for some service providers, a senior administrator acted as a gatekeeper to distribute my recruitment email and encouraged LIHEAP and WAP workers to participate (Appendix C). Also, I informed the participants that their identities and answers would be anonymous and confidential—so they would be able to speak freely. Another credibility weakness was that I only used one method of data collection—semi-structured interviews. One way to strengthen qualitative research is to use multiple methods of data collection, which is a form of triangulation. The purpose of relying on multiple methods of data collection (e.g. focus groups, participant observation, surveys) is that they capture different aspects of the issue being studied, which may provide a more complete picture. To address this, I used different types of service providers to provide multiple perspectives.

4.11.3 Dependability Strength
One way to assure dependability is by providing detailed explanations of how the data were collected and analyzed. To address this, I explained the process of how I collected and analyzed my data throughout Chapter 4 (Sections 4.5, 4.8, and 4.9). Additionally, my data are available for review by other researchers.

4.11.4 Dependability Weakness
I did not have other researchers independently examine and code the interview transcripts, which would help determine the inter-rater reliability. This leaves my interpretation particularly vulnerable to my own biases, an issue that I address within the credibility strengths (Section 4.11.1).

4.11.5 Transferability Strengths
The two main ways I assessed the transferability of this study were by the richness of the descriptions and by detailed information on the context. I provided a "thick description" of in-depth analysis by developing an integrated theory to describe how a higher average energy burden persists for MH residents (see Chapter 5). I also provided detailed information on the context of REI as a conceptual framework and of energy inequities as a theoretical framework (see Chapter 1). These frameworks can easily apply to different populations or in different countries to study related issues.

4.12 Limitations
There are general limitations to performing qualitative research, as well as, specific limitations to my study. A general limitation of qualitative research is the researcher's own biases since the research choices and the researcher heavily influences interpretations. To address this, I disclosed my personal experiences with this topic and how that might bias the interpretation of my data (Sections 4.3 and 4.11.1). Another general limitation to qualitative research is "participant reactivity" meaning that interviewees may alter their answers when they are aware that they are a part of a research study (Maxwell, 2005). To minimize this, I assured the interviewees that their participation was confidential, anonymous; they would be able to speak freely, or withdraw at any point. A limitation specific to my study was that I only interviewed MH service providers, but in reality, a more complete picture of persisting REI in MH would include the perspectives of MH residents in the analysis. To address this, I asked the service providers questions about their interactions with MH resident who were experiencing an energy-related issue (e.g. How do residents cope with some of these [energy-related] issues before receiving assistance?) More limitations specific to my study are discussed in detail within Section 4.11.

4.13 Delimitations
The delimitations were the intentional choices I made as a researcher to limit my study. I restricted the research participants to service providers in Minnesota that have interacted with MH residents within the past 5 years. My initial preference was to only speak with service providers of the two federal energy-related programs (LIHEAP and WAP), but I was unable to recruit enough of these workers, even with the support of a senior administrator sending out my recruitment email. Also, I was not familiar with the RLP program before interviewing and was referred through the service providers as an indirect way of addressing energy-related issues for MH residents. Another delimitation was the research setting: I conducted all interviews over the phone to be able to reach service providers across Minnesota in a quick and inexpensive way.

Chapter 5 – Interview Findings

5.1 Introduction

Using the approaches described in the Chapter 4 Methods, this chapter presents the findings of my interview data analysis. Based upon grounded theory development, I present a framework for explaining how a higher average energy burden persists within manufactured housing even with the current programs, namely LIHEAP and WAP. My analysis of the interview data reveals three broad conditions - social, policy, and manufactured housing conditions - that are foundational to understanding energy-related issues in manufactured housing. Further, I will show how the disproportionately high average energy burden in manufactured housing is a consequence of interactions between these conditions, for example, between social and policy conditions.

5.2 Analytical Framework

This framework is comprised of numerous elements and their interactions. Therefore, before reading the description of each condition and interaction, please refer to Figure 5.1 for an orientation to how they fit together, and to Table 5.1 for an overview of the social, housing, and policy conditions. It may seem premature to present these products of data analysis at the beginning of the chapter. However, it is consistent with the iterative, nonlinear process of developing grounded theory by moving between data and frameworks to continuously test their alignment. In the following sections, I elaborate my characterization of each of the three conditions (Sections 5.3 through 5.5) and sets of interactions (Sections 5.8 through 5.10). I use illustrative quotes and paraphrases from interviews to highlight the depth of the data sources from which I derived them.

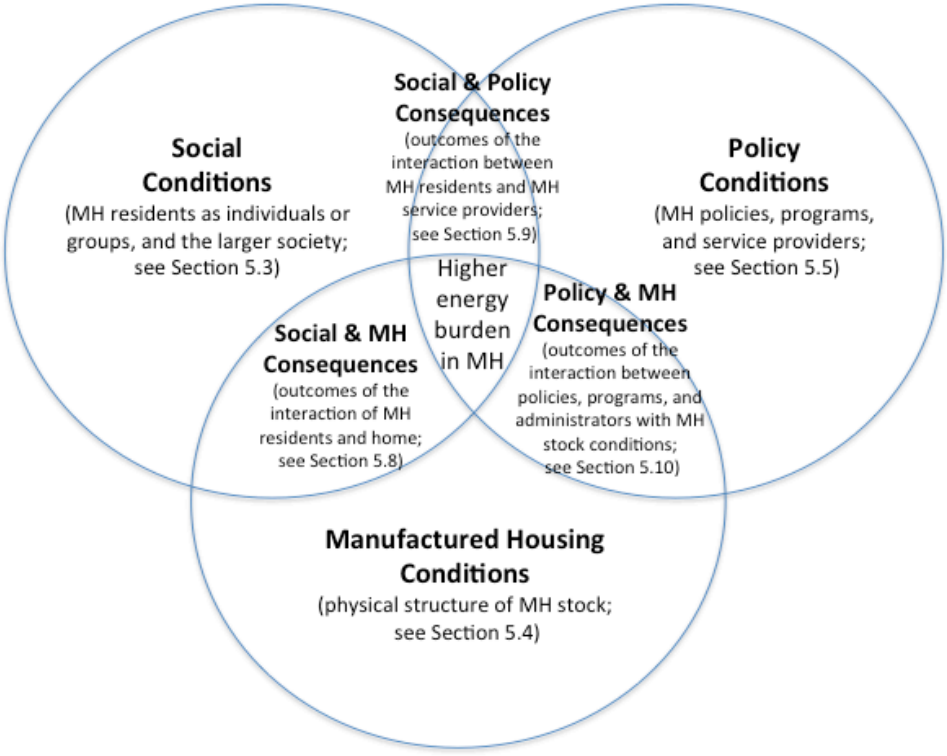

Figure 5.1. Overview of the intersections between the conditions of residential energy insecurity in manufactured housing.

Table 5.1

Summary of the Conditions of Residential Energy Insecurity in Manufactured Housing

	General Characteristics	**Constraints** (pressures relating to the condition that may contribute to a higher energy burden for MH residents)	**Perceptions** (ideas about the condition, expressed explicitly or implicitly by service providers and policies
Social Conditions (at individual, group, and societal scales)	•MH resident description	•limited contractors •rural residents often isolated	•MH residents seen as deserving or undeserving of assistance or neutral •stigma of living in parks
MH Stock Conditions (physical structure of the current MH housing stock in Minnesota)	•poor construction •improper installation •aging MH stock •urban/rural/park settings	•maintenance needs •design •easily damaged •special materials •remain roadworthy	•cheaper to live in than site built house •older MH (pre-1976) are temporary housing
Policy Conditions (policies, regulations, programs, administrators, and service providers for energy issues in manufactured housing)	•multiple administrative and regulatory bodies •multiple programs with related but different goals	•funding cannot meet demand •staff reductions •strict qualifying terms and repairs •inconsistent enforcement of regulations	•homes as commodities and investments •MH residents move often

5.3 Social Conditions

5.3.1 Characteristics

Service providers described manufactured housing clients as experiencing a number of resource limitations. For instance, MH clients were described as being low-income; which wasn't surprising since LIHEAP, WAP, and RLP are designed for low-income households. However, what was striking was the differentiation among these low-income clients between those that experienced chronic or recent poverty. Of residents who use these programs, MH clients were sometimes described as being in chronic poverty with multiple hardships. On the other hand, low-income site-built-house clients were sometimes described as experiencing recent poverty that was recent or seemed to be temporary. However, it should be noted that some service providers didn't notice a difference between low-income MH and SBH clients when asked. In addition to being low-income, MH clients were described in terms of other resource limitations. Specifically, by having a limited level of education, and by having limited knowledge of MH maintenance or repairs. One respondent shared that a MH client didn't understand the building science of their MH and cut a hole in the skirting to use the underbelly as a doghouse, which ruined $4,000 worth of weatherization work. MH residents experience a number of resource limitations from having chronic limited incomes, having limited levels of education, and having limited knowledge of MH maintenance or repairs.

5.3.2 Constraints

Service providers mentioned a number of constraints including the MH residents themselves, the handymen or licensed contractors that repair MH, and a general lack of energy information available before buying a home. Service providers expressed that MH residents had limited incomes where they couldn't afford the proper materials for maintenance or repairs. Also, MH

residents had limited levels of education where they may be unable to navigate the bureaucratic process of applying to assistance. MH residents were also described as having limited knowledge of the proper MH building science to perform maintenance or repairs without damaging their home. Handymen or licensed contractors that perform maintenance or repairs of MH were an additional constraint because there were a limited number that worked on MH and they often didn't have the knowledge of MH building science. A limited amount of handymen or licensed contractors worked on manufactured homes because: 1) MH had complicated building codes; 2) there was a higher risk of non-payment; 3) the structural and electrical differences were difficult to work on; and 4) the environment of the underbelly may be unpleasant. Of contractors that worked on MH, some did not correctly complete the work and actually caused severe damage because they lacked knowledge of MH building science. One respondent said they had seen professional plumbers who didn't understand the integral importance of the underbelly. To access the pipes, the plumbers would cut a hole into the underbelly and remove insulation. After the repair was completed, the hole and insulation were not mended so the pipes would freeze again. Another constraint was the lack of information on operational costs, like energy, available to residents before they purchase or rent their MH to make sure they can afford it. The key constraints were related to the MH residents, handymen or licensed contractors, and a lack of energy information available before buying a home.

5.3.3 Perceptions

With explicit and implicit meanings from comments, I interpreted three perceptions that service providers held of MH clients: 1) positive or deserving of assistance; 2) negative or not deserving or assistance; or 3) neutral or process-oriented.

One perception that some service providers held towards MH clients was a positive one where they were seen as deserving of assistance. When respondents made statements such as a client being the "right person" or a "good person," my interpretation was that they view these clients as being deserving of help. One respondent explained helping a resident in a heating crisis situation and indicated they felt good because they were "...doing the right thing for the right person." Another instance was described where a park manager reached out to service providers on behalf of a resident who was without heat and couldn't afford the repair but was a "good person." A different service provider described how residents often feel guilty for receiving help. In these interactions, the service provider comforted the resident with the justification they were in tough situation at the moment and paid their taxes. Interviewees often described seniors or people who are disabled and on a fixed income in a deserving tone and as the "...ones we really want to serve." Some service providers held a positive perception of their MH clients where they deserved assistance.

Another perception that some service providers held towards MH clients was a negative one where they were not seen as deserving of assistance. A few key statements by interviewees indicated to me that the respondent may hold a negative view that some clients were not as deserving of help as others. One group of statements related to the residents using the system unfairly and another group related to how the residents are stuck in a bad situation because of personal characteristics. Some statements in the first group were that, "Some people work the system..." and explained how residents often want to keep their old furnace even though it is being replaced for free. Another, more ambiguous comment stated that, "People do take advantage pretty extensively in mobile home parks of the energy assistance program..." It was tough to say if the respondent meant, "taking advantage" in a negative context but there was a connotation that it was used frequently there. Another statement was that people "...expect you to take care of everything..." which seems that these people are asking for more than what this interviewee thinks they deserve. A few statements related to the general characteristics of residents being unmotivated with bettering their lives with comments like "...they don't have any stable work and it doesn't seem like they are attempting to get any," or "...some people, they just, they don't strive toward anything different," or "...there's some people that...don't want to get ahead." Some service providers held a negative perception of their MH clients where they did not deserve assistance.

A third perception that service providers held of MH clients was neutral or process oriented. This is based on more of a global look at the interview patterns where there the service providers gave little details or opinions shared about MH clients. There was a professional distance when speaking about the issue even with my questions intended to probe. The emphasis of the interview was on the actions of the programs and not the interpersonal interactions with clients. One respondent indicated they were not supposed to ask or talk about the clients' personal lives but sometimes clients shared it anyway. Some service providers held a neutral perception of their MH clients where they were more focused on the process of administering assistance.

In addition to the perceptions expressed by service providers toward MH clients, there was a different scale of perceptions where some service providers sensed societal perceptions of stigma toward MH residents in parks. A weatherization worker with more than five years experienced articulated this in how he saw a MH resident's behavior during interactions:

> You probably notice a higher, almost like stigma of...they feel lesser class because not so much in the mobile homes that are out in rural areas by themselves but more so in the mobile home parks and it may be that persona that gets projected on them by society as living in a trailer park and you kind of see it on their...you know the way they interact and you kind of see it in their children versus site built [homes]. It's hard to see that when it's still doing the best they can do and still putting a roof over their head so it is probably that stigma just kind of gets placed on mobile homes.

This stigma may impact if and how MH residents in parks receive assistance both in how they internalize this stigma, but also in how service providers might perpetuate it if they are not sensitive to it. However, some service providers did not mention any evidence of stigma or behavioral differences between MH clients and SBH clients. Some service providers shared what they believed were evidence of societal perceptions of stigma towards MH residents in parks.

5.4. Structural Manufactured Housing Stock Conditions

5.4.1 Characteristics

Features related to the poor design of MH contributed to energy-related issues for residents. First, the rectangular shape of the home leaves every room exposed to an outdoor wall that loses heat easily and requires more energy. Also, a number of respondents mentioned that the older mobile home roofs were engineered to lose heat in order to melt snow so the MH wouldn't collapse under the weight. In the winter, homes with metal siding and roofs created a vapor barrier where moisture condensed inside the ceiling and walls. A respondent said that people mistakenly thought their roof was leaking and try to re-seal the outside surface but it continued to "leak" which ruined the insulation and contributed to mold. Another factor of the design that often contributed to energy-related issues is the belly-pan/underbelly (see Appendix A for diagram of MH). This is the area underneath the flooring that contains ductwork, plumbing, and insulation. There is skirting around the bottom perimeter of the MH that protects this area, but it was easily damaged, and led to catastrophic failures like pipes freezing and bursting. MH design features, like the rectangular shape, that the roof was made to leak heat to melt snow, a vapor barrier that caused condensation, and a weak skirting to protect the vital parts of the home, contributed to energy-related issues for residents.

Energy-related issues also stemmed from the improper site installation of the MH. The site installation included placing the home on some sort of foundation and connecting it to the utilities (see Appendix B for diagram of MH foundation). In the older MH, the foundation could be as basic as a few cement blocks. These blocks would unevenly sink into the ground from the freezing and thawing cycles in Minnesota, causing structural damage to the home as it twisted and buckled. Improper installation was a significant factor in rural homes where, "...75% and perhaps as high as 90% of the mobile homes are never set on a proper foundation..." However, newer homes are placed on a slab to prevent this settling into the ground so this is a problem for the older MH. Another aspect of an incorrect installation was the sewage leaks. A rural

respondent said, "...about 75% of them [MH] seem to leak sewage under there" because the sewage pipes were not attached correctly at installation. A different aspect of improper site installation was installing homes that were not meant for the climate of Minnesota. Specifically, one service provider mentioned that some MH from the southern U.S. were illegally transported and installed in northern Minnesota. The MH built for the southern U.S. did not have adequate insulation for the climate in Minnesota. One service provider mentioned that Federal Emergency Management Agency (FEMA) trailers that were used after Hurricane Katrina in Louisiana in 2005 had been transported and installed illegally in northern Minnesota. Improper site installation of MH that contributes to energy-related issues can range from an improper foundation, not being properly connected to utilities, or being installed in areas with climates that they were not designed.

5.4.2 Constraints

The current MH housing stock conditions were constrained by the need to remain transportable by roads and other design features that limited the types of weatherization improvements than could be done compared to SBH. The main constraint of the current manufactured housing stock was the need to remain "roadworthy" meaning the ability to be transported by freeway after installation at a site. To achieve this, special and lightweight materials were needed and the structure had to be certain dimensions. However, it was mentioned that MH rarely, if ever, move after being placed at the initial site. Also, there were features specific to MH that limited the ability to weatherize these homes compared to SBH. One feature was the lack of an attic to add insulation like in a SBH, making weatherization more difficult. Also, there needs to be special ventilation for natural gas water heaters to prevent deadly carbon monoxide fumes from entering the home. Paradoxically, some repairs may lead to other serious problems, like mold or moisture, in the home. The skirting of the MH also prevents WAP workers from doing weatherization audits on MH in the winter because it is susceptible to damage and snow piles up against it, making access difficult. The need to remain roadworthy and the limited types of weatherization repairs contribute to energy-related issues in MH.

5.4.3 Perceptions

The predominant perceptions expressed by service providers were that older MH were temporary housing and that MH are inexpensive to live in. MH were seen as temporary housing even when people were using it as a permanent residence. One WAP worker said, "The original premise of a mobile home was never meant to be a permanent house." This is in reference to the older mobile homes; probably MH built before 1976, and not to the newer and more solidly built manufactured homes from 2000 and later. Also, MH were seen as a less expensive place to live compared to SBH. However, when factoring in the lot rent, the mortgage, and the utilities, a RLP worker said "...the monthly expense can be as high as owning a stick built home." Specifically, respondents mentioned extremely high heating costs for MH into the thousands per month. For comparison, one service provider shared what a high heating cost would be for a duplex, which was lower than any bill amounts that service providers shared for MH (see Table 5.2 for examples). MH were perceived as temporary homes that were less expensive to live in.

Table 5.2

Summary of High Heating Costs

Worker - Main Program	Described Bill Type	Amount	Frequency	Service Location
Utility - N/A	Duplex Heating	$300	Monthly	Multiple States
CAP - WAP	MH Heating/Cooling	$500 to $1,000	Monthly	Metro Area
CAP - WAP	MH Heating	$1,000	Monthly	Metro Area
CAP - WAP	MH Heating	$2,500 to $3,000	Annually	Metro Area
CAP - WAP	MH Heating	$5,000	Not Specified	Metro Area

5.5 Policy Conditions

5.5.1 Characteristics

The emphasis of this study is at the program-level, not the policy-level, so the context will mostly focus on the relevant programs and then any related policies. Each program could be described by three main characteristics: 1) the main goal; 2) the funding source; and 3) the regulation and enforcement agencies. Of these programs, there were two types of main program goals: 1) those directly related to energy cost or efficiency; or 2) those related to home structural repairs that indirectly improved energy efficiency. LIHEAP directly addressed energy costs, WAP directly addressed energy efficiency, and RLP addressed structural issues that indirectly improved energy efficiency. For the funding structure, each program was funded by different federal or state agencies. LIHEAP received funding from the federal Office of Community Services that was administered through CAP Agencies in Minnesota. WAP also received federal funding, but from the Department of Energy, that was administered through CAP Agencies in Minnesota. RLP received state funding from the MHFA that was administered mostly through CAP Agencies in Minnesota. For regulation and enforcement agencies, only programs that altered the structure of the MH, namely WAP and RLP, were subject to follow the federal HUD codes for MH by construction year. This was enforced at the state-level through the Department of Labor and Industry within the Minnesota Department of Commerce. The programs each had a different primary goal, funding source, but the programs that addressed the structure of the MH were all subject to the same regulation and enforcement agencies.

5.5.2 Constraints.

The largest barrier for reducing energy-related issues for MH residents, as expressed by service providers, was policy and program constraints. One weatherization worker illustrated this by saying, "...it's not a client issue at all; regulations is a big one [barrier]." Of over 20 mobile home weatherization audits in a year, a weatherization worker with over 20 years experience shared that they could only weatherize 6 due to policy and program issues. The following policy constraints were broadly related to: 1) program administration (funding, eligibility requirements); and 2) regulations and enforcement.

A number of program administration constraints were related to funding from either: 1) the funding source, or 2) in administering program funds. From the funding source, one program constraint was simply a lack of money to meet the demand. A weatherization worker said, "We could be doing them [MH weatherizations] year round every day and just scratch it..." Additionally, the funding source changed the levels awarded annually to each program, making it difficult for administrators to plan. The other funding constraints were related to how program funds were administered. Specifically, WAP service providers expressed that there needed to be a certain cost-to-savings calculation for any repairs using the weatherization audit information in the [MHFA software program]. With expensive MH-specific item replacements, these software calculations often did not justify the costs in the chosen payback period and repairs were never done. Although the RLP does serve MH residents, the service provider expressed a reluctance to work with MH residents because there was a higher loan default rate compared to other housing types. Program constraints to reducing energy-related issues for MH residents were related to the funding source (limited amounts, annual award levels changed) and in how the program funds were administered (high cost-to-savings ratio, higher loan default rate).

Another set of program administration constraints was related to the eligibility requirements. RLP had the strictest requirements even though it was a loan program. The income cap was described as so low that people on Social Security or Disability Insurance sometimes didn't qualify. Also every person listed on the home title was required to be a current permanent resident. This is problematic for MH residents who own their home with family members that no longer live there, but are unable to afford the title change. Also, MH needed homeowners insurance. However, a service provider described homeowners insurance for MH as worthless because the insurance companies either don't pay out claims or, if they do, they immediately drop the MH resident right after. Also, the resident had to be current on property taxes, which could

often be difficult for some of these chronically low-income households. The last requirement is having an income because as a loan, it needs to be paid back, although there are forgiveness options. A respondent shared that MH residents don't qualify for RLP because, "...a lot of times there's no income at all." The eligibility requirements for programs, particularly RLP, were overly restrictive.

Program constraints were also related to regulations and enforcement. For instance, repairs done through WAP or RLP needed to follow the original HUD code regulations for the year the MH was built. Specifically, the type of windows, doors, and appliances for replacement had to match the original specifications, even if less expensive and more efficient options were available. There was no similar restriction on repairs in SBH. Also, WAP had the strictest regulations where no structural repairs could be done as part of a weatherization, including the skirting that is integral to protect the underbelly or the common leaking roofs in MH. Also, for liability reasons, WAP could not add electrical tape to prevent pipes from freezing despite it being an effective measure to prevent pipes bursting. Another constraint was the inconsistent enforcement of regulations. One was that the MH installation regulations were not enforced so insufficiently insulated homes from the southern U.S. are being transported and installed in northern Minnesota. Also, homes with modifications beyond the manufacturer's specifications were being sold when they shouldn't. Lastly, building inspectors generally did not like going into MH parks because, "...they know what's there..." and do not want to condemn homes for people who have no other place to live. Strict regulations and weak enforcement were program constraints.

5.5.3 Perceptions

There was two ways program perceptions were expressed: 1) directly by service providers; and 2) indirectly through how programs were administered. Some service providers felt that the current programs were not working at all for manufactured housing residents. Others felt that if a resident could qualify, which was expressed as being challenging, the combination of programs could be effective at addressing energy-related issues. A perception reflected though the program administration was that a home was a commodity first and foremost instead of necessity to live. Manufactured homes were seen as a depreciating commodity making it difficult to justify the investment in repairs where the value will never be recovered. An additional way this perception was demonstrated was in how some service providers diverted funds away from MH or only used their in-house funds for MH during emergencies. To illustrate this perception, an RLP worker shared that "…with a lack of resources, agencies tend to squirrel their money and put it towards a little more safe investments with site built houses." Also, perceptions shared by service providers ranged from the current programs failing MH residents, to others that thought the current programs worked well, granted the MH residents could get through the difficult eligibility process. Perceptions reflected in the program administration were that MH were not a good investment of public funds because of their depreciating value compared to SBH.

5.6 Definition of Consequences

The three main conditions (Social, Policy, and MH Stock) and their elements were not isolated from each other. They interacted within a system that contributed to a disproportionately high energy burden that persisted for MH residents, despite current interventions (refer to Figure 5.1). To illustrate the complexities within this system, I examined possible interactions between the conditions and their consequences for the MH residents' energy burden. Although I use the terms "Consequences" and "Outcomes" to describe these sections, I am not proving any causality, but rather proposing a grounded theory of likely interactions based on my research.

5.7. Level of Analysis for the Consequences

It should be noted that these consequences operate at several levels, from the micro (e.g., individual households and service workers), through the meso (e.g., groups of residents), to the macro (e.g., societal level conditions of poverty). I do not address these levels systematically here, but rather identify where those levels are salient. My analysis of the data finds that not all possible levels of analysis are salient for every condition or interaction, so that a detailed analysis of every level is not merited. More important, a more parsimonious framework (Figure 5.1) is

more powerful because it prompts researchers analyzing other policy settings to look in a more open-ended way at what the most salient interactions and levels of operation may be in those environments.

5.8 Consequences of Interactions between Social Conditions of Residents and Conditions of their MH

I classified the consequences of the interactions between the Social and MH Stock Conditions by either active coping strategies or passive outcomes. For this section, the level of analysis is on the interaction between a MH resident and their home. I do not know the causal factors but inferred that the combination of the described MH resident characteristics (i.e. low-income, lower education levels, limited knowledge or ability to maintain MH) with the structurally deficient MH, broadly leads to the following consequences. These household coping strategies represent the intentional, behavioral response of the MH resident to various household stresses. The other outcomes represent the passive or unintentional consequences between the interactions of a MH resident and their structurally deficient home (see Figure 5.2).

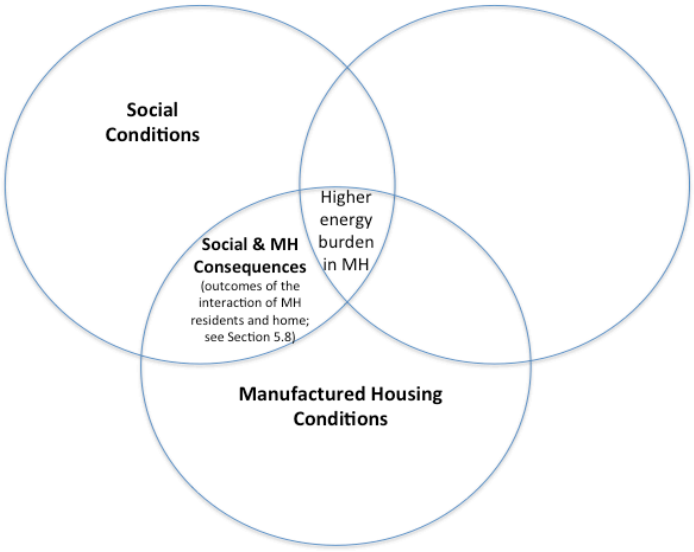

Figure 5.2. Consequences of interactions between social conditions of residents and conditions of their manufactured home.

5.8.1 Coping with High Maintenance Needs

There were a number of ways that MH residents coped with the various challenges of the housing needs. One way that residents cope with the demands of the house upkeep is by deferring preventative maintenance. This could be due to a lack of financial resources, physical ability, or knowledge in maintenance. By neglecting things that need repair, structural systems often fail prematurely. Common areas mentioned for failures were air and water leaks with roofs, windows, and plumbing. All of these in isolation or combination can contribute to internal damage to ceilings, walls, floors, insulation and structural beams. A specific item where maintenance is often deferred is with water heaters. A service provider described often seeing water heater leaks, where the floor and insulation below it became saturated, sometimes to the point it fell through the floor. This hole in the floor, on top of the wet insulation, causes substantial air leaks for heating the home.

An additional way residents cope with the high maintenance needs is to perform the repairs themselves. Some repairs included putting planks or plywood across holes in the floor or shoving rags into holes. Additionally, residents may not know they need a specially designed water heater or furnace and replace it with one designed for site built homes. A water heater designed

for a site built house can be $200 - $300 cheaper and is more widely available than one designed for a manufactured home but it is not safe. Doors for site built houses are also built better and are less expensive than manufactured home doors so a resident may cobble an incorrect door because it is cheaper but it doesn't fit correctly and allows air in. A respondent mentioned seeing a resident jerry rig stairs so they can get in where they failed. If the roof is leaking, some residents put one or more buckets down and a respondent stated seeing a resident puncture the ceiling with a pencil to have it drip down one spot. Residents may also seal the roof every year or two even though moisture from the vapor barrier is the cause.

5.8.2 Coping with the Cold

With a leaky home or one with inadequate insulation for winter, many residents needed to cope with the cold. Service providers described some residents trying to get warmer curtains or put plastic over leaky windows to retain heat. Other people simply used a lot of blankets in the winter to stay warm. Rural residents used hay bales to cover the skirting around their home to reduce the wind wash, but this often attracted mice and grew black mold. If the furnace went out, residents may have tried to heat their homes with the kitchen stove, install a wood stove, or use a propane heater. Another tactic for if the furnace goes out is to go to a hardware store and buy a bunch of space heaters. These coping mechanisms residents used to deal with cold homes were similar to those seen in the residential energy insecurity literature. For more information on *Coping with the Cold* in the literature, refer to Section 3.4.

5.8.3 Coping with High Energy Costs

Residents coped with high energy costs in many ways. One way was to seek out energy assistance to help manage high energy costs. Another way was to keep the temperature of their home cool in the winter with one respondent citing a senior keeping their home at 58°F. Residents also coped with these high costs is by choosing between paying for medicine (for seniors), food, or heating, the same "heat or eat" dilemma described in the literature review. One service provider tried to explain the seemingly inexpensive task of changing the furnace filter to a MH resident, "They [furnace filters] are 65 cents a piece. It takes 2 every 30 days. A whole case will cost you $8." The MH resident, a single mother, responded, "That's a jar of peanut butter. I can't afford that." Strategies like these were also employed by other low-income households to cope with high energy costs in the literature. For more information on *Coping with High Energy Costs* in the literature, refer to Section 3.4.

5.8.4 Lifestyle Damage

Respondents also noted that the lifestyles of residents in combination of the MH characteristics contributed to some damage that likely wouldn't happen in other housing types. For instance, laundry piles or clutter on the floor contributed to moisture and mold problems in the home. Substandard flooring created problems for residents who use wheelchairs where residents have trouble maneuvering on the weak flooring. Some residents used extension cords that ran from inside to outside the home for long periods of time. As the door would be closed around the extension cords, the doors would warp and create air infiltration.

5.8.5 Health and Safety Consequences

Residents who cannot financially afford better quality housing pay indirectly through health and safety consequences. To illustrate the acceptance of the poor conditions manufactured home residents deal with, an interviewee described a client justifying their awful living conditions by saying, "...well, this is better than living in my car." Respondents commonly mentioned mold and moisture as sources of health issues. Another interviewee described the poor indoor air quality as "deplorable" and said, "...it's hard to be hyperbolic actually because it's literally so bad."

5.8.6 Poverty Trap

The combination of low-income households with substandard housing, among other interactions, can result in a poverty trap. One reason is the unknown, high costs to maintain a MH. A respondent shared that, "...most of them [MH residents] are pretty surprised when they realize how expensive it is to maintain a mobile home." Also, a manufactured home is considered a

rapidly depreciating commodity. One respondent shared that if you have a MH with the, "...market value assessed at $4,000 and you put $25,000 into it, you still got a mobile home that's only assessed at $4,000..." Also, MHs do not last long enough for residents who own land to appreciate. For residents who live in a park, they are not building any equity for their future with their home. One respondent even shared that realtors give false information manufactured home buyers would build equity.

5.9. Consequences of Interactions between Groups of Residents and Policy Programs

The level of analysis in this section focuses on the outcomes of the interaction between MH clients as a group and the current programs. The three outcomes described are where MH clients received no assistance, partial assistance, or emergency assistance from the available programs (see Figure 5.3).

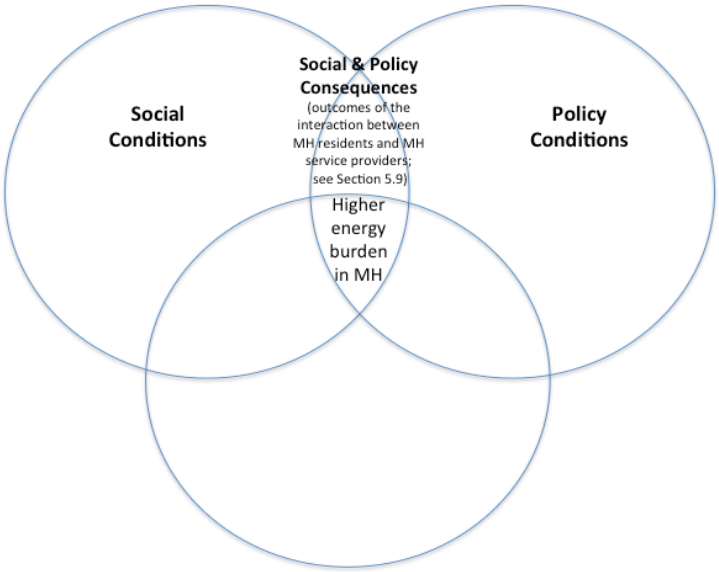

Figure 5.3. Social and policy consequences as an interaction between the social and policy conditions.

5.9.1 No Assistance

There were a number of circumstances where residents didn't receive any assistance. A respondent mentioned that some manufactured housing residents don't reach out for any type of help. Also, the qualifying residents for LIHEAP may not opt-in on the shared energy assistance application to be considered for WAP. A weatherization worker mentioned that manufactured homes are not considered the same as site-built homes so they won't do anything. For the older manufactured homes, or mobile homes, they are not considered housing so programs often do not offer any assistance. Residents also don't receive help if they are disqualified by not meeting all of the program requirements. One is the income and asset guidelines may not be met. For RLP, residents could be disqualified if they do not have the title, insurance for their home, or if their taxes aren't up-to-date.

5.9.2 Partial Assistance

For LIHEAP, the maximum help with heating bills is $400 divided into $100 increments over the winter heating months. However, respondents expressed it was common for MH energy bills to be many times that (refer to Table 5.2 for examples). Therefore, it is likely that many residents only receive partial assistance on their energy bills if they qualify through LIHEAP. A respondent shared a memorable interaction with a client where LIHEAP didn't cover enough energy costs and the power was shut off. If people do not get any other help through other programs, they generally stay on energy assistance indefinitely.

5.9.3 Emergency Assistance

As previously mentioned in *5.8.1. Coping with High Maintenance Needs*, residents often replace their water heater or furnace with one made for a SBH. This incorrect replacement could potentially vent lethal carbon monoxide into the home. If a contractor comes out to work on the home for any reason, both the water heater and furnace are checked. If the appliances are non-code, then the contractor will ticket them and an emergency replacement is triggered. Another situation where a resident would receive emergency assistance was if the furnace stopped working in the winter. If the resident was already on LIHEAP, then the resident can receive assistance from the Energy-Related Repair (ERR) program. For residents who do not qualify for LIHEAP, the MHFA Emergency Loan program is another option, if they qualify.

5.10 Consequences of Interactions between Manufactured Housing Stock and Policy and Regulations

When the MH Stock and Policy Conditions interact, the consequences were either no repairs can be done, called a walk-away, or only a partial fix can be completed based on the MH condition. This section has a broader level of analysis examining the policies and regulations that decide what the programs can and cannot do based on the MH Conditions (see Figure 5.4).

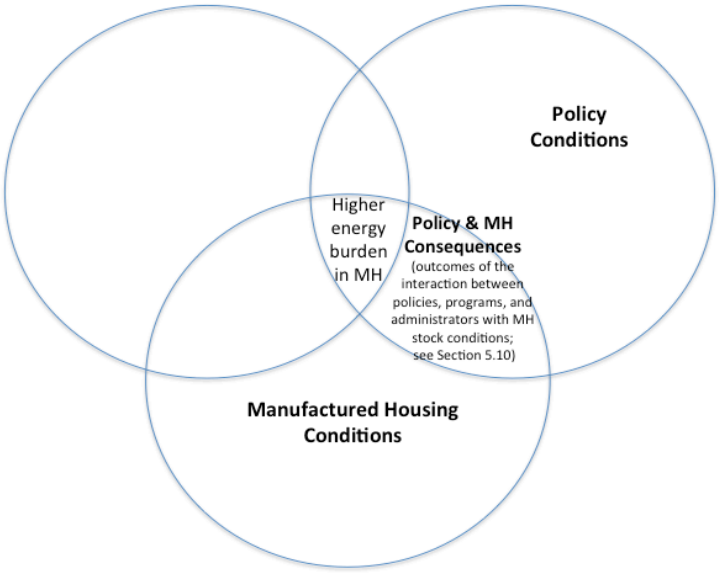

Figure 5.4. Manufactured housing and policy consequences as an interaction between the manufactured housing and policy conditions.

5.10.1 Walk-Aways

Respondents mentioned a number of instances where if the home had certain types of damage, they had to walk-away and not provide any help. A few mandated walk-away conditions mentioned. One condition was if the home was not installed on frost piers or the blocks were not the correct distance. Another condition is if there is water underneath the home. If there is a roof leak in the home, WAP funds cannot be used at all. However, the Rehab loan program could address this and then WAP funds could be used. If they do not qualify for WAP or RLP, an interviewee described that, "...it's kind of the end of the road for assistance…" Being unable to help in any way, some service providers expressed disappointment at this outcome. One interviewee explained that it was common for MH to have roof leaks but that they couldn't touch them for weatherization. Curious to what happened, I asked if those clients just stay on LIHEAP indefinitely. They responded, "Yeah, they'll be on energy assistance but at the same time their house is falling apart."

5.10.2 Partial Fix

Programs are rarely able to address all the needs for manufactured homes for a few reasons. One is that the design of the home limits the weatherization measures compared to other housing types. Specifically, there is no attic to blow insulation into like in a stick-built home. Also, regulations prevent some of the most effective measures to improve energy efficiency manufactured home like repairing roofs with weatherization funds. WAP funds used to be able to place rubber roofs on MH, but no longer can. Other repairs are limited because the HUD codes do not allow for structural changes that deviate from the original manufacturer's specifications. Despite being effective at improving the energy efficiency of a MH, windows are not often repaired. An interviewee gave the reason that the shifting of the home will damage them within five years. The programs only complete partial fixes also because, "...they just won't have enough money to cover all the needs…" and repairs need to be prioritized.

Table 5.3

S*ummary of the Consequences from the Interactions between Conditions*

	Consequences
Interactions between Social Conditions of Residents and Conditions of their MH Home	**Coping Strategies:** •for high maintenance needs •for cold home •for high energy costs
	Other Outcomes: •poverty trap •lifestyle damage •health and safety
Interactions between Groups of Residents and Policy Programs	**No Assistance:** •residents •older manufactured homes are not considered permanent housing
	Partial Assistance: •LIHEAP offers partial assistance •WAP covers some repairs
	Emergency Assistance: •MHFA Emergency Loan •LIHEAP Energy-Related Repair
Interactions between Manufactured Housing Stock and Policy and Regulations	**Walk-Aways:** •leaking roof •home not installed on frost piers or blocks not correct distance •water underneath home •missing paneling
	Partial Fix: •design limitations •regulations prevent most effective measures •too many needs for program funds

5.11. Conclusion

Even with the current programs that address energy issues for low-income households, either as a direct or indirect goal, a number of conditions and consequences contribute to a persisting and disproportionately higher average energy burden for MH residents. The social, policy, and MH conditions have distinct characteristics, constraints, and perceptions related to energy issues in MH. These conditions interact with each other with varying consequences and levels of analysis. For interactions with the social and policy conditions, there are three levels of interactions: 1)

micro, 2) meso, and 3) macro. The interaction between the MH resident (micro-social) and MH stock conditions had the consequences of coping strategies or other outcomes. Interactions between groups of residents (meso-social) with programs (meso-policy) had the consequences of no, partial, or emergency assistance. Policies and regulations (macro-policy) interacted with the MH structure with the consequences of walkaways or partial fixes. All of these aspects work within a system with other unidentified aspects that contribute to the pattern of a disproportionately high energy burden for MH residents.

Chapter 6 - Conclusions and Recommendations

This chapter ties together all of the research findings, highlights the main problems, presents recommendations to address these problems, and provides a conclusion in four sections. The first section (6.1) provides a summary of the findings from the literature review and interviews with manufactured housing service providers, organized by research objective. Immediately following each summary are the important conclusions from each research objective. The third section (6.3) highlights the main problems of reducing residential energy insecurity for manufactured housing residents in homes built before 2000, followed by recommendations. The fourth section (6.4) gives brief concluding remarks on the study.

6.1 Research Objectives: Summary of Findings and Conclusions

The aim of this study was to better understand how a disproportionately higher energy burden persists in pre-2000 manufactured homes, despite the current energy-related assistance programs.

Specifically, the research objectives to achieve this aim are listed and summarized:

1.) Identify how Residential Energy Insecurity is defined and measured in the literature.
2.) Investigate how service providers describe their experiences with manufactured housing residents facing an energy-related issue.
3.) Formulate recommendations to address the main problems.

6.1.1 Research Objective 1: Residential Energy Insecurity – Defined and Measured

Residential Energy Insecurity was defined using broad conceptual frameworks. One definition simply stated that REI occurred when a household couldn't maintain a comfortable indoor temperature or power the home. A recent multifaceted framework proposed three dimensions of REI: 1) Physical REI, related to the efficiency of a housing structure; 2) Economic REI, related to the relative cost of energy compared to income, also referred to as the Energy Burden; and 3) Coping REI, related to the behavioral response of a resident when dealing with energy issues. Fuel poverty, a type of Economic REI was the first conceptual lens of REI. This initial focus was on affording adequate warmth, but eventually expanded to include affording all energy services and to how residents coped with low incomes and cold homes. To measure REI, there were expenditure-based and consensual-based indicators. The expenditure-based indicator was when a household paid 10% or more of its income in energy expenditures. The consensual-based measures of REI are where the resident is asked a series of questions. One is if they feel they can warm their home adequately. Another question is if they have had a late payment on their energy bill in the past year. The last question is if there is the presence of drafts or mold in the home. Answering yes to any of those questions indicates REI. There was no standard definition of REI, but the concept is evolving to include more complex systems beyond energy expenditures and income. By incorporating Coping REI into the framework, people are placed more actively within this system as they respond to it. With all of the factors and their interactions, there is a need for more interdisciplinary and integrated frameworks to better understand REI, especially from the perspective of the resident, in order to mitigate it.

6.1.2 Research Objective 2: Service Provider Experiences with MH

In examining the interview data from the MH service providers, a system of elements and their interactions emerged that may contribute to a persistently higher energy burden for MH residents, even with the current programs designed to reduce energy-related issues (See Figure 5.1). The three main conditions were Social, Policy, and the MH Housing Structural conditions. Each had their own characteristics, constraints, and perceptions that operated at various levels from individuals to groups to society. When various elements of these conditions interacted, a number of consequences were described. There was a general trend of weatherizing fewer and fewer MH over the past five years. Also, service providers expressed that it was difficult for MH to

qualify for WAP or RLP, and if they couldn't there was no other help besides the partial assistance from LIHEAP.

6.1.3 Research Objective 3: Recommendations to Main Problems
Summarized in Table 6.3 and described in Section 6.3.

6.2 Overview of the Impacted Areas and Main Actors
Before describing the main problems and recommendations, I briefly separate out the impacted areas within this study of Residential Energy Insecurity to make the distinctions between them easier to see (Table 6.1). There are five impacted areas I examine within REI, because it is not just an energy issue; it also relates to housing, interventions, poverty/low-income, and research.

Table 6.1

Descriptions for the Main Impacted Areas of Residential Energy Insecurity

Impacted Area	**Description**
Energy	Administering or receiving energy services (heating, electricity, water heating, cooking, lighting, powering other appliances)
Housing	Describes the housing quality or is the seller/renter of housing
Intervention	Reduces Residential Energy Insecurity through an organization, program, or action
Poverty/Low-Income	Experiencing or addressing households in poverty/low-income
Research	Increasing the understanding of basic (understanding residential energy insecurity) and applied research (analyzing and evaluating policies and interventions to address residential energy insecurity)

Residential Energy Insecurity interacts within a complex system of multiple impacted areas and actors (Table 6.2).

Table 6.2

Main Actors and Impacted Areas of Residential Energy Insecurity

Impacted Areas **Main Actors**	**Energy**	**Housing**	**Poverty /Low-Income**	**Interventions**	**Research**
Residents in pre-2000 MH experiencing Residential Energy Insecurity	Problems with costs and/or efficiency	Systemic poor quality for mostly homeowners; not renters	Lower average income profile & other hardships	Uses extreme coping strategies; i.e. heat or eat, keep temperature at unhealthy level	
CAP Agencies **•LIHEAP**	Addresses costs		At or below 50% of the state median income	Partial discount on heating bill or emergency heating assistance	
CAP Agencies **•WAP**	Addresses efficiency	[May improve quality]	At or below 200% of the poverty line	Some repairs to home to improve efficiency	
MHFA **•RLP**	[May address efficiency]	Improves quality	At or below 30% of the MSP area median income	Loan for home improvements	
Utility Companies	Delivers services			[Resident contacts when past due on bills]	
Landlords/ Sellers		Provides housing			
Universities/ Policy Researchers				Analyze and design better interventions	Understand Residential Energy Insecurity better

Note. Descriptions indicate the predominant impacted area of a particular actor. Descriptions enclosed in [ ] indicate a secondary impacted area of a particular actor.

The main problems I identified from this study that may contribute to the disproportionately higher energy burden that persists for MH residents, despite the current programs, are summarized in Table 6.3.

Table 6.3

Summary of Main Problems Identified from this Study and Recommendations

Main Problems	Evidentiary Basis [Cross Reference]	Relevant Program(s) or Organization(s)	Recommendations
1. Programs cannot meet the current demand and level of need for services.	Interviews [Section 5.5.2, para. 2 and more interview data not shown]	WAP	1.1. Increase federal funding to meet the current demand for weatherizations.
	Alluded to in interviews [Section 5.9.2] and secondary research [Text after Recomm.1.2]	LIHEAP	1.2. Change benefit levels from Cost-Based Targeting to Percentage-of-Income Targeting to better meet the level of need.
2. MH residents are often disqualified from repair programs that address the underlying energy efficiency issues.	Interviews [Section 5.5.2, para. 3]	RLP	2.1. Improve initial eligibility guidelines for residents of pre-2000 MHs by raising the income ceiling, allowing property tax arrears, eliminating the homeowners' insurance requirement, and altering the title requirement to a minimum of one full-time resident listed to qualify for repair programs.
	Interviews [Section 5.5.2, para. 4]	WAP	2.2. Allow structural repairs that are integral to improving MH energy efficiency, like holes in the protective skirting panels or the common leaking roof, to be repaired with WAP funds in pre-2000 MHs.
	Interviews [Section 5.5.2, para. 4]	HUD	2.3. Allow less expensive and more energy efficient materials to alter pre-2000 MHs from original specifications in the HUD code.
	Researcher proposed based on synthesis between interviews describing MH characteristics [Section 5.4.1 para. 2] and walk-away conditions [Section 5.10.1, and more data not shown]	WAP	2.4. For MHs that were incorrectly sited but in fair structural condition, allow WAP funds to do at least minor weatherizations on pre-2000 MHs, with a priority on pre-1976 MHs.
	Researcher proposed based on synthesis between interviews describing MH characteristics [Section 5.4.1 para. 2] and walk-away conditions, [Section 5.10.1, and more data not shown]	RLP	2.5. For MHs that were incorrectly sited and in poor structural condition, allow RLP funds to demolish these homes and replace with an affordable and more energy efficient home with a priority on pre-2000 MHs, with a priority on pre-1976 MHs.
	Researcher proposed based on synthesis between interviews describing stigma of vulnerable population [Section 5.3.3 para. 5-6], the opt-in structure [Section 5.9.1], and secondary research [Text after Recomm. 2.6]	WAP	2.6. Incentivize weatherization audits to overcome barriers to opting-in on the LIHEAP application and then use it as a critical opportunity to provide education.

Table 6.3 Continued

Main Problems	Evidentiary Basis	Relevant Program(s) or Organization(s)	Recommendations
3. Current prioritization criteria bias larger, site-built homes.	Interviews [Section 5.5.3 and more data not shown] and the "high energy use criteria" was confirmed as an absolute value so larger homes will use more energy, on average [Interview data not shown; 2009 RECS Survey Data, 2013 not shown]	WAP	3.1. Change the criteria for "High Energy Use" prioritization from an absolute value to a relative one based on the amount used or cost per square foot; otherwise a larger home will almost always have higher energy use or costs, even though MHs are typically less efficient.
	Interviewees often used investment terms related to real estate values and not health and safety improvements [Sections 5.5.3 and 5.8.6 and more data not shown]	WAP	3.2. Expand Cost-to-Savings ratio calculations to include health and safety improvements.
4. Interventions are primarily reactive to a prolonged struggle or a life-threatening emergency.	Alluded to in interviews [Text after Problem 4, para. 4 underlined text]	Utility Companies, CAP Agencies, & Partner Organizations	4.1. Introduce data analysis practices at utility companies to monitor a household's energy use compared to the average energy use by housing type, size, and age to proactively identify high-risk households for earlier interventions with partner organizations.
	Interviews shared where many memorable interactions with MH residents were desperate conditions [Text after Problem 4, para. 4, more data not shown]	CAP Agencies & Partner Organizations	4.2. Increase proactive outreach efforts for high-risk households in pre-2000 MH.
5. Without the proper materials or knowledge of the MH-specific building science, MH residents may worsen energy issues of their home by deferring maintenance or attempting repairs.	Interviews [Sections 5.3.1 and 5.3.2] and secondary research [Text after Recomm. 2.6, para. 4]	CAP Agencies	5.1. Design and administer a 'Maintaining Your Mobile/Manufactured Home' workshop for MH residents that teaches the MH building science, specialized maintenance needs, and common repairs of MH. To communicate effectively with people facing chronic poverty, the CAP agency facilitators need to be trained in and use a relational approach with class-sensitive language [i.e. non-patronizing, non-shaming, non-condescending].

Table 6.3 Continued

Main Problems	Evidentiary Basis [Cross Reference]	Relevant Program(s) or Organization(s)	Recommendations
6. Without the proper knowledge of the MH-specific building science, hired handymen and licensed contractors may severely damage MH during repairs.	Interviews [Section 5.3.2]	CAP Agencies	6.1. Distribute a list of trusted contractors and handymen that know how to properly work on the specialized needs of MH: plumbing, electricity, and heating.
7. MH residents do not know what the energy costs are before buying or renting a MH.	Interviews [Section 5.4.3]	Utility Companies & Landlords/ Sellers	7.1. Before any residential dwelling is sold or rented in Minnesota, the last 12 months of all energy costs (heating and electricity), should be disclosed along with other energy efficiency information in a "Truth in Energy Costs" document.
8. A lack of sufficient understanding on the complex realities of Residential Energy Insecurity.	Literature review revealed limited amount of research on understanding REI in the U.S. & a lack of studies to quantify the social costs of health and safety impacts [Chapter 3]	Universities/ Policy Researchers	8.1. More studies on the lived experience and social costs of Residential Energy Insecurity to better understand and more accurately measure the true need and to improve interventions.

6.3. Main Problems and Recommendations for Programs

In examining the interview data, many problems emerged that were related to the persistence of a higher energy burden in MH or other energy-related issues, despite the current energy-related assistance programs. I selected eight of the broadest problems and proposed recommendations to address them in order to reduce Residential Energy Insecurity for MH residents.

Problem 1: *Programs cannot meet the current demand and level of need for services.*

Recommendation 1.1: *Increase federal funding to meet the current demand for weatherizations.*

WAP

Overwhelmingly, WAP service providers expressed the need for increased funding to meet the current demand. A service provider in Greater Minnesota commented, "The funding isn't there to do enough of them [weatherizations of MH]. We could be doing them year round and just scratch it." This sentiment was shared with a metro-area service provider saying, "There's always more demand than there is the ability to meet that demand in this program." One manifestation of this limitation is the waiting list for WAP. A metro-area service provider said a person could be on the waiting list for up to several months. To meet the current demand for this program, which still underestimates the societal need, service providers requested more funding.

Recommendation 1.2: *Change benefit levels from Cost-Based Targeting to Percentage-of - Income Targeting to better meet the level of need.*

LIHEAP

Although MH residents were served in the greatest numbers by LIHEAP and stay on this program indefinitely if disqualified from WAP and RLP, I was unable to speak with any non-emergency LIHEAP service providers. Thus, no one explicitly called for changes to the LIHEAP benefit targeting structure. However, two WAP service providers, each with over 20 years experience, mentioned seeing extreme heating season bills of up to $5,000 in MH. When looking into how LIHEAP benefits are targeted, these extreme costs are not sufficiently addressed by the current LIHEAP benefit targeting structure.

The minimum LIHEAP benefit for the annual heating season costs was $100 and the maximum benefit was $1,400 in FY 2014 ("LIHEAP: Fighting Poverty in Minnesota," n.d.). From "Targeting LIHEAP Benefits," Minnesota was described as using a cost-based targeting strategy to administer awards in 2010, where only a portion of the annual heating season bill was covered based on income level and heating source ("Targeting LIHEAP Benefits," 2010). In this report, the benefit ranged from 10.7% to 69% of annual heating costs ("Targeting LIHEAP Benefits," 2010). To illustrate this gap in services, the highest LIHEAP eligible income households at $37,100 for a family of four, a $5,000 heating season bill represents a 13.5% energy burden. Even with the maximum grant of $1,400 - at best - the energy burden would still be at 9.7% compared to the 4.5% average energy burden for all housing types and all construction years ("2009 RECS Microdata," 2013). An increase of benefit levels and funding to reduce a low-income household's energy burden to the average energy burden would better serve these families.

These problems are not just a matter of funding, but are much more complex with programmatic eligibility requirements.

Problem 2: *MH residents are often disqualified from repair programs that address the underlying energy efficiency issues.*

Service providers commonly expressed that MH residents, especially in the pre-1976 homes but up to MH built through the 1990s, were often disqualified from the current federal (WAP) and state (RLP) programs that provided energy efficiency repairs. The three main ways MH residents were disqualified from these programs were: 1) the residents didn't meet the initial eligibility guidelines, 2) the home needed a structural repair, or 3) the home was not set on a proper foundation. When MH residents cannot qualify for these two programs, they would not likely receive assistance to repair the underlying energy efficiency issues. A WAP service provider in Greater Minnesota expressed their disappointment when an MH resident in need of assistance was disqualified from weatherization measures:

> Well, a lot of [MH residents] kind of see this [WAP] as kind of their last, about the only opportunity they get, cause they don't qualify for a loan [RLP] or don't have the money to do it themselves and if it's not through us, it's not going to be through anyone typically. I don't know if final would be the right word but it's kind of the end of the road for assistance. So it's pretty disappointing. For both of us, frankly.

To address this gap in services, the initial eligibility requirements and allowable structural repairs should be relaxed for residents living in MHs constructed before 2000.

Recommendation 2.1: *Improve initial eligibility guidelines for residents of pre-2000 MH by raising the income ceiling, allowing property tax arrears, eliminating the homeowners' insurance requirement, and altering the title requirement to a minimum of one full-time resident listed to qualify for repair programs.*

RLP

The initial eligibility requirements for RLP should be improved to better serve MH residents in homes constructed before 2000. The first requirement to change is the income ceiling. Although

this is the only loan program, it has lowest income eligibility guideline. To qualify, a household must be at or below 30% of the Minneapolis/St. Paul area median income, which is $26,000 for a family of four ("Home Improvement Program Income Limits," n.d.). However, as a loan program, a household with no income would not be eligible. A service provider commented on how restrictive the income ceilings were saying, "Sometimes even someone with just social security can't qualify because their income is too high for it." The second requirement to change is the homeowners' insurance requirement for MH. A service provider described it as, "somewhat worthless" for MH because if a person files a claim, they are either not paid or if they are paid then they are immediately dropped. The third requirement to change is being current on property taxes. If residents are drowning in disproportionately high energy costs, they will not be able to pay other bills that are removed from basic needs like taxes. The fourth requirement to change is that everyone listed in the title was a current resident. However, MH with multiple family members on a title may not all live there at a given time and residents may not be able to afford the fees to change the title. Therefore, the most important requirement for the title would be that at least one person listed on the title is a full-time resident. In combination, improving the RLP eligibility requirements would better serve MH residents in pre-2000 homes.

In addition to the resident eligibility requirements, MH structural eligibility requirements need to be considered for program disqualification.

Recommendation 2.2: *Allow structural repairs that are integral to improving MH energy efficiency, like holes in the protective skirting panels or the common leaking roof, to be repaired with WAP funds in pre-2000 MHs.*

WAP

To preserve this essential affordable housing source given the history of poor construction codes for pre-2000 MH, WAP funds should be used for structural repairs that are integral to improving the energy efficiency of the home. The two main repairs that service providers would like to perform on MHs with WAP funds were: 1) repairing skirting, and 2) installing rubber roofs. The skirting, which is unique to manufactured homes, protects the underside of the home that houses the ductwork, plumbing, and insulation. When the skirting is damaged or missing, more energy is needed to heat the home, pipes are at risk of freezing, and animals have access to damage the floor insulation. An experienced WAP service provider explains:

> The software we use will give me all kinds of money to fix the belly pan but then we cannot spend money to fix skirting - we can't help them with the skirting portion of it. So it's one thing to fix the belly pan but if they don't have decent skirting, you're fighting a losing battle because when it's 20 below, a cat's going to find the warmest place it can and of course it's going to crawl up into the belly next to the ducting where it's warm but the DOE does not allow us to do anything with skirting.

Another structural repair service providers wished they could perform was installing rubber roofs. One WAP service provider expressed:

> One of the issues we run into a lot is, for instance, if the roof is leaking, we can't touch them. And we do run into plenty that are, you know how specific where you get there, and you know they need the help, they know they need that and I can't touch it because it's leaking and pouring through there and it's rather disappointing we're not allowed to do that.

In the past, installing a rubber roof was an acceptable repair using WAP funds but that has changed. A few service providers who had previously installed rubber roofs on MHs described them as, "the one thing we've seen really work on a mobile home." It wasn't clear why installing rubber roofs were stopped for weatherizations. A reason some service providers gave for this change was that the non-rubber roofs were designed to lose heat in order to melt snow, because

MHs were unable to support the weight or snow buildup. However, I could not find any external evidence that the homes were designed this way; rather that is an artifact of the poor construction codes and substandard materials. Furthermore, the RLP finances rubber roofs so it seems that the actual reason is not a matter of safety, but perhaps one of finances. Given these considerations, WAP funds should be allowed for certain repairs on pre-2000 MH that are integral to energy efficiency like repairing skirting and installing rubber roofs.

Recommendation 2.3: *Allow less expensive and more energy efficient materials to alter pre-2000 MHs from original specifications in the HUD code.*

HUD
Service providers would like flexibility with the HUD code limitations on MH alterations. Currently, the HUD code restricts alterations to maintain the original manufacturer's specifications, namely on the type of replacement materials and the weight, in order to keep the home "roadworthy." However, service providers expressed that most homes don't ever move from the original site. Additionally, the Manufactured Housing Institute (MHI) "estimates that more than 90% of today's manufactured homes never move from their original site" ("Frequently Asked Questions," n.d.). Furthermore, the MHI advises against relocating homes stating, "While, theoretically, a manufactured home can be moved after its initial placement, it is neither common nor advisable to do so" ("Frequently Asked Questions," n.d.). So this concern to maintain the MH "roadworthiness" does not reflect how the majority of these homes are used or are even recommended to be used. Also, if homes are altered beyond the manufacturer's specifications, the Department of Transportation tag is supposed to be removed where the enforcement of those regulations is a separate issue beyond the scope of this study. Therefore, service providers would like to use more energy efficient and less expensive material replacements, particularly doors and windows, for pre-2000 MH that would currently violate the HUD code.

Recommendation 2.4: *For MHs that were incorrectly sited but in fair structural condition, allow WAP funds to do at least minor weatherizations on pre-2000 MHs, with a priority on pre-1976 MHs.*

WAP
Service providers shared a systemic problem of older MHs in Minnesota where they were not properly sited at installation, meaning the foundation they were placed on was not stable. This often leads to the slow and uneven sinking of MHs into the ground, especially with the annual freeze-thaw cycles in Minnesota. As homes sink, the walls may bend and buckle which can worsen the seals around windows and doors. Due to this, WAP automatically disqualifies improperly sited MH in fear that any investment would be wasted. As one WAP service provider in Greater Minnesota describes:

> There is no real inspections [of proper MH installation] out there as far as rural homes go. It's very common. As a matter of fact, the weatherization program, the blocking has to be a certain distance apart, and if it doesn't meet the criteria, we have to walk away. We can't help them with any of their problems then.

The resulting damage from these improper installations was from a past systemic failure of enforcing inspection regulations, and beyond the personal control of MH residents, so there should be a better approach through WAP than walking away from these homes. At a minimum, these homes should have partial weatherization repairs advised by experienced WAP workers. This will provide low cost, high impact options to improve the energy efficiency, health, and safety of residents. As this is only a temporary fix to preserve this important affordable housing stock, these efforts should also be in combination with resident education on preserving their home and planning for either home replacement or creating a long-term moving plan.

Recommendation 2.5: *For MHs that were incorrectly sited and in poor structural condition, allow RLP funds to demolish these homes and replace with an affordable and more energy efficient home with a priority on pre-2000 MHs, with a priority on pre-1976 MHs.*

RLP
Many pre-1976 MH will need to be demolished and replaced, but there is not a clear path to guide this transition that would improve the quality of the affordable housing stock. One way could be to use the existing RLP program, with the altered eligibility guidelines recommended in 2.1. This would use the $27,000 in funding to demolish substandard homes and provide a down payment on a newer and more energy efficient MH. To ensure the resident has the best chance at sustainable self-sufficiency, the loan should be offered in combination with a financial literacy course that is sensitive to people in chronic poverty, who are often averse to commercial debt (Anderson et al., 2012; Brunner et al., 2012).

Recommendation 2.6: *Incentivize weatherization audits to overcome barriers to opting-in on the LIHEAP application and then use it as a critical opportunity to provide education.*

WAP
No service provider expressed this as a problem, but I see many barriers to opting-in for weatherizations (WAP) on the joint energy assistance (LIHEAP) application. These create missed opportunities for systemic anti-poverty interventions. Effectively, residents who do not opt-in for a home weatherization are disqualifying themselves from assistance that addresses some of the underlying issues. When a resident seeks energy assistance, the first step is to fill out the joint application for LIHEAP and WAP through the local CAP agency. Although a resident who is income-eligible for LIHEAP generally meets the income eligibility requirements for WAP, the applicant needs to opt-in for their home to even be considered for a weatherization. There are many barriers that would prevent high-risk households (i.e. worst housing quality, chronic poverty, lower levels of education, experiencing multiple hardships) from opting-in to receive assistance for the underlying source of the energy inefficiency of their home.

There is a documented stigma cost to receiving welfare where qualified people will counter-intuitively avoid welfare despite the increase to their utility that it offers (Moffitt, 1983). I see this self-disqualification to weatherization as one manifestation of these welfare stigma costs. Informed by my background growing up in what I previously described as a high-risk household, some of the barriers that are created by this opt-in structure are:

- Residents may not know what the term ‘weatherization’ means or what it entails, and are too intimidated to ask
- Residents may have invisible mental health impairments that make navigating the bureaucratic system confusing and stressful, and will avoid any unnecessary involvement
- Residents may work non-traditional hours where they would need to sleep during business hours or may not be able to predict their upcoming work schedule
- Residents may be unable to make the time-commitment because of instability in their lives
- Residents may choose to avoid the shame/stigma of a middle/professional class person coming to their home and making insensitive judgments or comments
- There may be a mistrust of authority figures based on past negative experiences
- Residents may choose to protect themselves against the societal stigma of living in a MH

To combat the opt-in barriers mentioned in the list above, a different structure is needed that incentivizes weatherization audits. The ideology behind this approach is that even if a household would not qualify for weatherizations under the current eligibility requirements, the weatherization audit could be used as a bridge to educate residents. Weatherization workers would need to be trained on class-sensitive approaches to not inadvertently alienate this population (Jones & Vagle, 2013). For the workshop portion, workers would teach the MH-specific building science, maintenance, and how to do common repairs on their MH (see Recommendation 5.1 for more on

content and delivery). Not only would this educate residents on the specialized needs of MHs, but it could serve as a bridge to building relationships and trust with residents. This could open future opportunities for them to engage with other anti-poverty programs, and help build the capacity and resilience of these residents ultimately towards self-sufficiency. The strongest incentive to help would be cash, but more research is need to be determined how much will effectively overcome the barriers of the welfare stigma. (See Recommendation 6.1 for other materials that could also be distributed during this audit/workshop).

Problem 3: *Current prioritization criteria bias larger, site-built homes.*

WAP – High-Energy Users
Income-eligible residents who opted-in on the LIHEAP applications were prioritized for weatherizations based on having a resident who was: 1) a senior; 2) a person with a disability; 3) a minor child; or 4) a high-energy user. The more of these criteria a household had, the higher the priority would be. Clearly, there are no issues with the first three criteria, but the high-energy user prioritization seemed problematic when comparing MH to SBH, all other things being equal. There were two biases that I saw from the interviews that may systematically skew weatherization benefits away from eligible MH residents.

The high-energy user criterion is based on the absolute value of the annual energy costs; so larger homes will use more energy on average and be prioritized. However, because MHs are typically smaller than site built homes, the comparative lower energy cost is masked. Compared to the average SBH resident, the average MH resident consumed 1.47 times the Btus per square foot but spent disproportionately more—1.74 times the dollars per square foot (Figures 1.2 and 1.3). However, compared to the average SBH resident, the average MH resident consumed and spent less on energy per household—0.6 times the Btus and 0.76 times the dollars compared to SBH residents (Figures H.1 and I.1). Additionally, low-income households tend to use less than their preference, so these costs would underestimate the true need (Anderson et al., 2012). So the lower average income profile of MH residents compared to SBH residents would suggest that their average energy use may underestimate the true needs to meet their health and comfort needs.

Not only are high-energy users prioritized for weatherization, but repairs are also determined by a cost-to-savings calculation from a software program that would bias site-built homes.

WAP - Cost-to-Savings Calculation
After homes receive an energy audit (see Appendix F for the process of receiving assistance), the results of the blower door test are plugged into a software program to determine repairs that will save the most money. Mobile homes have a different program compared to site built homes, as one service provider explained:

> MHEA - Mobile Home Energy Assistance - and that's a software program we use to determine the feasibility and what the improvements will be and the payback energy saving will be we use that kind of software for working on mobile homes.

Given the restrictions on maintaining the original manufacturer's specifications of MH, the materials are generally less efficient and more expensive than an equivalent item in a site built home. Therefore, weatherizations would bias site built homes with a service provider expressing: "It is a struggle to find something comparable to a site built [home] that is going to have the same energy savings in a mobile [home]."

I didn't have access to what the actual calculations are, but it almost seemed that the property values were also considered part of the cost-to-savings calculations. More information would be needed, but this would further bias against weatherizing as a service provider expresses: "A mobile home is worth what it's worth and it doesn't matter how many thousands of dollars you throw into it, it's still not worth more than a mobile home is worth." This bias was pervasive with

the service providers, with another one comparing MH with SBH: "The depreciation on a mobile home, whether it's single wide or double wide, they automatically depreciate. Whereas site-built [homes], overall, appreciates in value."

Recommendation 3.1: *Change the criteria for "High Energy Use" prioritization from an absolute value to a relative one based on the amount used or cost per square foot; otherwise a larger home will almost always have higher energy use or costs, even though MH are typically less efficient.*

WAP
To better prioritize housing quality equitably, the energy consumption and costs should be normalized to the size of the house using the amounts per square feet. Additionally, residents should be asked what temperature they currently keep their home at compared to what they would prefer to keep their home at to better assess what the energy needs gap truly is.

Recommendation 3.2: *Expand Cost-to-Savings ratio calculations to include health and safety improvements.*

WAP
The information on how these values are calculated was not readily available but is still worth noting. If the cost-to-savings calculations for energy improvements also factors in the property value increases, then there is a conflict between the real estate investment and improving the health and safety conditions of vulnerable populations. If this is current bias, then the health and safety benefits need to be monetized and considered as an investment in the general public welfare.

Problem 4: *Interventions are primarily reactive to a prolonged struggle or a life-threatening emergency.*

Surprisingly, service providers at CAP agencies did not know how people were initially connected to the energy-related assistance programs. Some service providers thought many MH residents hear about these programs (WAP & LIHEAP) through neighbors or relatives. Utility companies used a passive strategy where information about energy-related assistance programs was mailed with a resident's utility bill before the heating season began. This approach may work well for people who know how to advocate for themselves and navigate bureaucracies (i.e. college-educated people or people who are represented by advocacy organizations, like recent immigrants or refugees) but may not work well for residents who are have lower levels of education because the bureaucratic process can be complex and frustrating and these people generally experience other multiple hardships. However, there was no mention of the utility companies following up with households after the information was sent unless there were late or missing payments.

Household energy usage and costs depend on a number of factors, including the resident's behavior (i.e. indoor temperature, type and amount of lighting), the energy efficiency of appliances, and the housing quality. Opponents of proactive energy-related assistance measures may attribute the disproportionately high energy costs solely to a resident's behavioral choices - like choosing to keep the indoor temperature high in the winter or keeping lights on when not in a room - discounting the dramatic effects that poor housing quality can have on energy usage and costs. However, research shows that, if anything, people cope in dramatic ways like keeping the indoor temperature uncomfortably low in the winter or using a TV set as the only source of lighting or only lighting one room in order to save money on energy costs (Brunner et al., 2012; Harrison & Popke, 2011). This would mean the disproportionately high energy usage and costs as more of a function of the poor energy efficiency from the poor housing quality.

The struggles that people face with energy-related issues are not as publicly visible or understood as compared to the struggles that people face with other necessities, like a lack of food. This, in

combination with pre-2000 MH residents being particularly high-risk for having energy-related issues (i.e. systemic poor housing quality, lower average income profile, lower average levels of educational attainment), the current passive outreach may contribute to a resident experiencing prolonged struggles or an emergency situation. As research has shown, the stress from these hardships can have a negative impact on a person's mental and physical health (Anderson et al., 2012; Gilbertson et al., 2012; Hernández & Bird, 2010). Also, the social transaction costs associated with the stigma of receiving assistance may prevent a resident from reaching out sooner, if at all (Moffitt, 1983). It is difficult to directly measure the societal costs of this hidden suffering (i.e. the health costs or lost productivity), but the crisis orientation of these interventions for necessities likely contributes to intergenerational poverty traps. To illustrate how the current passive approach to connecting people to energy-related assistance impacts people, a utility service provider described a memorable interaction with a MH resident:

> Our customer service people [at the utility company] got a phone call from a long time resident of a particular mobile home area and communicated to us - I believe it was in mid-November - she just simply said, "I can't do this anymore. Come out and turn my service off. I can't afford it." And was just kind of asking us to shut the service off and our customer service person said, "Well, you're not moving?" "No, no, no; I'm not moving. I just can't afford this. I just can't do this anymore." And so internally that customer service person eventually got the information to me and I contacted the customer and just said, "You know, I understand you want to have us come out there and shut the service off." And at the time, you know surprisingly, the bill was I mean she was a little bit past due, she wasn't a lot past due, it wasn't that high, but she just was going into the heating season and said, "You know what, I can't do this." And as I continued to talk to her, she communicated to me that she had fourth stage cancer and she didn't know if she was going to be surviving the winter but she didn't want to leave the financial burden of a high energy bill or a high bill with her children and I said, "Number one, we're not coming out there to turn your service off. And number two, we're gonna find a way that we're going to be able to get you some help and keep your service going and making sure that she's living in a comfortable environment." Well, it went on and on and I ended up going out to visit her and I got out there and clearly she was very, very, very ill. But it was also something that I said, "Have you talked to your kids and so on and so forth?" And it was one of those senior people that doesn't want to be a burden to anybody and their children have no idea because she said she did not communicate with them anything that was going on with her financial challenges. They knew about her illness, but they just...the financial stuff nobody understood and so it was just looking at that particular situation and a customer that was in a...you know...not too nice of an environment and I knew that the mobile home was not that energy efficient just by looking at the bills and what she was anticipating for the heating season. But at the end of the day, we were able to secure the resources that she needed to get through that heating season and just kind of opened up a communication with her that if in the future at any point, not all is lost when you get past due on your bill, you just need to be able to make sure you pick up the phone and contact us so we can work within the network to get her some help. It wasn't only the help we got her financially for her utility bill, we were also able to work with one of the local agencies to get some more efficient appliances in her mobile home and get some insulation in her mobile home. So unfortunately I did learn that approximately 6 months later she did pass away but again during that time we wanted to make sure it wasn't the utility bill [cleared throat] that she was worrying about.

To prevent this situation from happening to anyone else and to reduce the unnecessary suffering people experience through prolonged struggles or waiting until there is a life-threatening

emergency to receive assistance, especially for high-risk households, more proactive approaches by the utility companies, partner organizations, and CAP agencies are needed.

Recommendation 4.1: *Introduce data analysis practices at utility companies to monitor a household's energy use compared to the average energy use by housing type, size, and age to proactively identify high-risk households for earlier interventions with partner organizations.*

Utility Companies
Utility companies already collect and store the energy usage and cost data associated with an address. This information, supplemented with three more variables on the home, could become a powerful tool to quickly identify and connect households to assistance before a crisis. The data that would needed for each address would be the housing type, the square foot of the home, and the age the home was constructed. To compare like-to-like, housing types should be recorded by the following categories: single-family detached, single-family attached, mobile/manufactured home, apartments in buildings with 2-4 units, and apartments in buildings with 5 or more units. Next, the total square feet of the home should be recorded so the relative energy costs and use can be more accurately calculated. Lastly, the year the home was constructed should also be recorded because older homes are generally less energy efficient.

To facilitate earlier interventions that would reduce energy-related costs and suffering, utility companies could actively identify households that are high-risk for Residential Energy Insecurity by using a combination of straightforward, but informative indicators. One indicator of risk could be how a household's annual energy usage and costs compare to the average energy usage and costs of that particular housing type. Separating by housing type is necessary because there are structural properties that are distinct by housing type (i.e. sharing a wall in single-family attached housing resulting in lower energy usage and costs) and the larger single family detached homes will generally use more energy in absolute terms masking the need for assistance of smaller homes with different structural properties. The higher the amounts are from the average for the appropriate housing type, the higher the risk. The second indicator would be the annual amount of energy used and spent per square foot of a household compared to the average for the similar housing type. Again, the higher the home is compared to the average, the higher the risk. The last indicator would be the age of the home, where the construction year of the home could be recorded. Generally, the older a home is, the less energy efficient and higher risk it would be for residential energy insecurity.

CAP Agencies & Partner Organizations
The utility companies should then compile a list of households that are high-risk for Residential Energy Insecurity and send it to the local CAP agency and partner organizations. The utility service provider said they had a network of dozens organizations they work with. Then, these organizations could follow up with residents to assess their income level to calculate their energy burden. A survey should also be administered that records the consensual indicators like asking if they feel able to afford to comfortably heat or cool their home or what temperature they would like to keep their home at (Thomson & Snell, 2013; Anderson et al., 2012), which would measure the extent of the true need.

In addition to the proactive top-down approach here where the utility company identifies potential high-risk households, a complementary proactive bottom-up approach is needed working with MH residents before any problem has been specifically identified so MH residents will be better equipped to help themselves and achieve lasting self-sufficiency.

Recommendation 4.2: *Increase proactive outreach to high-risk households in pre-2000 MH.*

CAP Agencies & Partner Organizations
Increasing proactive outreach activities to high-risk households in pre-2000 MH strongly aligns with the mission and purpose of the Minnesota Community Action Partnership:

> To remove obstacles and solve problems that blocks the achievement of self-sufficiency. In order to reduce poverty in its community, a Community Action Agency works to better focus available local, state, private and federal resources to assist low-income individuals and families to acquire useful skills and knowledge, gain access to new opportunities and achieve economic self-sufficiency ("About Us," n.d.).

Energy-related issues can be obstacles to achieving self-sufficiency with crippling health and financial costs for MH residents in pre-2000 homes. To interrupt this likely poverty trap, CAP agencies and partner organizations can proactively go into high-risk communities, like MH parks with pre-2000 homes, and regularly provide outreach activities. In the following proactive outreach approaches, there are three main goals of systemic efforts to disrupt this high-risk poverty trap while increasing the lasting self-sufficiency of pre-2000 MH residents: 1) empowerment within the community; 2) education on MH maintenance; and 3) awareness of existing energy-related programs.

Empowerment
CAP agencies and partner organizations could design and facilitate a "Neighborhood Energy Watch" program modeled after the "Neighborhood Crime Watch" program. Workshops would be held for training residents in high-risk communities, like MH parks with pre-2000 homes, on identifying energy-related issues in their home and their communities. Some energy-related issues for people to identify in MH would be holes in the skirting, cracked or broken windows, sagging ceiling, gaps in window or door seals, or older appliances. Once identified, the neighborhood captain could engage with that resident on energy efficiency information, how to repair the problem, and how to get help. Or if people are uncomfortable addressing their neighbors directly, there could be a website or phone number set up to anonymously report the address of a home in need of help for the local CAP agency/partner organization to follow up with. This would help identify high-risk homes earlier and hopefully prevent situations getting to the severe conditions described in Problem 4.

Education
Another way to reduce this barrier to self-sufficiency would be to provide regular education like a 'Maintaining Your Mobile/Manufactured Home' workshop in high-risk communities. This workshop would teach the MH building science, specialized maintenance needs, and common repairs of MH (see Recommendation 5.1). Also, information on how to hire a trustworthy contractor or repairman could be distributed (see Recommendation 6.1). For single-sited rural pre-2000 MH, that resident could be contacted to have a weatherization audit and workshop with an incentive (see Recommendation 2.6 and Recommendation 5.1) for workers to go out to the home. Also, it would be good to have alternative formats like instructional videos available online or on DVD for people who cannot make the workshop due to work schedules or other barriers.

Awareness
Through the 'Neighborhood Energy Watch' or the 'Maintaining Your Mobile/Manufactured Home' workshops, information on the current energy-related assistance programs should be shared. For rural single-sited pre-2000 MH, this information should be mailed with the contractor information described in Recommendation 6.1, and information on setting up the audit/workshop or when the local CAP agency or partner organization will give a workshop in their office.

Problem 5: *Without the knowledge of the MH-specific building science or proper materials, MH residents may worsen energy issues of their home by deferring maintenance or attempting repairs.*

Deferred Maintenance
Service providers often described deferred maintenance as a major factor that influenced energy-related issues in MH. Especially for older MH, the poor construction materials rapidly degraded without proper maintenance. The main reasons described for residents deferring maintenance

were because: 1). they couldn't afford the costs, or 2.) didn't know the specialized maintenance needs. To illustrate the severity of this issue, one service provider described a single mother's reaction to a common furnace maintenance cost: "I put [furnace] filters in and said, 'They're $0.65 cents a piece. It takes 2 every 30 days. A whole case will cost you $8." She said, 'That's a jar of peanut butter; I can't afford that.'" The resident described in this instance was experiencing REI where she was choosing food over her energy-related home maintenance costs.

Repairs
Service providers also explained that many residents unintentionally damaged their home when attempting repairs. This was due to a lack of knowledge on the specialized needs of their MH - what one service provider referred to as the "MH Building Science." In particular, any improper repairs compromising the MH underbelly would severely damage the entire system of the house from the heating and ventilation to the plumbing. A WAP service provider explains this issue:

> A lot of it is client education, I think. They don't know any better. A pipe froze so they're just going to rip some of that belly out and heat tape it or they're going to unhook that duct. They just don't know. They are going to do it the cheapest way and it's going to make the problem worse.

To preserve and maintain a healthy home environment and prevent damage from attempted repairs, MH residents need more information on how to properly maintain and repair they home.

Recommendation 5.1: *Design and administer a 'Maintaining Your Mobile/Manufactured Home' workshop for MH residents that teach the MH building science, specialized maintenance needs, and common repairs of MH. To communicate effectively with people facing chronic poverty, the CAP agency facilitators need to be trained in and use a relational approach with class-sensitive language.*

Workshop Content: MH Building Science, Maintenance, and Repair Information
Experienced WAP service providers should develop a workshop for MH residents on the proper maintenance of manufactured homes. From issues described in the interviews, some suggested topics to cover would be: a.) an overview of MH "Building Science" (i.e. heating & ventilation, plumbing, MH-specific appliances); b.) affordable and straightforward ways to perform routine maintenance and common repairs; c.) inexpensive coping strategies to reduce energy costs (i.e. covering windows in plastic during the winter, adjusting thermostat, wearing more clothing layers); and d.) provide a list of trusted MH repair contractors that know how to properly do repairs. (See Recommendation 6.1)

Workshop Delivery: Designed for People Experiencing Chronic Poverty
In addition to the technical aspects, these workshops should be sensitive to the accessibility and communication needs of MH residents experiencing chronic poverty. To make the workshop accessible, the time and location offerings need to be flexible. One suggestion would be to perform the workshop during a home energy audit. Another suggestion would be to host workshops in MH communities across Minnesota (see Recommendation 4.2). If the resident were not available, another way to make the information accessible would be to create instructional videos and upload them to a free public domain, like YouTube, where residents could be directed to watch them anytime from a CAP agency, public library, or home. Another overlooked aspect of working with people experiencing chronic poverty is the communication patterns between socioeconomic classes. Workshop facilitators will need to translate technical jargon and concepts into straightforward terms and concrete examples that a person with any education level could understand. Also, facilitators should use a relational approach when leading these workshops and communicate using class-sensitive language.

Problem 6: *Hired handymen and licensed contractors may severely damage MH during repairs.*

Not only have MH residents unintentionally damaged their home attempting a repair, but poor workmanship by professional contractors have as well. Given the specialized needs of MH and being a lower income population that is at a higher risk for non-payment, it can be difficult to find qualified contractors to perform repairs. A service provider with over 30 years of experience shared a common example of damage caused by professional plumbers in MH:

> A lot of times they [MH residents] have a hard time even getting a plumber to come out and work on them because first thing they have to do is cut a hole in the belly. Now you've just opened up a gap. Essentially the belly is like the bottom wall and when they cut a hole in it, it's like cutting a hole in your wall. They work on the plumbing and typically they just walk away leaving that hole when they are done. Next thing you know, heat's blowing out of that hole and their pipes re-freeze in the same spot because there is a gap there. I've seen that done by, actually, professional plumbers and homeowners themselves cause a lot of times they didn't realize the purpose of the belly and the insulation underneath.

In these situations, residents could lose the money for the repair, have the inconvenience of being without water, and rescheduling another repair.

Recommendation 6.1: *Distribute a list of certified contractors that can properly work on the specialized needs of MH: plumbing, electricity, and heating.*

CAP Agencies
Some service providers at CAP agencies mentioned having a relationship with qualified MH contractors through their experience coordinating emergency repairs. To leverage this information and to proactively help MH residents, who are a high-risk population for being low-income, CAP agencies should send this information to residents in a clear and visible way. To share this information, the local CAP agencies could mail a letter, particularly to residents starting with pre-1976 up to pre-2000 MH, with a guide on how to hire a qualified contractor with appropriate questions and considerations listed. To keep the contact information visible, a summary with the local CAP agency phone number, and a list of qualified MH contractors and phone numbers could be listed. Also included with this information could be information on upcoming workshops on MH Maintenance (see Recommendation 5.1).

Problem 7: *MH residents do not know what the energy costs are before buying or renting a MH.*

The utility company service provider talked about a pattern they had seen across all housing types: "People, especially in income-challenged environments, are more worried about getting a roof over their head than looking at what this is really gonna cost them on an ongoing basis to live there." This is particularly relevant for MH residents, who are often low-income and in poorly constructed homes, with energy costs into the thousands of dollars. An experienced WAP service provider described, "If you've got a very poor mobile home, you're easily looking at $500- to $1,000 in cooling and heating a month. Which is crazy!" In more severe cases, another experienced WAP service provider explained, "I've seen some [MH] purchased for $500 and then the heating bills are ten times that." To get a sense of how energy costs for MH were compared to site built homes, I asked one experienced WAP service provider if a "leaky" mobile home would use more energy than a "leaky" conventional house: "Absolutely!" The service provider further compared these energy costs between the average site built home and MH they work on:

> I would say an average site-built house with a basement [1,000 square feet], the annual heating would probably be about $900 - $1,000. Whereas a mobile home of the construction size I was just describing to you [600 square feet], I would say in the neighborhood of $2,500 - $3,000. Or maybe even higher in the annual heating bill.

So, to avoid this unexpected hardship on low-income families looking to buy or rent a home, information about what to expect for annual energy costs should be disclosed.

Recommendation 7.1: *Before any residential dwelling is sold or rented in Minnesota, the last 12 months of all energy costs (heating and electricity) should be disclosed along with other energy efficiency information in a "Truth in Energy Costs" document.*

Utility Companies & Landlords/Sellers
Before buying or renting a dwelling, households need clear information about the expected annual energy costs to quickly gauge their affordability needs. Numerous factors influence the annual energy expenses for any particular dwelling. Therefore, the clearest information that most closely reflects the individual characteristics of a dwelling would be the last 12 months of all energy costs with at least one full-time resident. Utility companies already record this information, so it would be a matter of the seller or landlord obtaining the permission to release this information as part of the lease or purchase agreement within a "Truth in Energy Costs" document. In addition to the annual energy costs for the specific dwelling, utility companies should also disclose the average annual energy costs in the area by dwelling type - single family detached, manufactured home, single family attached, and apartments. This combination of specific and general energy information would give potential buyers and renters the best available information to avoid undue hardships - like choosing between 'heating or eating' and other necessities - or to prepare for higher heating bills. Having this information available would also incentivize landlords and sellers to improve the energy efficiency of their homes.

Problem 8: *A lack of sufficient understanding on the complex reality of Residential Energy Insecurity.*

Recommendation 8.1: *More studies on the lived experience and social costs of Residential Energy Insecurity to better understand and more accurately measure the true need and to improve interventions.*

Universities & Policy Researchers
As the U.S. housing stock continues to age and become less efficient, a better understanding of the complex interactions within Residential Energy Insecurity will help design new interventions and improve current ones or prevent it from occurring altogether. Specifically, more research is needed from the resident's viewpoint to catch any gaps in the service provider's perceptions. Also, more research is needed to better quantify the true social costs of people coping with Residential Energy Insecurity. There are many opportunities for further study by examining the interdisciplinary areas of energy, poverty, housing, and health. By improving the understanding of this phenomenon, better interventions can be designed and this framework may even be applied to countries outside of the U.S. in the future.

6.4 Conclusion
Currently undervalued as a basic need in America, issues related to residential energy can have detrimental impacts on the quality of life for millions of people. The conceptual framework of Residential Energy Insecurity proposed by Hernández et al. provides a complex and systemic approach to examine the potential causes and consequences of REI at many scales, as well as, the reactions of and potential impacts on residents. To identify energy inequities by housing type, a number of indicators were described so that housing types were compared fairly based on the energy burden, the energy use and cost per square foot, with the additional context of the relative hardships experienced by the average household by housing type. On average, manufactured housing residents are particularly vulnerable to energy inequities, compared to other housing types, due to the history of poor quality in the older homes built before 1976 and up through 2000, the low income profile of residents, and other hardships. Given the lower efficiencies of low-income housing types, REI interventions could be framed with efforts to reduce carbon emissions and promote sustainability. Also, the true costs of REI on families and to society should be

studied and estimated so better interventions that weigh these costs can be designed. In the wealthiest country in the world, people should not be struggling to meet their basic needs.

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Appendices

Appendix A: Diagram of Manufactured Home

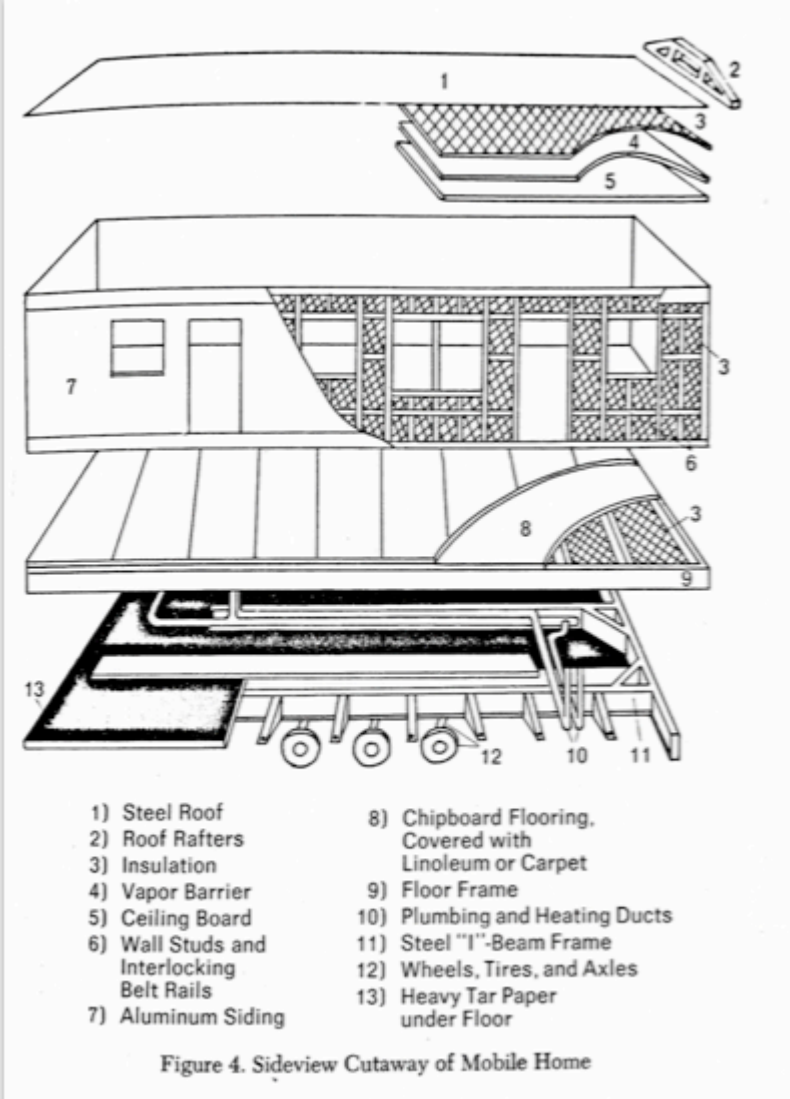

Figure 4. Sideview Cutaway of Mobile Home

Image Source: (McDonnell, 1975)

The diagram above shows the simplified layers of a mobile home. One of the most important components unique to mobile/manufactured homes is the underbelly. Specifically, at the base (10) shows the underbelly components of the plumbing and heating ducts that are susceptible to damage if not properly protected by insulation (3 on flooring) and the protective outer skirting (not shown).

Appendix B: Diagram of a Manufactured Home Foundation

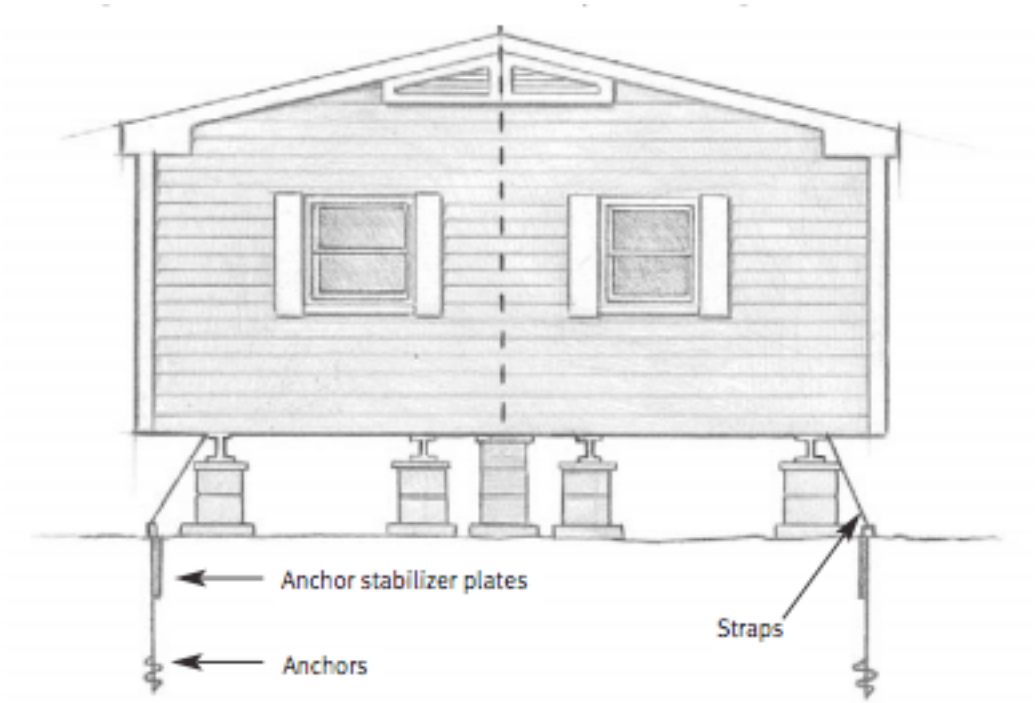

Image Source: ("Manufactured Housing Research Alliance," 2002)

The diagram above shows the most popular type of foundation for securing a manufactured housing to the ground referred to as "Pier and Ground Anchor Support Systems." If the concrete piers are not placed in the correct positions and stabilized in the soil, they can sink unevenly into the ground, causing severe structural damage to the home. *Note:* The manufactured home pictured is a double wide where two halves that are the size of a singlewide manufactured home are joined at the middle dotted line.

Appendix C: Recruitment Email

Dear [Contact Person],

My name is Kathleen Matter and I am a graduate student at the University of Minnesota. I am conducting research to better understand factors that influence energy issues of mobile home residents. Based on your professional experience serving mobile home residents experiencing an energy-related issue, I invite you to participate and share your insights.

There will be a 30-minute phone interview that will be audio recorded and later transcribed for analysis. Participation is voluntary and you are able to withdraw from the study at any point. Your responses will remain confidential and anonymous with all identifying information removed from the final report. There are no known risks to participating in this study. Expected benefits are the creation of a framework to guide future research efforts and to inform public policy of ways to reduce energy issues of mobile home residents.

If you agree to participate, please respond to this email and suggest a few times to schedule the interview with the best number to call you. The questions will be sent out to you at least 24 hours in advance for you to review.

Thank you for your time and consideration,
Kathleen Matter

Appendix D: Reminder Email

Dear [Contact Person],

Below is the list of questions for the interview tomorrow if you would like to review them. I will call you at [their number] at [time and date] and the interview will last approximately 30 minutes. In case there are any issues, my number is [redacted].

Thank you very much for being willing to participate and I look forward to speaking with you tomorrow morning.

Kathleen

Interview Questions

1.) Please tell me your position, how long you have worked in that position, and the programs or policies you work with.

2.) Based on your experiences, what factors have contributed to energy-related issues for mobile home residents?

3.) From start to finish, what is the process that a mobile home resident will go through when trying to receive assistance with an energy-related issue?

4.) Please tell me about a memorable interaction you had with a mobile home resident who was experiencing an energy-related issue?

5.) What policies or programs are working well at reducing energy-related issues for mobile home residents?

6.) What are the greatest barriers for assisting mobile home residents with energy-related issues?

7.) How would you improve the current policies or programs to better serve mobile home residents experiencing energy-related issues?

8.) Is there anything I missed that you would like to share?

9.) Is there anyone else you would recommend I speak with that may have insight into energy-related issues facing mobile home residents?

Appendix E: Interview Script and Questions

Opening
Hello, may I speak to [Contact Person]? Great, how are you? Thank you for agreeing to participate in this interview. Before we begin, I'd like to go over a few logistics. First, are you able to hear me all right? The purpose of this study is to better understand factors that influence energy issues for mobile home residents. Today's interview will last approximately 30 minutes and will be audio recorded. Participation is voluntary and you can withdraw at any point. In the final report, your name and identifying information will be removed so you will remain anonymous. Given these terms, do you agree to participate today? Do you have any questions before we begin?

Interview Questions

1.) Please tell me your position, how long you have worked in that position, and the programs or policies you work with.

2.) Based on your experiences, what factors have contributed to energy-related issues for mobile home residents?

[How do residents cope with some of these issues before receiving assistance?]

3.) From start to finish, what is the process that a mobile home resident will go through when trying to receive assistance with an energy-related issue?

[How do you interact with residents?]

4.) Please tell me about a memorable interaction you had with a mobile home resident who was experiencing an energy-related issue?

[What specifically was memorable?]

[Describe average MH client] [Describe average site built/conventional house client]

5.) What policies or programs are working well at reducing energy-related issues for mobile home residents?

6.) What are the greatest barriers for assisting mobile home residents with energy-related issues?

7.) How would you improve the current policies or programs to better serve mobile home residents experiencing energy-related issues?

8.) Is there anything I missed that you would like to share?

9.) Is there anyone else you would recommend I speak with that may have insight into energy-related issues facing mobile home residents?

Closing
That concludes the interview. If I have any further questions about your interview answers, may I contact you for clarification? Thank you for your time and willingness to participate.

Appendix F: Description of the Assistance Process

I asked the interviewees to describe the process a resident goes through when trying to receive assistance for an energy-related issue. If the service provider didn't state it explicitly, I directly asked how residents find out about the program. Interviewees described a number of ways residents could hear about the programs with LIHEAP described as the primary gateway program. One way to hear about LIHEAP was though a friend, family, or neighbor. There are also advertisements through CAP agencies or information about programs included in resident's heating bill. A social service agency might also reach out to CAP agencies on behalf of a manufactured housing resident.

After finding out about a program, a client calls in and will be directed to fill out the energy assistance application at the CAP agency, on the Internet, or have it mailed to them directly. If residents received LIHEAP the prior year, they are automatically mailed a new application before the heating season starts. As part of that application, residents can opt-in to receive weatherization assistance. Applications are approved if they meet income and asset guidelines that vary depending on the program. This is verified using pay stubs and bank statements. Also, the last year's gas and electricity consumption data is pulled from the resident's utility provider. If approved, LIHEAP pays $400 for the heating season in $100 increments paid directly to the utility provider.

The resident is placed on a waitlist if they opted-in on the LIHEAP application. When the resident comes up on the weatherization queue, an energy audit is performed on the home. There were minor variations in how the energy auditors described the process but it follows the general procedure that follows. First, the client is interviewed on how they run their home and lifestyle. Examples include turning down the thermostat, if there are mold or mildew issues, overheated or cold spots, or roof leaks in the home. Next, the mechanical and structural parts of the home are inspected. The furnace, water heater, and kitchen stove are all tested for carbon monoxide and efficiency. Insulation values are checked in the walls and belly as well as the ductwork. A blower door test is performed to test for air leakage. All of the measurements are plugged into the MHEA software to determine an acceptable payback for the federal Department of Energy and the state Department of Labor and Industry. Then, work orders are made up and contractors are set up for the mechanical and insulating repairs. The contractors do the work and an inspector will go out and ensure the work was done properly. A passionate respondent stressed that they try to educate the homeowner during the entire process indicating, "the state is big on health and safety." From the audit to the work completed and inspected is 90 days. In addition to the local inspector, the state auditor might inspect some work or a federal monitor might also inspect homes that were weatherized.

A less visible part of the weatherization program is solar assistance for low-income households. For households that are income eligible for energy assistance and received weatherization, CAP agencies may refer people to nonprofit groups that work on installing solar.

Process for Emergency Energy-Related Repair (LIHEAP)
A program within LIHEAP is reserved for crisis situations where there is no heat in the home or life-threatening carbon monoxide. An emergency situation could also be triggered when a contractor does work on a home and discovers and is required to tag a water heater or furnace that is not made for a manufactured home. Interviewees mentioned that people are connected to this program by calling their utility or CAP agency and reporting the situation. Clients receive a letter about this program after they are approved for heating assistance. The resident speaks to a LIHEAP CAP worker who assesses the situation and sends contractors. To qualify for the emergency funding, three things have to be satisfied. One is that the client needs to be on the energy assistance program. The resident has to also be the homeowner which is proven by a county website or other documentation. Lastly, there needs to be heating crisis as described by the conditions above. If the furnace is out, the contractor tries to repair it but anything greater than $1,000 or if a replacement is needed, it goes back to the CAP agency worker to go through

the bidding process. If a replacement is needed, it will take two to three days to complete the process.

Process for Rehab or Emergency Loan (MHFA)
People hear about the rehab or emergency loan program through the Minnesota Housing Finance Agency through WAP, social service agencies, the county, the park manager, or a neighbor who had work done. When people contact a Community Development Agency, the administrator will send them an application. Next, the income and assets are verified with copies of social security, copy of title, copy of insurance, 6 most recent bank statements for checking and savings account statements. People can get a loan up to $27,000 through rehab and $15,000 through the emergency loan program. The owner gets bids from contractors and sends them to the loan administrator. The owner can pick the contractor but generally the least expensive is used unless there is a justification for going with another contractor. For these programs, the state says, to the best of your ability, prioritize based on health and safety, accessibility, energy efficiency, and things that extend the livability or habitability of a home.

Table F.1

Summary of Interactions between MH Clients and Energy-Related Programs

	General Process Steps when Trying to Receive Assistance
Interactions between MH Clients and Energy-Related Programs	1. Awareness by Resident of Programs 2. Applying and Approval by Resident at CAP Agency for LIHEAP and/or WAP 3. Audit and Software Calculations by WAP Workers 4. Work Orders and Contractors arranged by WAP Workers 5. Inspections by WAP Workers

Appendix G: Institutional Review Board (IRB) Exemption

UNIVERSITY OF MINNESOTA

DETERMINATION OF HUMAN SUBJECT RESEARCH

Version 1.2

Updated June 2014, check http://www.irb.umn.edu for the latest version

Route this form to:	U Wide Form: UM 1571
See instructions below.	June 2014

This form is used to help researchers determine if a project requires IRB review. It also provided documentation that the IRB has reviewed the project description and issued a determination.

Additional information that may assist you in determining whether or not to submit an application can be found on the IRB website. See Does My Research Need IRB Review? and Guidance and FAQs IRB Review of Exempt Research.

Please allow up to five (5) business days for review and response.

Email completed form to irb@umn.edu

Based on the information provided, this project does not meet the regulatory definition of human subjects research. Additional IRB review is NOT required.

Jeffery Perkey

Project Title

Provide the grant title below if the project is funded.

Section 1 Contact Information

Name (last name, First name MI)	Highest Earned Degree:
Matter, Kathleen J	B.A.

Preferred contact information: matte067@umn.edu

Preferred email at which you may be contacted by IRB staff.

Affiliation and contact information

☒University of Minnesota ☐Fairview ☐Gillette

U of M Required Contact information	U of M Internet ID (x.500):	matte067
	University Department:	Humphrey School of Public Affairs - Science, Technology and Environmental Policy

Section 2 Summary of Activities

2.1 Provide a brief description of your project. Include a description of what any participants will be asked to do and a description of the data accessed and/or collected (1,000 character limit).

I plan to examine the sociopoliticial context of energy poverty in mobile homes of Minnesota using semi-structured interviews of key informants in order to improve public policies. The key infomants would include mobile home park managers (except if they are residents in the mobile home park), advocacy and service groups that work with mobile home residents on energy programs, utility companies, and public officials. Due to the exploratory and preliminary nature, I will not be interviewing mobile home park residents. Participants would be asked to complete a 30 minute in-person or phone interview of their relevant professional experience. Notes will be taken during the interview to record responses. I will take an audio recording of the of the interview if participants consent to being recorded and later transcribe the interview for content analysis.

2.2 Are all of the data used in this project publicly available, e.g. blog, aggregate data, etc.?

☐ Yes ☒ No

Section 3 Is this Project Human Subjects Research as Defined by Federal Regulations?

Research is defined in the Code of Federal Regulations, 45CFR46.102(d), as *a systematic investigation designed to develop or contribute to generalizable knowledge*

The Belmont report states "...the term 'research' designates an activity designed to test a hypothesis or answer a research question(s) [and] permit conclusions to be drawn... Research is usually described in a formal protocol that sets forth an objective and a set of procedures to reach that objective."

Research generally does **not** include operational activities such as routine outbreak investigations and disease monitoring and studies for internal management purposes such as program evaluation, quality assurance, quality improvement, fiscal or program audits, marketing studies or contracted-for services.

Generalizable knowledge is information where the intended use of the research findings can be applied to populations or situations beyond that studied. Note that publishing the results of a project does not automatically meet the definition of generalizable knowledge.

3.1 **Do you have a specific research question or hypothesis?**

☒ Yes ☐ No

3.2 **Is your primary intent to generate knowledge that can be applied broadly to the group/condition under study?**

☒ Yes ☐ No

Human subject is defined in the Code of Federal Regulations, 45CFR46.102(f)(1or2), as a living individual *about whom* an investigator obtains data through intervention or interaction or identifiable private information.

The specimen(s)/data/information must be collected from or be **about** live subjects. Research on cadavers, autopsy specimens or specimens/information from subjects now deceased is not human subjects research.

3.3 **Does this project involve intervention or interaction with a living individual or group of individuals? (e.g. confidential surveys, interviews, medical or educational testing)**

☒ Yes ☐ No

3.4 **Does this project involve access to identifiable private data or specimens from living individuals?**

☐ Yes ☒ No

3.5 **Does this project consist exclusively of interviewing or surveying subjects about his/her area of expertise, with a focus on policies, practices, and/or procedures (e.g. the collected data does not focus on personal opinion or private information)?**

☒ Yes ☐ No

3.6 **Is the project meant to record the stories, knowledge or experiences of individuals? Oral histories typically do not intend to answer a research question or hypothesis.**

☐ Yes ☒ No	
If a protocol exists for this project it must be submitted for review. Submit this request along with any supplemental documents that may aid in review of your project to the University of Minnesota IRB at irb@umn.edu.	

Appendix H: Average Household Annual Energy Expenditure by Housing Type

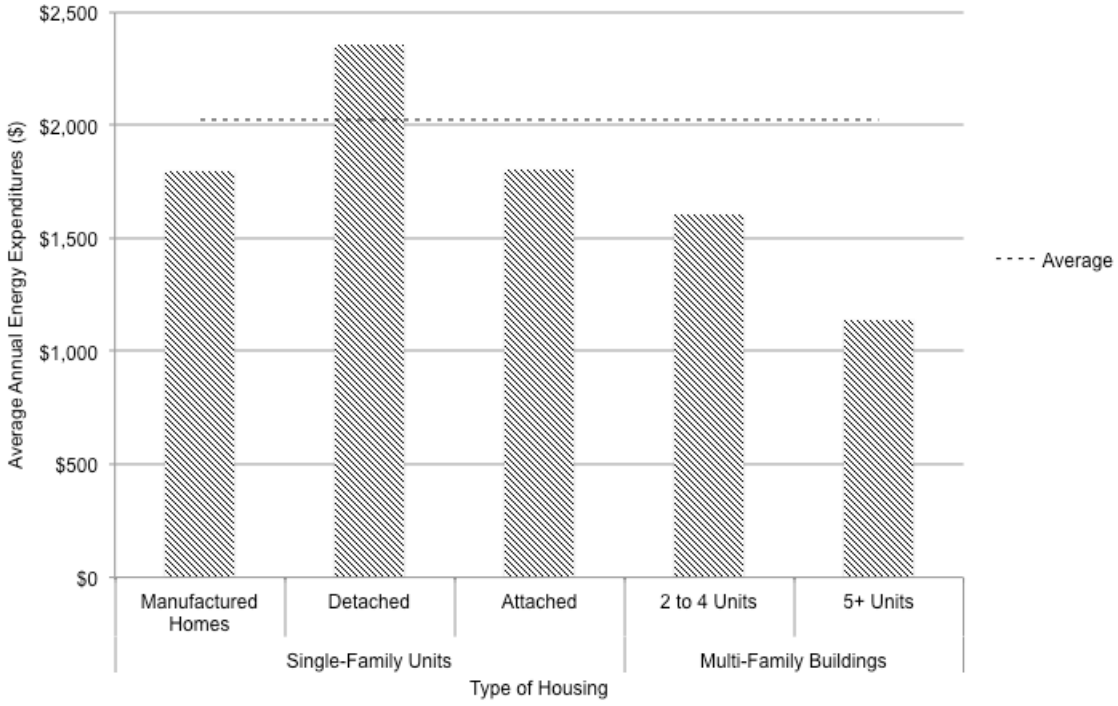

Figure H.1. Average household annual energy expenditure by housing type for all construction years. Adapted from "2009 RECS Survey Data," 2013, *U.S. Energy Information Administration.*
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Appendix I: Average Household Annual Energy Consumption by Housing Type

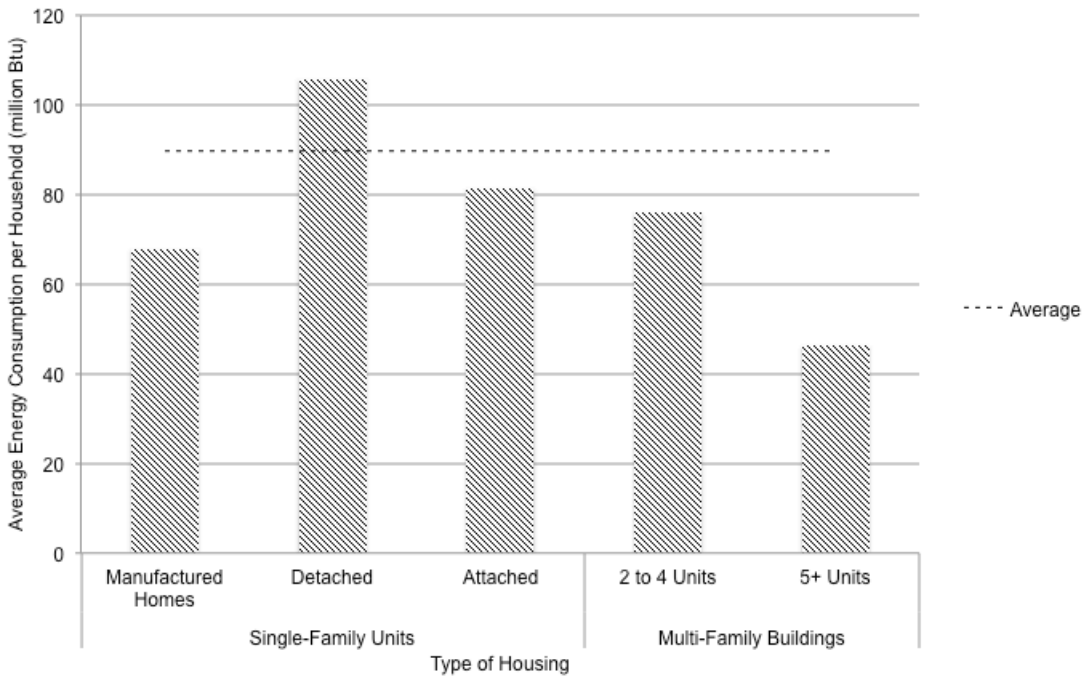

Figure I.1. Average household annual energy consumption in million Btu by housing type for all construction years. Adapted from "2009 RECS Survey Data," 2013, *U.S. Energy Information Administration.*