Energy Needs, Housing, and Well-Being in theTown of Bridgewater

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Executive Summary

In the Town of Bridgewater, as in several communities in the Atlantic provinces and Canada, many households struggle to access sufficient energy services at home to meet their needs, maintain a healthy indoor temperature, and live a decent life – a situation known as energy poverty. Depending on the measure, between 6% to 19% of Canadian households are in energy poverty (Riva et al., 2021; Das et al., 2022). In Atlantic Canada, over 30% of households are facing energy poverty. When the cost of energy for transportation is considered, many more households find themselves in energy poverty.

In 2019, the Town of Bridgewater (TOB) conducted a survey to estimate the prevalence of energy poverty. Results showed that 38% of households self-reported spending more than 10% of after-tax income on energy for the home and for transportation. This startling number served as a catalyst for *Energize Bridgewater*, an ambitious and unique community-wide program with the goal to reduce energy poverty by 20% by 2026. TOB is collaborating with researchers from McGill University on a study assessing the health and well-being impacts of *Energize Bridgewater*. For the first phase of the study, a community-wide survey was conducted in May 2022 to provide the TOB with a baseline energy poverty rate before the full implementation of *Energize Bridgewater*. This survey further provides the first in-depth quantitative exploration of energy poverty in Canada.

This report summarizes the main results from the survey concerning energy poverty, housing, and health and well-being. Overall, 516 residents of Bridgewater, aged 19 years and older, fully completed the survey. Participants answered questions about their housing type, conditions, and household composition; the type of energy used at home, energy costs, and financial hardship; satisfaction with their dwelling; mobility; and health and well-being. Participants also provided demographic and socioeconomic information. Energy poverty is defined as difficulty in accessing or affording enough energy to meet one's needs, such as heating and cooling, powering appliances, and transportation. Thus, the focus is on both energy poverty in the home and in transportation. Various indicators are used to measure energy poverty, including indicators based on the share of energy expenditure to household income and on self-reported assessments of thermal comfort and experience of financial hardship. Overall, results confirm that an important proportion of households in the Town of Bridgewater are facing energy poverty.

As per expenditure-based indicators:

- 17% of survey participants are living in households spending more than 10% of their annual income on energy for the home.
- 38% of survey participants are living in households whose ratio of energy cost to household income is more than twice the national Canadian median share.
- When considering energy for the home and for transportation, 35% of participants are in households spending more than 10% of their annual income on energy.

When considering self-reported measures of thermal (dis)comfort, financial hardship, and transportation needs, the social implications of energy poverty are made more visible:

- 20% reported difficulty affording to keep their dwelling adequately warm.
- 35% indicated they had to juggle bills to pay for utilities, and 23% reported difficulty in paying utility bills on time.
- 32% reported cutting back on groceries to pay for power and heating in the past year.
- 21% of participants reported shivering inside their dwelling in the past cold season because of the cold; 8% reported seeing their breath inside; and 12% reported trouble sleeping because of the cold.
- 15% indicated an average indoor temperature below the World Health Organization (WHO) Housing and Health Guidelines, that is a temperature <18°C.
- 29% reported difficulty affording transportation needs in the past year.

There is also variation in energy poverty across housing type, characteristics and tenure. The highest levels of energy poverty are often observed for participants living in:

- apartments in converted houses;
- dwellings using oil as their primary source of energy for heating;
- dwellings built prior to 1961.

When self-reported measures of thermal comfort and financial hardship are used, energy poverty appears to be higher for renters compared to homeowners:

- 26% of renters reported difficulty affording to keep their dwelling warm (vs. 17% of homeowners).
- 46% of renters reported having had to juggle bills in the past year to pay for utilities (vs. 29% of homeowners).
- 26% of renters reported an ambient indoor temperature below WHO guidelines (vs. 10% of homeowners).
- 28% of renters reported shivering inside their home in the past cold season (vs. 17% of homeowners).

Energy poverty also appears to significantly compromise the health and well-being of those experiencing it. Compared to participants not living in energy poverty, those facing energy poverty were significantly more likely to report poorer general and mental health, higher levels of stress, and lower satisfaction with life.

Based on the 2M metric which classifies households in energy poverty if they spend more than 5.4% of their household income on residential energy expenditures, **38% of residents in Bridgewater are facing energy poverty. This situation has important implications in everyday lives.** The proportion of participants experiencing energy poverty varied according to the measure used, which points to the importance of using **multiple indicators in combination to quantify energy poverty**. While there is some overlap between the prevalence of energy poverty as measured by the survey results and TOB's previous estimate, there are discrepancies due to differences in measurement. Findings suggest that *Energize Bridgewater*'s efforts to alleviate energy poverty for renters, those living in apartments in converted homes and in older dwellings, and for households heating with oil, could potentially have the largest impacts in reducing energy poverty. Based on results from the survey, and further informed by international scientific evidence, recommendations are formulated for measuring energy poverty and for future research.

38% of residents in Bridgewater are facing energy poverty. This situation has important implications in everyday lives.

Recommendations on the Measure of Energy Poverty

Recommendation 1. Use the 2M threshold instead of the 10% threshold as the expenditure-based metric of energy poverty. As per the 2M threshold, households spending more than 5.4% of their household income are considered to be facing energy poverty. This indicator helps situate energy poverty faced by residents in TOB relative to the Canadian ratio of energy expenditure to household income. This measure is less influenced by adjustment for housing costs than the 10% threshold. It is also more closely aligned with the lived experience of household facing energy poverty.

Recommendation 2. Continue measuring energy poverty for the home using the self-reported indicator *Difficulty in affording to keep the home adequately warm*. This self-reported indicator informs on the lived experience of energy poverty. It is similar to the one included in the EU Survey on Income and Living Condition, and can provide a comparison point.

> **Recommendation 2.1. Consider other self-reported indicators of energy poverty for their comparability with other sources of data.** For example, difficulty in paying utility bills and experience of disconnection from utilities are comparable to metrics used in the USA to assess energy security. Satisfaction with the dwelling's energy efficiency and with the ability to maintain comfortable indoor temperature are indicators included in the Canadian Housing Survey and can serve to make national comparison.

Recommendation 3. Focus the primary energy poverty indicators on home energy poverty only and remove transportation fuel poverty from the figures. This is important because conflating energy poverty in the home and in transportation may mask results of housing-related intervention.

Recommendation 4. Continue monitoring the transportation dimension of energy poverty. This is important because transportation accounts for an important share of household energy consumption and budget. Some households may in fact experience a 'double energy vulnerability,' being exposed to both domestic- and transportation-related energy poverty. Data should be collected on monthly or annual expenditure for transportation, and Bridgewater should continue using the self-reported indicator *Difficulty in affording transportation needs*.

Recommendation 5. Continue monitoring energy poverty using a range of metrics. This is important because metrics of energy poverty have yet to be validated for the Canadian context. The expenditure-based 10% threshold should continue to be monitored since it is easily interpretable across different settings.

Recommendations for Future Research

Recommendation 6. Conduct further research on energy poverty in Bridgewater, including a repeat of the community-wide survey at 2-year intervals, and a cohort study following clients of *Energize Bridgewater* overtime. This research is needed to assess the impacts of *Energize Bridgewater* on energy poverty and well-being among clients from the whole community.

Recommendation 7. Assess the scalability and transferability of *Energize Bridgewater* to other communities. *Energize Bridgewater* is a multi-component, community-wide program aiming to improve energy security for those involved in the program, and for the whole community. This program is unique in Canada. Assessing the context and implementation process of *Energize Bridgewater* is needed to understand the factors and conditions needed, and the feasibility, to scale and transfer this program to other settings.

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Glossary

Here are some terms used throughout the report that might require some clarification.

Single-detached house: a single dwelling on a single lot.

Semi-detached house: a dwelling attached to one or more dwelling units on separate properties split along the property line (including duplex, row house).

Apartment in purpose-built building: a dwelling unit in a multi-unit residential building (apartment building) that was built for that purpose.

Apartment in converted home: a dwelling unit in a multi-unit residential building that was not built for that purpose (such as a single-detached home that was renovated to create separate units).

Mobile home (or mini home): a prefabricated dwelling designed for transportation on its own frame.

Housing condition: the overall physical state of a dwelling, including its need for regular maintenance, minor repairs, or major repairs where:

> **Regular maintenance** includes painting, furnace cleaning, etc.
> **Minor repairs** include repairs for missing or loose floor tiles, bricks, or shingles, and defective steps, railings, or siding, etc.
> **Major repairs** include repairs for defective plumbing or electrical wiring, and structural repairs to walls, floors, or ceilings, etc.

Housing costs: in the context of this study, housing costs correspond to the cost of rent or of mortgage.

Household income: in the context of this study, household income corresponds to the total income received by all members of a household before taxes and deductions.

Household energy costs: in the context of this study, household energy costs are the expenditures for energy sources to heat, cool, and fuel appliances, such as electricity, oil, wood, or propane.

Transportation costs: in the context of this study, transportation costs are the expenditures for gas for cars or trucks, public transportation fares, and for taxi rides.

Energy poverty: a situation that happens when a household cannot attain sufficient amounts of energy services to meet their needs, to maintain healthy indoor temperature, and to live a decent life. In the context of this study, this includes both energy needs in the home (e.g., heating, cooling, fueling appliances), and energy needs in transportation (for gas, public transportation, or taxis). There are various ways of measuring energy poverty. In this report, we focus on residential and transport-related energy poverty, measured using information on energy expenditures, on people's assessment of the thermal comfort, energy efficiency of their dwelling, and their experience of financial strain linked to energy costs. Box 1 (p. 21) provides a summary of the measures used in the report.

1/ Context

In the Town of Bridgewater, as in several communities across Atlantic Canada and elsewhere in the country, many households struggle to attain socially and materially necessitated levels of domestic energy services to meet their needs and to maintain healthy indoor temperatures – a situation known as energy poverty (Bouzarovski and Petrova, 2015; Thomson et al., 2017). Recent national estimates indicate that, depending on the indicator retained to measure energy poverty, between 6% to 19% of Canadian households face energy poverty (Riva et al., 2021; Das et al., 2022). In Nova Scotia and elsewhere in Atlantic Canada, more than one in three households are in this situation. When the cost of energy for transportation is taken into account, many more households in the region are estimated to be facing energy poverty.

Energy poverty is multidimensional. It is caused by household-level socioeconomic factors such as a household income, the needs and practices of household members, the energy efficiency of the dwelling, and by structural factors such as the type of energy supply and energy bills. Living in cold (and hot) dwellings is compromising people's health and well-being in myriad ways (O'Sullivan, 2019; World Health Organization, 2018). Increasingly, energy for transportation is included in the conceptualisation and measurement of energy poverty, as transportation accounts for an important share of household energy consumption and budget. Some households may in fact experience a 'double energy vulnerability,' being exposed to both domestic- and transportation-related energy poverty (Martiskainen et al., 2021; Robinson & Mattioli, 2020; Simcock & Mullen, 2016). It is possible that households, especially those in smaller towns and rural areas, may decide to modify their domestic energy use rather than reduce their vehicle fuel consumption, as they might be dependent on their car to get to work. A 2016 Canadian report showed that nationwide estimates of energy poverty increased from 8% to 19% when gasoline was included (Green et al., 2016), highlighting the relevance of considering transportation costs in the measures of energy poverty in Canada.

In 2019, the Town of Bridgewater (TOB) conducted a survey to estimate the prevalence of energy poverty in the Town. Bridgewater considered a household to be facing energy poverty if they indicated that they spent more than 10% of their income on home and transportation energy, and reported difficulty affording energy for their home and/or for transportation. As per this definition, 38.5% of households in TOB were facing energy poverty in 2019. This startling number served as a catalyst for *Energize Bridgewater*, an ambitious and unique community-wide program aiming to reduce energy poverty by 20% by 2026. This program comprises various components: housing energy efficiency improvements; support programs for households living in energy poverty and in precarious housing situations; improvements to active and public transportation infrastructure to offset the costs of private transportation; the implementation of renewable energy infrastructure; and community outreach on energy-related issues. *Energize Bridgewater* takes a "whole-systems" approach to tackling energy use and energy affordability in the community. This program is unparalleled elsewhere in the country. Programs like *Energize Bridgewater* have the potential to lift households out of energy poverty and improve their well-being, while also reducing greenhouse gas emissions. Documenting such outcomes is paramount to understanding the scalability of programs tackling energy poverty.

The Town of Bridgewater is collaborating with Prof. Mylène Riva and her team at the Canada Research Chair in Housing, Community and Health at McGill University to develop a longitudinal study assessing the health and well-being impacts of *Energize Bridgewater*. The study is called BridgES, which stands for Bridgewater Energy Security. The first phase of BridgES saw the realization of a community-wide survey in the spring of 2022 with the goal to provide TOB with baseline estimates of energy poverty before the full implementation of *Energize Bridgewater*.

This report presents a first description of the results from the survey, focusing on the rates of energy poverty in the Town of Bridgewater and the intersection of energy poverty with selected housing indicators. It also presents the housing conditions, socioeconomic characteristics, and health and well-being of the participants who completed the survey. Data from the 2016 Census are used to compare participants to the population in the Town of Bridgewater, Lunenburg County, and Nova Scotia, and to illustrate the geographical distribution of energy poverty across neighbourhoods in the Town of Bridgewater.

Informed by results from the survey, a baseline estimate of energy poverty is provided to TOB. Recommendations are formulated around metrics that should be used to measure energy poverty going forward and around priorities for research.

This is the first report on the result from this survey. Upcoming data analysis will focus on population groups for whom there is a greater risk of energy poverty, on strategies deployed by households to cope with energy poverty, and on the impacts of energy poverty on daily life, including on health and well-being. Overall, results from the survey will serve to inform the various components of *Energize Bridgewater* by providing knowledge about who is exposed to energy

poverty and who is most vulnerable to its impacts. This type of evidence will improve the targeting of the components of *Energize Bridgewater* to households who are most in need. Evidence gathered will further provide a baseline against which to compare changes in energy poverty and well-being brought about by *Energize Bridgewater*. More broadly, results will provide the first in-depth quantification and characterization of energy poverty in one community in Canada using a range of variables that go well beyond what is currently available in any population survey in the country.

2/

Description of the Survey Methods and of Participants

The questionnaire used for the survey was co-designed by researchers from McGill University and the Town of Bridgewater, with input from Nova Scotia Public Health Western Zone, the South Shore Open Doors Association, and academics from Canada and New Zealand. The questionnaire consisted of six sections: housing composition and dwelling conditions; energy use, energy costs, and energy hardships; satisfaction with dwelling; health and well-being; mobility; and demographic and socioeconomic characteristics. The questionnaire and the approach used to carry out the survey were reviewed and approved by McGill University's Research Ethics Board (REB #21-12-003).

Data was collected between April 29 and June 15, 2022, by five student researchers from McGill University. The research team, the team at *Energize Bridgewater*, community organizations, and local businesses collaborated to implement different recruitment methods to bolster participation to the survey:

- A statement about the survey was posted on official municipal websites and social media pages;
- Social media posts were published on various Facebook pages, such as the page made for the survey (**'Bridgewater Energy Security Survey'**), a page for renters in the Bridgewater area, and the 'Community Bulletin Board';
- The communication team at the Fresh Cuts Market made two announcements on their Facebook page to promote participation in the survey;
- Posters with information about the survey were displayed in several public spaces across Bridgewater, such as at the library, community centers, clinics, local businesses, churches, etc.;
- The research team went door-to-door to distribute postcards with information about the survey and to speak with residents about the survey;
- McGill researchers attended and participated in several community events to get to know residents and encourage participation. Such events included attending church services, volunteering at community meals at different community organizations, and spending time in community centers.

To be eligible to participate in the survey, individuals had to be 19 years or older, residing in the Town of Bridgewater (i.e., within the town boundaries as identified with the 6-digit postal code), renting or owning their current dwelling, and having lived full-time at their current address at least since January 2022. Only one adult per household was eligible to participate.

After providing informed consent to participate, respondents could complete the survey online, over the phone, or in-person. As compensation, participants received a $10 gift card to Fresh Cuts Market, a local supermarket. Participants could accept the gift card or decide to donate it to a local food bank. This proved to be an important way to show our gratitude to participants and to support the local economy and the community. Overall, the survey donated $1110 worth of Fresh Cuts gift cards to the Bridgewater Interchurch Food Bank and the Better Together Family Resource Center.

2.1. Survey Participants

Overall, 516 participants, each from a different household, completed the survey in full, representing about 13% of all private dwellings in Bridgewater. Most surveys (82%) were completed online, 10% over the phone, and 8% in-person.

There appears to be a good spatial distribution of survey respondents across the town. Figure 1 maps the spatial distribution of participants based on their 6-digit postal code areas. Areas in green show the postal code areas of participants (with the number of participants ranging from one to ten per postal code area), whereas areas in clear represent those postal code areas from which no one completed the survey, including non-residential areas in purple (such as commercial or industrial zones).

Figure 1. Spatial distribution of survey participants by postal code

2.2. Comparing participants to the survey to the population of the Town of Bridgewater, Lunenburg County, and Nova Scotia

More women (61%) participated to the survey then men (37%) (Table 1). The mean age of respondents was 54 years (results not tabulated). Participants were somewhat equally distributed between age groups, with about one third of respondents aged 19 to 44 years, 45 to 64 years, and 65 years and older. A little over half of participants were married or in common law relationships. Among survey participants, some reported gender identities other than woman or man. About 5% of participants identified as African Nova Scotian, Asian, Latinx, or Indigenous. To protect the confidentiality of participants, the proportion of non-gender binary participants is not presented, and ethnic diversity has been grouped in Table 1. Median household income was $50,000, with 9% of participants reporting a household income below $20,000, and 18% a household income of $100,000 or higher.

To assess the extent to which the participants to the survey were representative of the population of Bridgewater, we compared their socio-demographic characteristics and housing situations to the population in Bridgewater using data from the Canadian Census for 2021. A comparison with the populations of Lunenburg County and Nova Scotia is also provided (see Table 1).

The socio-demographic profile of survey participants differs to some extent from the profile of the population of the Town of Bridgewater. The age structure of participants mostly corresponds to the age profile of TOB, with a slight over-representation of the 35- to 44-year-old group. The gender of participants, however, differs more from those of the census, with more women than men represented among survey participants. The higher participation of women in population surveys has been observed elsewhere (Galea and Tracy, 2007). There is an under-representation of people living alone and some overrepresentation of participants reporting an annual household income below $20,000. Considering housing characteristics, homeowners are over-represented among survey participants, while people renting their dwelling are under-represented. Dwelling type and year of construction are quite similar to the profile of the Town of Bridgewater. Slightly more survey participants reported that their dwellings required major repairs (12% vs. 9% for the Town of Bridgewater).

To account for the discrepancy in the gender composition of the survey, all results presented in the rest of the report are weighted to resemble the gender composition of the Town of Bridgewater (54% women, 46% men). Of note, results of weighted and unweighted analyses are very similar (usually with less than 1% difference).

Table 1. Description of survey participants along socio-demographic and housing characteristics and comparison with the population of the Town of Bridgewater, Lunenburg County, and Nova Scotia using data from the 2021 Canadian Census

	Survey participants	Town of Bridgewater	Lunenburg county	Nova Scotia
Socio-demographic characteristics (%)				
Age				
19 to 34 years	15.9	18.8	15.1	22.7
35 to 44 years	18.0	12.6	12.0	14.6
45 to 54 years	12.2	13.8	15.0	15.7
55 to 64 years	20.7	18.9	22.4	19.6
≥ 65 years	33.1	35.8	35.5	27.4
Gender				
Woman	61.2	53.6	51.2	51.3
Man	36.8	46.3	48.8	48.7
Cultural identity/ethnicity				
White/Caucasian	94.6	94.8	97.6	90.2
African Nova Scotian, Asian, Latinx or Indigenous	5.4	5.2	2.4	9.8
Married or in a common law relationship	54.5	55.0	63.4	57.6
Median total income of households ($) [a]	50,000	57,200	65,500	71,500
Household income (before tax)				
< $20,000	9.1	6.5	5.2	5.6
< $50,000	46.7	43.5	37.1	33.0
≥ $50,000	52.0	56.7	62.9	67.0
≥ $100,000	17.6	21.4	26.6	31.7
Housing tenure and household composition				
Tenure				
Owner	64.7	58.0	80.4	66.8
Renter	35.3	42.0	19.4	32.6
Household composition				
Single-person households	28.7	38.8	30.6	30.8
Housing type and condition				
Dwelling type				
Single-detached house	52.1	48.1	81.0	63.7
Semi-detached house	5.8	4.9	2.0	5.0
Mobile home	13.6	11.5	5.5	3.6
Apartments	28.5	32.7	10.1	24.9
Year of construction				
Before 1961	30.0	27.3	32.3	25.9
After 1995 [b]	24.0	31.7	28.4	32.9
Major repairs needed	12.4	8.5	9.0	8.2

[a] For census data, median total income of household before tax in 2020 is reported.
[b] For Census data, this corresponds to dwellings built after 1991.

3/ Results

This section of the report starts by presenting information on participants' housing situations, encompassing housing type and condition, household composition, the type of energy used at home, and satisfaction with the dwelling. Then, the prevalence of energy poverty is presented, starting with home energy poverty followed by energy poverty indicators in relation to transportation and transportation needs. Last, we present results for selected health and well-being indicators.

3.1. Housing Situation

This section presents an overview of the housing type, characteristic and conditions, of the household composition of survey participants, and of the heating system and source of energy that provides the majority of heating for participants' dwellings. This information helps situate household energy hardship within the context of the built and social environment of the home.

3.1.1. Housing type, characteristics and conditions

About half of the survey participants lived in single-detached houses, 29% lived in an apartment located in a converted older home or in a purpose-built building, and 13% lived in a mobile home (Table 2). About 1 in 4 participants lived in a dwelling built after 1995. Over half considered their dwelling to be in need of repairs, with 12% reporting the need for major repairs (e.g., defective plumbing or electrical wiring, structural repairs to walls, floors, ceiling, etc.). About one third indicated that their dwelling felt damp sometimes, often, or always, while 14% reported patches of mould larger than a letter-size sheet of paper in their dwelling.

Table 2. Dwelling type, characteristics, and conditions [a]

Dwelling type and characteristics (%)			
Dwelling Type		**Size of main floor**	
Single-detached house	52.6	Less than 1000 sqft	44.5
Semi-detached house	5.8	Larger than 1000 sqft	55.5
Mobile home	13.2	**Number of storeys**	
Apartment, converted home	13.9	One storey	61.2
Apartment, purpose-built building	14.6	Two or more storeys	38.8
Year dwelling was built	%	**Basement**	
Before 1961	29.7	Finished basement	27.5
Between 1961 and 1995	46.2	Unfinished basement	30.9
After 1995	24.1	No basement	41.7

Dwelling conditions (%)					
Need of repairs		**Frequency dwelling feels damps**		**Patches of mould larger than a letter-size sheet of paper**	
Regular maintenance	47.9	Never or rarely	63.8		
Minor repairs	39.8	Sometimes	26.0	Yes	13.5
Major repairs	12.3	Often or always	10.3	No	86.5

[a] Note that similar information is presented in Table 1. The discrepancies in results are because of the weighting of the analyses.

3.1.2. Household size and composition

Almost two thirds of participants were homeowners, whereas 35% were renters (Table 3). Lease periods for renters varied greatly, with almost half of renters having short-term (monthly) lease periods or no lease agreement. This type of situation could increase the experience of housing instability.

Most participants (72%) lived in households composed of two or more people whereas 28% lived alone. Almost 30% of participants lived in households with children (under 18 years of age) and 37% lived in households where at least one person was aged 65 years or older. On average, household size was 2.3, ranging between one to eight people per household. Almost 40% of respondents reported having lived at their current address for more than 10 years. One in four participants reported having moved at least twice in the previous five years, and over 15% reported moving at least three times in the past five years. This indicates that for some participants housing instability might be an issue.

Table 3. Household tenure, size and composition [a]

Housing tenure and lease period (%)			
Housing tenure		**Lease periods for renters**	
Own	65.1	Yearly	49.2
Rent	34.9	Monthly	37.2
		No lease period	13.6
Household size and composition (%)			
Number of people in household (household size)		**Household Composition**	
1	28.1	People living alone	28.1
2	41.0	Households with children (0-17 years)	27.6
3	12.9	Lone-parent households	11.1
4	10.6	Households with older adults	36.6
5 or more	7.4		
Residential stability (%)			
Time lived in dwelling		**Number of moves in the past 5 years**	
Less than 1 year	10.2	0	55.2
1 to 2 years	16.8	1	18.1
3 to 5 years	17.9	2	12.2
6 to 10 years	17.1	3 or more	14.5
More than 10 years	38.0		

[a] Note that similar information is presented in Table 1. The discrepancies in results are because of the weighting of the analyses.

3.1.3. Heating system and source of energy

Information on the heating system and source of energy that provides the majority of heating for participants' dwellings, as well as the presence of an air conditioning unit, is presented in Table 4. From our sample, heat pumps were the most common form of heating for households at 35%, followed by electric radiant and/or baseboard heating (around 25%) and furnaces with forced air (around 15%). Over 60% reported electricity as their main energy source, 21% reported oil, 8% reported wood, while 7% reported other sources of energy for the heating of their dwelling (this encompasses gas fireplaces and dual heating systems). Most participants (71%) reported having air conditioning (AC), with 79% of those with AC reporting their system to be efficient enough to keep their dwelling cool in the summer (results not tabulated).

Table 4. Household heating types and energy sources

Type of heating and source of energy (%)			
Type of heating		**Sources of energy**	
Furnace, forced air	14.2	Electricity	63.4
Boiler, hot water/steam radiators	11.5	Oil	21.4
Heating stove	7.3	Wood/wood pellets	8.2
Electric radiant and/or baseboard heating	24.1	Other (incl. dual systems and propane)	7.0
Heat pump	35.2		
Gas fireplace	1.4		
Other	6.4		

3.1.4. Energy expenditures for the home by housing conditions

Table 5 presents the mean annual spending on energy for the home, overall and by selected housing characteristics. Participants reported mean annual household spending of almost $3,500 on their energy needs per year. Overall, residential energy expenditures are higher for those living in single-detached houses, for those living in dwellings built before 1960, for homeowners compared to renters, and for those using oil or other sources of heating compared to electricity.

Table 5. Mean energy expenditure for the home by housing type and characteristics

	Annual mean energy expenditure for the home ($)		Annual mean energy expenditure for the home ($)
Overall mean (median)	3,470 (2,930)		
Housing type		**Tenure**	
Single-detached house	4,070	Renter	2,690
Semi-detached house a	2,820	Owner	3,760
Mobile home	2,710		
Apartment, converted house	2,530	**Type of energy use**	
Apartment, purpose built	2,490	Electricity	3,280
Year built		Oil	3,880
Before 1961	3,610	Other	3,680
1961-1995	3,470		
After 1995	3,300		

3.2. Energy Poverty

Different terminology is used to refer to energy poverty, such as fuel poverty, energy insecurity, or energy hardship. Despite the different terminology, there is a shared understanding that 'energy poverty' refers to a situation when a household cannot attain sufficient energy services needed to maintain healthy and comfortable ambient temperatures (referring to both warmth and cooling) and to power appliances (Bouzarovski and Petrova, 2015; Thomson et al., 2017). There are three types of indicators to measure energy poverty (Charlier & Legendre, 2021; Tirado Herrero, 2017). *Expenditure-based measures* evaluate the share of a household's income dedicated to energy costs. *Self-reported measures* refer to people's assessment of the thermal comfort and energy efficiency of their dwelling and their experience of financial strain linked to energy costs. *Direct temperature readings* are also used, but these are costly to implement. See Box 1 for a summary of some of the indicators used to measure energy poverty along with their limitations. While energy poverty is most often considered within the home, research and policy have started paying a greater attention to energy poverty as also encompassing the energy needed for transportation (Martiskainen et al., 2021; Robinson & Mattioli, 2020; Simcock & Mullen, 2016).

Box 1: Measuring Energy Poverty in the Home

Expenditure-based indicators of energy poverty evaluate the energy burden faced by households, i.e. the share of their income dedicated to energy expenditure, against absolute or relative thresholds. Two indicators are commonly used: the 10% threshold (absolute), and the 'high share of energy expenditure to income' (relative). A first indicator categorises households as facing energy poverty **if they spend more than 10% of their annual income on energy expenditures** (hereafter referred to as >10%). This measure was defined in 1991 in England, based on required expenditure when, at the time, this represented about twice the national median share of energy cost to income (Boardman, 1991). Since then, different jurisdictions, including in Canada, have relied on the 10% threshold in research and in policy. A second indicator categorises households in energy poverty **if their share of energy expenditure to household income is more than twice the national median share** (hereafter referred to as >2M). According to data from the Canadian Census, the national median share of energy expenditure to household income was 2.72% in 2016 (data for 2021 not yet released). Thus, households spending more than 5.44% of their annual income for home energy are considered to be facing energy poverty. This is close to the 6% threshold identified by the Canadian Urban Sustainability Planners (2019), adapting a measure previously developed by Rezaei (2017). In this report, we use 5.4% as the threshold for the 2M indicator. It is to note that this proportion is subject to change over time.

Strengths and limitations of expenditure-based indicators include (Thomson et al., 2017; Charlier & Legendre, 2021; Tirado Herrero, 2017):

- Expenditure-based indicators of energy poverty are commonly used because of their perceived objectivity and because they allow to quantify energy poverty.
- With an absolute threshold, energy poverty rates increase with rising energy prices. Relative thresholds may be subject to fluctuations over time, thus providing a more complex account of energy poverty and the difficulty of a 'moving target.'
- While the 10% threshold is not grounded in the specific context of a region under study, a relative threshold may represent hardship more accurately.
- Expenditure-based approach mostly rely on actual spending rather than on required spending to meet the need of a household. Considering actual spending may underestimate energy poverty rates because lower-income households often limit their energy use, therefore spending less on energy than would be required to maintain a warm (or cool) home.
- Expenditure-based measures cannot be computed for renters for whom utility bills are included in the rent.
- There is no agreement in the scientific literature as to how household income should be defined, i.e. before or after tax; before of after considering other housing costs such a rent or mortgage, and property taxes; whether income (and energy costs) should be equivalized to reflect household size.

Self-reported indicators of energy poverty refer to people's assessment of the thermal comfort and energy efficiency of their dwelling and their experience of financial strain linked to energy costs.

Strengths and limitations of self-reported indicators include (Thomson et al., 2017; Charlier & Legendre, 2021; Tirado Herrero, 2017):

- Self-reported indicators have the potential to capture the wider elements of energy poverty, such as its lived experience. These indicators are 'bottom-up' in that they are based on individual's experience of energy poverty and their perceived burden, on their assessments of adequate warmth and thermal comfort.
- Less complex to collect self-reported data than energy expenditure data
- Because they are subjective to individual circumstances, self-reported indicators are prone to measurement error, e.g., when households may not identify themselves as energy poor even though they may be characterised as energy poor under other measures.

In their 2019 survey, the Town of Bridgewater considered three core indicators for energy poverty: i) reporting spending >10% of household income on home and transportation energy; ii) difficulty affording energy for their home; and iii) difficulty affording energy for transportation. For a household to be considered in energy poverty, they had to report spending >10% of household income on home and transportation energy and difficulty affording energy for their home and/or for transportation. As per this definition, 38.5% of households in TOB were considered to be facing energy poverty in 2019 (Town of Bridgewater, 2019). While similar indicators were used for the present survey, they are not all directly comparable. We come back to this in section. 3.2.3.

This section of the report provides results that will be used to update TOB's energy poverty rate and to recommend metrics of energy poverty that the Town should use in the future. First, results for the various indicators chosen to assess energy poverty in the home are presented, followed by indicators to assess energy poverty in transportation.

3.2.1. Energy poverty in the home

Data from the survey allows for the assessment of energy poverty based on both expenditure-based and self-reported measures, with participants also reporting on the usual temperature inside their dwelling when at home during the day in the winter. Using different measures of energy poverty allows for a more complete portrait of the extent of energy poverty in the Town of Bridgewater given the advantages and disadvantages of each type of measure (see Box 1). Expenditure-based measures, while considered more objective, can underestimate the actual prevalence of energy poverty if households in energy poverty are intentionally limiting their energy use to decrease their spending. Self-reported measures consider a broader range of variables linked to energy needs, but they are more subjective to individual circumstances.

3.2.1.1. Prevalence of energy poverty using expenditure-based measures

In the survey, participants reported their annual household income before tax and their expenditures for electricity and heating. The share of energy cost to household income was computed before and after considering rent or mortgage. Computation of these measures was restricted to participants reporting an annual household income of at least $1000 (answers from 4 participants were excluded). Information needed to compute energy poverty thresholds was missing for about 14% of participants who did not report household income, energy cost, or other housing cost (n=70 participants). For 44% of renters (n=80 renters), electricity and/or heating are included in their rent. For these renters, it was thus impossible to compute expenditure-based measures of energy poverty. While these individuals are not included in the calculation of energy poverty using expenditure-based measures, they are included in analyses for self-reported measures of energy poverty.

Two expenditure-based measures of energy poverty were used, i.e., the >10% threshold and the >2M indicator, which sets the threshold at >5.4%. These are computed before and after considering rent or mortgage (Table 6). As per the >10% indicator computed before other housing costs, 17% of participants are experiencing energy poverty; this proportion increased to 23% after considering rent or mortgage. As for the >2M threshold, the proportion of participants in energy poverty is similar when computed before or after rent/mortgage, categorizing 38% of participants in energy poverty. These estimates are similar to the proportion of households in energy poverty in the Town of Bridgewater as measured using data on energy expenditures for the home, shelter-related costs, and household income from the 2016 Canadian Census (Table 6).

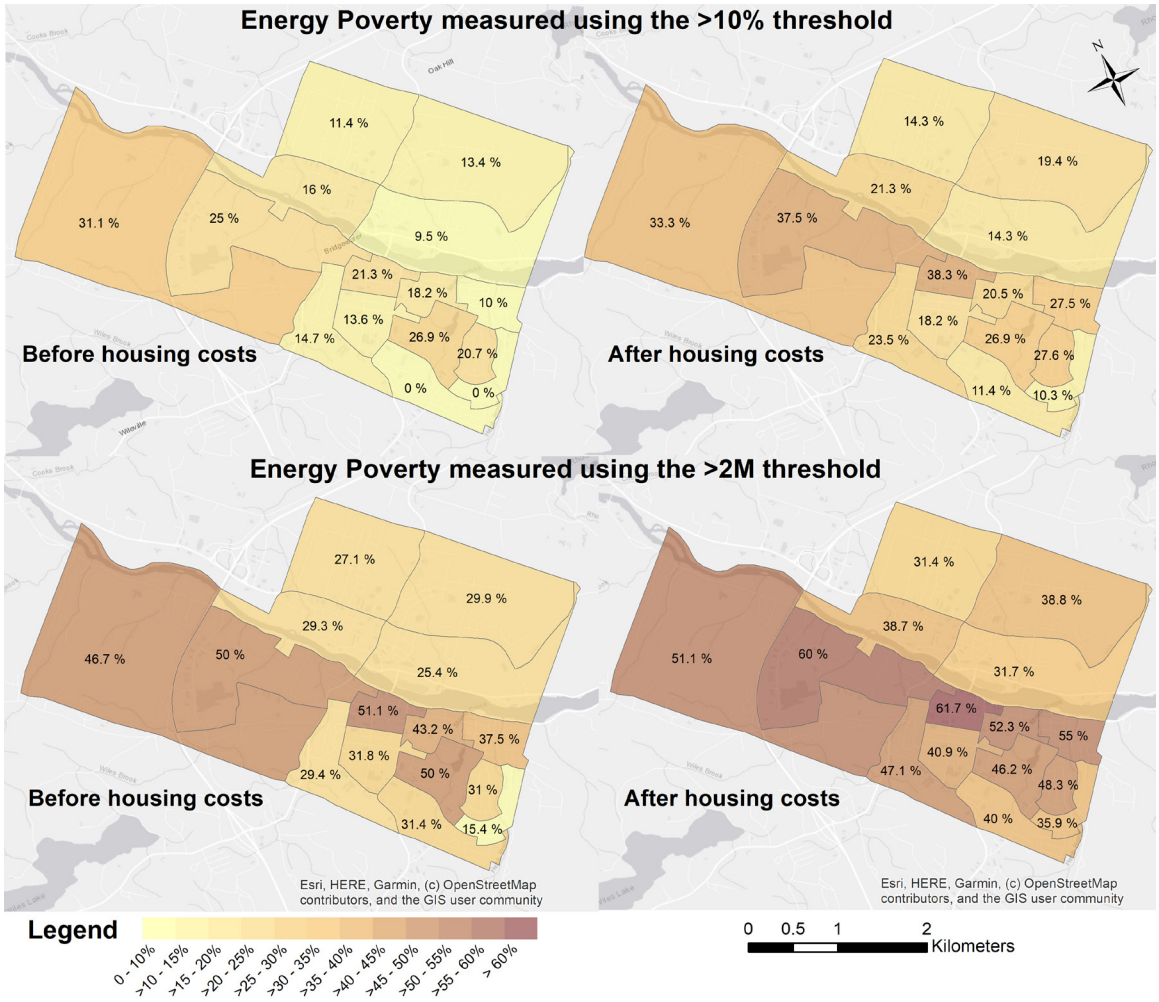
Table 6. Proportion of households in energy poverty, by different expenditure-based measures

	% of participants in energy poor households	% households in energy poverty as per the 2016 Census
>10%, before housing costs	17.2	15.0
>10%, after housing costs	22.5	22.5[a]
>2M, before housing costs	37.6	37.1
>2M, after housing costs	37.9	43.4[a]

[a] In the Census to which we have access, these figures are computed on household income after tax, and include property taxes and condo fees in housing costs.

Figure 2 presents variation in energy poverty at the level of dissemination areas in the Town of Bridgewater. Dissemination areas are small geographic units, composed of one or more adjacent street blocks with an average population of 400 to 700 persons. These are the smallest standard geographic areas for which all census data are disseminated. The Town of Bridgewater encompasses 15 dissemination areas. While the proportion of households in energy poverty varies according to the indicator of energy poverty selected, we see a similar spatial pattern across all maps, with a higher proportion of households in energy poverty west of the LaHave River.

Figure 2. Spatial distribution of energy poverty in the Town of Bridgewater



3.2.1.2. Prevalence of energy poverty using self-reported measures

This section presents responses to the questions related to thermal comfort in the dwelling during the last cold season (approximately October to April), including answers from all participants and notably from renters for whom utilities are included in their rent. Twenty percent of participants reported being unable to afford to keep their dwelling adequately warm (Table 7). Participants reported on the frequency with which they were able to keep their dwelling warm and the reasons keeping them from doing so. More than half of the participants (56%) reported always being able to keep their dwelling warm. However, 39% of participants reported that they were sometimes or often able to keep their dwelling warm, and a further 5% stated they were never or rarely able. Among the reasons keeping participants from being able to always keep their dwelling warm, the most common were issues of affordability, inadequate fit of windows and doors, energy inefficiency and insufficient thermal insulation, and lack of heating in some rooms.

Table 7. Proportion of households unable to keep their dwelling adequately warm

Cannot afford to keep dwelling adequately warm (%)	20.2
Frequency of ability to keep dwelling adequately warm (%)	
Always	56.1
Often	23.5
Sometimes	15.1
Never or rarely	5.4
Reasons a restricting participants from being able to always keep their dwelling warm (%)[a]	
To save on costs	75.0
Windows not tight or single-paned	55.4
Doors don't fit the frame properly	47.9
Insufficient thermal insulation of the dwelling	45.4
Household cannot afford heating needs	39.2
Low energy efficiency	38.3
Lack of heating system in some rooms	37.0
Dwelling too big for efficient heating	17.2
Lack of control of heating	16.8
Environmental concerns	15.1
Non-functional heating	14.3

[a] Reasons computed for the subsample of 43.9% participants reporting not being able to always keep their dwelling warm.

The World Health Organization (WHO) *Housing and Health Guidelines* recommends indoor temperatures are kept at, or above, 18°C (64.4°F) in common living areas, because exposure to cold indoor temperatures can lead to, or exacerbate, health issues (mostly respiratory and cardiovascular conditions) (World Health Organization, 2018). Fifteen percent of participants reported a usual indoor temperature below the WHO health guidelines (Table 8). Thinking back to the past cold season (October to April), 21% of participants said that their dwelling has been so cold that they shivered inside, 8% reported being able to see their breath inside, while 12% reported trouble sleeping because of the cold (Table 8).

Table 8. Other indicators of thermal discomfort

In the past cold season, participants reporting (yes vs. no; %)	
Average indoor temperature below WHO guidelines (<18°C) when at home	14.7
Shivering inside their dwelling because it was so cold	20.6
Seeing their breath inside their dwelling because it was so cold	7.6
Having a hard time sleeping because of the cold	12.0

3.2.1.3. Comparing expenditure-based and self-reported indicators of energy poverty

Table 9 compares the proportion of household characterised as facing energy poverty according to self-reported and expenditure-based measures. There is a stronger concordance between self-reported measures and the relative expenditure-based indicator (>2M) compared to the absolute indicator (>10%). For example, about 72% of participants reporting not being able to afford to keep their dwelling warm are considered as facing energy poverty, when measured with the >2M computed before housing costs vs. 38% for the 10% indicator. Considering housing cost does not greatly improve the concordance with the self-reported indicators for the >2M indicator. This suggests that the >2M indicator might be more closely related to the lived experience on energy poverty, as captured by the self-reported indicators.

Table 9. Comparing selected expenditure-based and self-reported indicators of energy poverty

	>10% before housing (%)	>10% after housing (%)	>2M before housing (%)	>2M after housing (%)
Cannot afford to keep dwelling warm	37.9	51.8	71.7	76.0
Juggled bills to pay for utilities	32.5	45.3	61.3	64.5
Ambient temperature < 18oC	27.0	35.1	54.0	58.0
Shivered inside dwelling	27.5	43.6	57.8	59.6

3.2.1.4. Satisfaction with affordability of energy bills, with energy efficiency of dwelling, and with ability to maintain a comfortable temperature

Participants were asked about their satisfaction with their energy bills, the energy efficiency of their dwelling, and with their ability to maintain a comfortable temperature in the winter and in the summer (Table 10). Over 40% and 28% reported being dissatisfied or very dissatisfied with, respectively, the affordability of energy bills and the energy efficiency of their dwelling. About 20% of participants reported being dissatisfied or very dissatisfied with their ability to maintain a comfortable temperature in the winter and in the summer.

Table 10. Satisfaction with affordability of energy bills, energy efficiency of dwelling, and with ability to maintain a comfortable temperature

Satisfaction with	Satisfied or very satisfied (%)	Neither satisfied or dissatisfied	Dissatisfied or very dissatisfied
Affordability of energy bills	42.2	19.4	38.4
Energy efficiency	51.7	20.3	28.0
Ability to maintain a comfortable temperature in the winter	68.3	12.1	19.6
Ability to maintain a comfortable temperature in the summer	68.4	13.8	17.8

3.2.1.5. Financial hardship related to energy use

Experience of financial strain as experienced by participants and their households in the year preceding the survey is presented in Table 11. Almost 35% indicated they had to juggle bills to pay for utilities, and 32% reported cutting back on groceries to pay for power and heating. Over twenty percent reported having difficulty paying their utility bills on time. Almost 20% reported cutting back on paying utilities to pay for food. Close to 10% of participants reported having days when their home was not heated because bills could not be paid and having had to skip or delay mortgage/rent payments, while 11% reported having received a notification from utilities companies threatening disconnection.

Table 11. Financial hardship experienced in the last year

Participants reporting (yes vs. no; %)	
Juggling bills to pay for utilities[a]	34.9
Cutting back on groceries to pay for utilities	31.9
Difficulty paying utility bills on time	23.3
Cutting back on paying utilities to pay for food	18.6
Receiving a notification from utilities company threatening to shut off utilities because of unpaid bills	10.5
Having days when the home was not heated because bills could not be paid	9.0
Skipping or delaying a mortgage or rent payment	8.8
Utilities disconnected because bills could not be paid on time	3.6

[a] Utilities refers to power and heating.

3.2.1.6. Energy expenditure and energy poverty by housing conditions

Table 12 presents different measures of energy poverty by tenure and housing characteristics. Among renters, 22% are in energy poverty as per the >10% threshold, compared to 19% of homeowners. Although higher with the >2M threshold, the prevalence of energy poverty is similar between renters and homeowners at around 40%. When considering self-reported measures, more renters than homeowners are facing energy poverty. One third of renters (compared to 15% homeowners) are unable to keep their dwelling warm and 46% of renters reported juggling bills in the past year to pay for utilities (vs. 29% homeowners). Over 25% of renters reported an ambient indoor temperature below WHO guidelines (vs. 10% of homeowners) and almost 30% of renters reported shivering inside their home in the past cold season (vs. 17% of homeowners).

Table 12. Proportion of participants by different housing indicators, in energy poverty measured using expenditure-based and self-reported measures

	% of participants in energy poverty by different indicators					
	>10%	>2M	Cannot afford to keep dwelling warm	Juggled bills to pay utilities	Ambient temp < 18oC	Shivered inside dwelling
Tenure						
Renter	22.2	41.6	26.1	45.9	26.0	28.0
Owner	18.8	44.0	17.1	29.0	9.6	16.6
Housing type						
Single-detached house	20.2	47.0	20.2	31.0	10.7	20.0
Semi-detached house	21.3	44.8	28.6	37.3	19.9	22.8
Mobile home	23.2	44.9	20.3	38.4	10.8	16.5
Apartment, converted house	20.5	47.5	28.9	44.7	29.1	30.5
Apartment, purpose built	11.4	16.7	9.0	35.5	20.8	16.2
Main source of heating						
Electricity	17.0	40.6	17.8	32.1	14.4	17.3
Oil	25.2	51.3	29.0	43.4	20.8	26.0
Other	19.7	43.5	18.2	34.5	10.0	26.9
Year built						
Before 1961	24.9	57.4	24.0	41.6	21.6	21.6
1961-1995	20.7	45.1	21.9	34.3	15.3	24.1
After 1995	11.7	22.8	12.4	27.8	7.07	12.6

When comparing the prevalence of energy poverty by housing type, the highest levels of energy poverty are often observed for participants living in apartments in converted houses and in dwellings using oil as their main source of energy. Levels of energy poverty for households that used electricity as their main source of energy were lower than those using oil across all expenditure-based and self-reported metrics. People in older dwellings (built prior to 1961) were more likely to experience energy poverty than those in newer dwellings (built after 1995).

In Table 13, self-reported indicators of energy poverty are presented for renters for whom utilities are included vs. not included in their rent (with utilities here referring to electricity and/or heating included in the rent). For all indicators, the prevalence of energy poverty is higher among renters having to pay for their utilities. That said, a significant proportion of renters for whom utilities are included (fully or partly) in the rent, report difficulty in keeping the dwelling warm, low ambient temperature, shivering inside the dwelling, dissatisfaction with energy efficiency of the dwelling and with their ability to maintain comfortable temperature in the winter and in the summer. This may be because renters do not have control over when the heating is turned on or off in the fall and the spring.

Table 13. Self-reported measures of energy poverty for renters with utilities included vs. not included in their rent

	Renters for whom utilities are:	
Participants in energy poverty according to'	not included in rent (%)	included in rent [a] (%)
Inability to keep dwelling warm most of the times [b]	37.1	25.0
Ambient temp < 18°C	31.1	19.5
Shivered inside dwelling	34.8	19.6
Dissatisfaction with energy efficiency [c]	44.8	15.6
Dissatisfaction with ability to maintain a comfortable temperature in the winter [c]	37.8	15.4
Dissatisfaction with ability to maintain a comfortable temperature in the summer [c]	28.1	19.1

[a] At least one utilities included in rent.
[b] Compares participants reporting sometimes, rarely, or never being able to keep their dwelling warm, compared to those reporting always or often being able.
[c] Compares dissatisfied or very dissatisfied vs. neither dissatisfied or satisfied, satisfied, or very satisfied.

3.2.1.7. Strategies to increase thermal comfort and to limit energy use

To increase the thermal comfort of their dwelling, many participants mentioned using different strategies to stay warm (Table 14). Strategies most frequently reported were the use of a space heater as an alternative source of heating, wearing extra layers of clothing and drinking more hot drinks to stay warm, and placing towels at the bottom of doors or hanging several curtains on windows to prevent drafts.

When asked about strategies to limit energy use in order to decrease energy costs (Table 15), more than half of participants reported turning off the lights when they would have preferred having them on, using less (or no) hot water when washing clothes, turning down the heat, and heating some rooms only. At least a quarter of respondents indicated they heated their dwelling more when children were home or when having visitors. During the cold season, about 5% of participants reported spending more time in other locations than their dwelling to escape the cold. In contrast, in the warm season, 21% reported leaving their dwelling to escape the heat. During the cold season, participants reported going to friends or relative's homes or to public places like the mall or the library. In the warm season, people reported going to the beach, to public places, to a park, to friends or relative's homes, to the municipal pool, or driving around in their car with the air conditioning on (results not tabulated).

Table 14. Methods implemented to increase thermal comfort

Using additional source of heating (%)	
Space heater	27.0
Oven or stove	11.5
Electric blankets	18.5
Hot water bottles	13.3
Other ways of keeping warm (%)	
Putting on more layers of clothing	70.0
Having more hot drinks than usual	29.9
Taking multiple hot showers	10.6
Measures implemented to improve warmth in the dwelling (%)	
Putting plastic on windows	16.2
Using tape to cover holes in windows or doors	13.8
Hanging several curtains or blankets on windows	17.1
Hanging blankets on door frames	9.0
Laying blankets or extra carpets on the floor	13.8
Placing towels, blankets, or clothing at the bottom of doors	23.8

Table 15. Strategies to limit energy use in order to decrease costs

Strategies used (%)	
Using less (or no) hot water when washing clothes	57.9
Turning off the lights, even when prefer having them on	57.5
Turning down the heating, even when prefer to keep it higher	53.7
Heating some rooms only	52.4
Heating more when there are visitors	35.3
Taking shorter showers to not use too much hot water	33.0
Turning off the heating, even when prefer having it on	25.7
Heating more when children are home (for participants in households with children)	58.3

3.2.2. Energy poverty in transportation

The following section addresses energy poverty in transportation, situating it in the context of the mobility habits, costs, and needs of survey participants. More than 88% of respondents used a car, either as driver or passenger, as their primary mode of transportation (Table 16). Over 80% of participating households either owned or leased a vehicle, and 88% had a valid driver's license (results not tabulated). About 12% of participants reported active modes of transportation (walking/cycling) or public transportation as their most common mode of transportation.

Table 16. Modes of transportation

Most common mode of transportation [a] (%)	
Car (as driver or passenger)	87.8
Public transportation	3.7
Active transportation	8.4

[a] Car also includes the 9 participants reporting 'taxi' as their most common form of transportation; active transportation includes walking, cycling, wheelchair, walker, and disability scooter.

When asked whether they could get to places out of walking distance, most participants (85%) reported being able to get to those places without help, while 10% said they were able to get around, but with help. Five percent reported not being able to get to places out of walking distance (Table 17). Considering their daily need for public transportation, most participants (69%) considered that they did not have a need for public transportation services, whereas 16% reported a moderate to high need for public transportation (Table 17). For those reporting a need for public transportation, 21% considered that their needs were fully met', 35% that their needs were partially met, and 16% that their needs were not met. Still, 28% reported not using public transportation.

Table 17. Ability to get to places outside of walking distance and need for public transportation

Participants' ability to get to places outside of walking distance (%)			
Able, without help			85.1
Able, with help			9.6
Unable			5.3
Need for public transportation services (%)		**(Extent to which needs are met by public transportation services for participants reporting low, moderate or high need for public transportation %)**	
High need	5.0	Fully met	21.1
Moderate need	10.5	Partially met	35.1
Low need	15.5	Not met	16.2
No need	69.0	Does not use public transportation	27.6

When considering energy spending for transportation (car, public transportation, and cost), participants reported spending on average $2250 per year (Table 18). Yearly annual mean spending ranged from $630 for those reporting mainly using public transportation to $2410 for car users. People reporting mainly using active modes of transportation reported spending $1200 annually on transportation. This likely represents the amount spent to cover other costs of transportation.

Table 18. Mean annual cost of transportation overall and by mode

Annual cost of transportation by most common mode of transportation ($)			
All modes of transportation	2,250	Public transportation	630
Car (as driver or passenger)	2,410	Active transportation	1,200

Almost 30% of respondents reported difficulty in affording their transportation needs in the past year, and 62% reported having avoided trips to lower costs associated with transportation (Table 19). About 35% of participants are in households spending more than 10% of household income on energy for the home and for transportation.

Table 19. Energy poverty in transportation

Energy poverty in transportation (yes vs. no; %)	
Had difficulty affording transportation needs in the last year	28.7
Avoided trips in the last year to lower transportation costs	61.7
Spent more than 10% of household income on home energy and transportation	34.9

Energy poverty was higher for participants mainly using public transportation or the car as main modes of transportation (Table 20). When further considering energy spending for the home and for transportation, participants reported spending almost $5,800 per year (Table 21). Participants in single-detached and semi-detached dwellings reported a noticeably higher annual energy spending compared to those living in other dwelling types. Annual energy spending for the home and for transportation was also higher for homeowners compared to renters.

Table 20. Mode of transportation by expenditure-based measures of energy poverty

	>10%	>10%, incl. transportation cost	>2M	Difficulty affording transportation needs
Car	18.5	40.8	42.3	27.8
Public transportation	38.8	46.5	51.9	49.7
Active transportation	27.0	33.5	52.3	28.3

Table 21. Mean annual energy spending for the home and for transportation, by housing type and tenure

	Annual mean energy expenditure for the home and for transportation ($)
Overall mean (median)	5,760 (4,900)
By housing type	
Single-detached house	6,600
Semi-detached house	5,560
Mobile home	4,420
Apartment, converted house	4,230
Apartment, purpose built	4,430
By tenure	
Renter	4,380
Owner	6,270

3.2.3. Difference between metrics of energy poverty in this report and previous TOB assessments

There are some discrepancies between the rates of energy poverty reported in this report vs. those produce by TOB in 2019. These discrepancies can be attributable to differences in how energy poverty is measured, as illustrated in Table 22. As explained earlier, in their 2019 survey, TOB considered household as facing energy poverty if they met a combination of three core indicators: reported spending >10% of household income on home and transportation energy and reported difficulty affording energy for their home and/or for transportation (Town of Bridgewater, 2019). Considering this, 38.5% of households in TOB were considered to be facing energy poverty in 2019 (Town of Bridgewater, 2019). When we created a similar indicator using the current survey data, we obtained an estimate of 25.5% participants living in households facing energy poverty.

Table 22. Differences in the measure of energy poverty in the survey, using data from the Census, and by the Town of Bridgewater

TOB Core indicators	2019 TOB survey	2022 Bridges Survey	2016 Census
> 10%	Self-reported a	Ratio computed	Ratio computed
Home + transportation	45.3%	34.9%	
Home only	Not available	17.2%	15.0%
Household income	Not available	Self-reported[a]	From income tax files
Cost of energy at home	Not available	Self-reported[a]	Self-reported[a]
Cost of energy for transportation	Not available	Self-reported[a]	Not available
Difficulty affording home energy cost	Self-reported[a]	Self-reported[a]	Not available
	37.4%	20.2%	
Difficulty affording transportation energy cost	Self-reported[a]	Self-reported[a]	Not available
	25.5%	28.7%	
Energy poverty as per TOB primary indicator: difficulty affording energy for the home and/or for transportation and spending >10% of income on home and transportation energy	38.5%	25.5%	Not available

[a] Participants to the 2019 TOB survey were asked to self-report whether their households spent > 10% of after-tax income on energy for the home and for transportation.

In the current survey, participants reported their expenditures for energy at home and in transportation and their annual household income *before* tax. Then, using this information, a ratio was computed, and the threshold set at >10%. The variables used for measuring energy poverty are similar to those used in the Census, with the exception that the Census contains household income before and after tax as reported in income tax files. In the measure used by the Town of Bridgewater, households were asked to report if they spent more than 10% of their income after tax on energy. Because data on energy expenditure and household income were not collected, a ratio cannot be computed. There was also a difference in the formulation of the question on difficulty in affording home energy cost between the surveys. It is also possible that differences in estimates arise because of the different socioeconomic profile of participants to the 2019 TOB survey and to the survey conducted in 2022.

3.3. Health and Well-Being

Table 23 describes how participants rated their general and mental health, the amount of stress in their life, and their satisfaction with life. More than 20% of participants reported their general health to be fair or poor, whereas 27% reported fair or poor mental health. Considering the amount of stress in daily life, 26% indicated their daily life was either quite a bit or extremely stressful. Close to 75% of participants reported being satisfied with their life; around 16% reported being either dissatisfied or very dissatisfied with their life.

Table 23. Health, well-being, and life satisfaction

Health and well-being indicators (%)			
Self-rated general health		**Self-rated mental health**	
Excellent or very good	43.4	Excellent or very good	43.4
Good	35.1	Good	29.8
Fair or poor	21.5	Fair or poor	26.8
Amount of stress in daily life		**Life satisfaction**	
Not at all or not very stressful	29.2	Satisfied or very satisfied	73.6
A bit stressful	44.5	Neither	10.4
Quite a bit or extremely stressful	26.3	Dissatisfied or very dissatisfied	16.4

The association between various expenditure-based and self-report indicators of energy poverty was explored in regression models that considered the age and gender of participants (these analyses are not weighted). Table 24 presents the odds (or the risk) of participants facing energy poverty (measured using selected expenditure-based and self-report indicators) to report poor general health, poor mental health, stress in daily life, and lower life satisfaction. The odds are obtained from logistic regression models that account for the age and gender of participants (these analyses are not weighted). The 95% confidence interval tells us that we can be confident, with a 5% margin of error, that the 'true' value of the odds is within the confidence interval. The association is statistically significant if the confidence interval does not include the value of 1.

Overall, there is a higher risk of rating one's general and mental health as poor, of reporting higher stress in daily life, and lower life satisfaction among participants facing energy poverty, irrespective of the measures of energy poverty used. All associations are statistically significant. For example, compared to participants not facing energy poverty, participants categorized as energy poor per the 10% indicator are more than twice as likely to report poor general health and more than three times more likely to report their daily life to be quite a bit or extremely stressful. Among participants reporting shivering inside their dwelling, the risks of reporting poor general health and higher stress were 3.78 and 4.54 times higher, respectively, compared to those who did not report shivering inside their dwelling.

Table 24. Association between expenditure-based and self-reported indicators of energy poverty, health, and well-being [a]

	Self-rated poor general health	Self-rated poor mental health	Daily life quite a bit or extremely stressful	Neither or not satisfied with life
	Odds ratio (95%CI)	Odds ratio (95%CI)	Odds ratio (95%CI)	Odds ratio (95%CI)
>10%	2.42 (1.42, 4.12)	2.50 (1.47, 4.24)	3.31 (1.92, 5.71)	2.19 (1.32, 3.65)
>2M	2.47 (1.51, 4.05)	2.41 (1.50, 3.85)	2.44 (1.50, 3.95)	2.34 (1.48, 3.70)
Juggled bills to pay for utilities	3.12 (1.95, 4.99)	3.63 (2.35, 5.62)	3.80 (2.44, 5.91)	3.05 (1.98, 4.69)
Shivered inside dwelling	3.78 (2.31, 6.18)	4.21 (2.63, 6.74)	4.54 (2.81, 7.32)	3.11 (1.97, 4.93)

[a] Odds ratios and 95%CI intervals computed using logistic regression models. Models are adjusted for age and sex. Weights are not applied.

Because the associations between energy poverty and health are cross-sectional (both energy poverty and health are measured at the same time in the survey), we cannot say that energy poverty *causes* poor health. Longitudinal data is needed to make such a claim. Also, because other factors can influence the association between energy poverty, health, and well-being (for example other socioeconomic characteristics of the participants, the condition of their dwellings, etc.), these results should be interpreted with caution. More analysis is required to model the risk of energy poverty for health. For the time being, these results indicate a statistically significant association between energy poverty, health and well-being.

4/ Discussion and Conclusion

Over 500 residents of Bridgewater participated in the survey on energy use, housing, and well-being. This is a resounding success since this represents more than 10% of the town's households. This level of participation was achieved because of the many recruitment strategies deployed, the support from the Town of Bridgewater, and help from many community organizations, businesses, and churches.

Overall, results confirm that an important proportion of households in the Town of Bridgewater are in energy poverty as per expenditure-based indicators, with 17% of survey participants living in households spending more than 10% of their annual income of energy for the home. Close to 40% of participants were in households whose ratio of energy cost to household income is more than twice the national Canadian median share (>5.4%). When considering self-reported measures of energy poverty related to thermal (dis)comfort, financial hardship, and transportation needs, the social implications are even more visible. Around 20% of participants reported being unable to always or often keep their dwelling warm or to afford to keep their dwelling adequately warm. Almost one in three indicated they had to juggle bills to pay for utilities or reported cutting back on groceries to pay for power and heating in the past year. Concerning transportation, 29% reported difficulty affording transportation needs in the past year.

Many residents in Bridgewater are facing energy poverty, with important implications for everyday life

The highest levels of energy poverty were often observed for participants living in apartments in converted houses, in dwellings using oil as their primary source of energy for heating, and in dwellings built prior to 1961. Energy poverty appears to be higher for renters compared to homeowners, especially when self-reported measures of thermal comfort and financial hardships are used. Energy poverty also appears to significantly compromise the health and well-being of those experiencing it. Twenty percent of participants said that their dwelling had been so cold in the past cold season that they shivered inside; 8% reported seeing their breath inside because their dwelling was so cold. Fifteen percent reported an average indoor temperature below the World Health Organization *Housing and Health Guidelines* of 18°C. Participants in energy poverty were significantly more likely to report poorer general and mental health, higher stress, and lower satisfaction with life.

Results from the survey indicate that **many residents in Bridgewater are facing energy poverty, with important implications for everyday life**. The proportion of participants experiencing energy poverty varied according to the measure used, which points to the **importance of using multiple indicators in combination to quantify energy poverty**. While there is some overlap between the prevalence of energy poverty as measured by the survey results and the previous TOB estimate of energy poverty, there are discrepancies due to differences in measurement.

In what follows, recommendations are formulated for measuring energy poverty using a combination of indicators and for disentangling the measure of energy poverty from the home and from transportation. These recommendations are formulated based on the results from the survey and on international scientific evidence, keeping in mind there is yet no consensus on how energy poverty should be measured in the Canadian context. Recommendations for future research are also presented.

4.1. Recommendations on the measure of energy poverty

Recommendation 1. Use the 2M threshold instead of the 10% threshold as the expenditure-based metric of energy poverty. As per the 2M threshold, households spending more than 5.4% of their household income are considered to be facing energy poverty. This indicator helps situate energy poverty faced by residents in the TOB relative to the Canadian share of energy expenditure to household income. As indicated in this report and elsewhere (Riva et al., 2021), this measure is less influenced by adjustment for housing costs than in the 10% threshold. It is also more closely aligned with the lived experience of household facing energy poverty. Using this metric requires collecting data on both energy cost and household income (if possible before and after tax). Comparison with Census data for the Town of Bridgewater is possible every 5 years (when the Census is conducted).

Recommendation 2. Continue measuring energy poverty for the home using the self-reported indicator *Difficulty in affording to keep the home adequately warm*. This self-reported indicator informs on the lived experience of energy poverty. It is similar to the one included in the EU Survey on Income and Living Condition and can provide a comparison point.

> **Recommendation 2.1. Consider other self-reported indicators of energy poverty for their comparability with other sources of data.** For example, difficulty in paying utility bills and experience of disconnection from utilities are comparable to metrics used in the United States to assess energy security. Satisfaction with energy efficiency of the dwelling and with the ability to maintain comfortable temperature in the winter and in the summer, are indicators included in the Canadian Housing Survey and can serve to make national comparison.

Recommendation 3. Focus the primary energy poverty indicators on home energy poverty only, and remove transportation fuel poverty from the figures. This is important because conflating energy poverty in the home and in transportation may mask results of housing-related intervention. For example, the Coordinated Access System and the Housing Energy Management System of *Energize Bridgewater* are likely to have an impact on home energy poverty first.

Recommendation 4. Continue monitoring the transportation dimension of energy poverty. This is important because transportation accounts for an important share of household energy consumption and budget. Some households may in fact experience a 'double energy vulnerability,' being exposed to both domestic- and transportation-related energy poverty. Data should be collected on monthly or annual expenditure for transportation and Bridgewater should continue using the self-reported indicator *Difficulty in affording transportation needs*.

Recommendation 5. Continue monitoring energy poverty using a range of metrics. This is important because metrics of energy poverty have yet to be validated or developed for the Canadian context. While developed in another context, the absolute expenditure-based 10% threshold should continue to be monitored by Bridgewater since it is easily interpretable.

4.2. Recommendations for future research

Recommendation 6. Conduct further research on energy poverty in Bridgewater, including a repeat of the community-wide survey at 2-year intervals, and a cohort study following clients of *Energize Bridgewater* overtime. This research is needed to assess the impacts of *Energize Bridgewater* on energy poverty and well-being among clients, and to assess the overall impacts of *Energize Bridgewater* on energy poverty and well-being in the Town.

Recommendation 7. Assess the scalability and transferability of *Energize Bridgewater* to other communities. *Energize Bridgewater* is a multi-component, community-wide program aiming to improve energy security for those involved in the program, and for the community as a whole. This program is unique in Canada. Assessing the context and process of implementation of *Energize Bridgewater* is needed to understand the factors and conditions needed, and the feasibility, to scale and transfer this program to other settings.

4.3. Conclusion

This is the first in-depth and targeted study on energy poverty in Canada. While results are specific to Bridgewater, Nova Scotia, findings illustrate the prevalence of energy poverty and its ramifications on everyday life. Energy poverty needs to be brought to the forefront in policy and academia to ensure an equitable energy transition. Paying attention to energy poverty is further warranted in the context of various crises such as extreme weather events that can compromise access to energy in the case of storms, floods, and forest fires, or increase energy use when cooling is needed during heatwaves. The COVID-19 pandemic and stay-at-home measures likely had an impact on energy use at home. In the survey, for example, 38% of participants reported that the pandemic increased their overall energy consumption at home in the past year.

Some limitations were encountered through this data collection and analysis. Firstly, there is a discrepancy in the socioeconomic profile of survey participants compared to the population of Bridgewater. While participants were randomly recruited, the survey was not designed to be representative of the Town of Bridgewater. Therefore, even if weights are applied to the data analysis, results cannot be understood to be fully representative of the Town of Bridgewater. Namely, when conducting the door-to-door recruitment, it was much harder to reach people living in apartments where front doors were not always publicly accessible. Despite targeted efforts, there was an underrepresentation of men among survey respondents.

There were also limitations related to the computation of expenditure-based measures of energy poverty. In the survey questionnaire, participants were asked to provide very specific quantifications of their household income and energy expenditures. There was a lot of variability in how people could report this information to account for variability in energy billing (e.g., monthly, bi-monthly, yearly). Missing values, approximations, and 'don't knows' can bias these indicators. In addition, expenditure-based indicators were not computed for renters for whom utilities bills are included in their rent (44% of renters). As highlighted in the recommendations, as the Town of Bridgewater continues monitoring energy poverty, it will be important to use various metrics to tap into the different dimensions of energy poverty, i.e., the burden of energy bills on household finances and the impacts of energy hardship of daily life.

These are the first sets of results from the BridgES study. Findings suggest that *Energize Bridgewater*'s efforts to alleviate energy poverty directed to renters, to those living in apartment in converted homes, in older dwellings, and to households heating with oil could potentially have the largest impacts in reducing energy poverty. More research will be conducted to better understand the strategies used by households to cope with energy poverty and the health and well-being impacts of energy poverty in the Town. In the coming years, the team will aim to recruit clients of *Energize Bridgewater* to assess the effectiveness of the program in improving living conditions, reducing energy poverty, and improving well-being in Bridgewater.

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