Chapter 3

Poverty and Energy Poverty: Who Suffers?

3.1 Introduction

Trends in energy poverty can be explored quantitatively using expenditure-based indicators that quantify the burden of securing access to energy services (such as cost of services as percentage of income), using subjective indicators of ability to maintain thermal comfort. The former set, often grounded in actual expenditures, purports to capture a more 'objective' measure of energy burdens, but excludes or discounts the severity of the experience of those who are purposely under-heating their homes in cold weather in order to manage their bills. The latter set of indicators will capture the subjective experience of energy poverty more accurately, but may make comparisons between households with different attitudes and priorities more complicated. In order to account for the challenges of using either set of indicators, some (Healy, 2004, most famously) have created indices that combine both kinds of indicators. However, even with such indices there are questions around the relative weight of each set. More importantly, the creation of such indices is limited by the availability of data. While, the European Household Panel (ECHP) Survey provides access to variables used for both class of indicators for all member states, no such comprehensive survey exists in Canada. Statistics Canada does collect information in its Survey of Household Spending (SHS) that would enable the use of expenditures based indicators, as well as documenting certain key characteristics of the dwellings (such as need for major repairs), but unfortunately does not include any subjective indicator of the ability to maintain thermal

comfort. As such, explorations of trends in Energy poverty are limited to the expenditure based class of indicators.

However, data for Northern territories even in the Survey of Household Spending is often unreliable and not comparable to southern provinces. This places another limitation on quantitative explorations of energy poverty in Canada, particularly since energy carriers are often more expensive in the North and the need for heating more urgent. Furthermore, the SHS does not provide data for First Nations communities, many of whom (particularly those in northern regions of the Canadian provinces) also face much higher energy burdens, due to the higher costs of energy service provision. As a result of these exclusions, any quantitative exploration of energy poverty trends in Canada is fundamentally limited, not only by the fact that subjective measure of the experience is available, but more importantly by the fact that the experience of those who struggle most with high burdens of accessing energy services are systematically excluded from the data. Nonetheless, an analysis of the available data would shed light on trends across the provinces, and would allow starting a more robust conversation on energy poverty in Canada. Thus, in this chapter, I use an expenditure-based measure of energy — namely, the percentage of household income spent on meeting basic household energy needs— to explore broad patterns associated with energy poverty across the Canadian provinces.

3.2 Defining energy poverty

For this purpose, I use the 2011 cycle of the Survey of Household Spending (the last version I had access to at the time of analysis), and more specifically the following variables within it to construct an expenditure-based measure of energy poverty: net annual household income, annual household expenditure on heating and annual household expenditure on electricity. I calculate a percent expenditure value documenting each household's energy burden in the sample. Then using the weights correcting for demographic and geographical representation across Canada, I calculate median percent expenditure values for Canada, as well as individual provinces. Table 3.1, below, summarizes these values.

Using this national median value, an energy poverty threshold at twice the median household expenditure can be established at 5.8%. By this definition, 21% of the Canadian households (or 2.8 million households) are in energy poverty. Establishing a threshold using this method, essentially, treats energy poverty as a relative poverty phenomenon, contending that if a household is spending more than twice the median expenditure as percentage of income value, they're experiencing disproportionately high en-

Province	Median percent expenditure	Standard error
Newfoundland and Labrador	4.8%	0.1%
Prince Edward Island	4.9%	0.2%
Nova Scotia	4.6%	0.1%
New Brunswick	4.4%	0.1%
Quebec	2.6%	0.1%
Ontario	2.9%	0.1%
Manitoba	2.7%	0.1%
Saskatchewan	3.6%	0.1%
Alberta	2.9%	0.1%
British Columbia	2.4%	0.1%
Canada	2.9%	0.0%

Table 3.1: Median expenditure on household energy services as percentage of net income (by province)

ergy burdens. Of course, the question of how much above the median value should be thought of as too much and whether 200% above this median values is high enough will always receive an answer that is seen as arbitrary. I use twice the median value to be consistent with how the classic 10% threshold that UK until recently used as definition for energy poverty is said to have been derived and to stay consistent with other quantitative studies of energy poverty.

Given this threshold the rates of energy poverty in each province as percentage of provincial population, as well as numbers of households in energy poverty are summarized in Table 3.2. It is important to mention that this method of defining the threshold of energy poverty yields a value several percentage points lower than the 10% value that studies from both the Canadian Centre for Policy Alternatives(Lee et al., 2011) and the Fraser Institute (Green et al., 2016) have used (Both organizations seem to have taken the old UK definition without exploring what an appropriate definition should be in the Canadian context). As a result, the estimates of the number of households experiencing energy poverty are higher in this study — at least relative to the Fraser Institute report which estimates 7.9% of Canadian households to be in energy poverty in 2013, where this study finds 21% of Canadian households to be in that category (Green et al., 2016) [1]. The values from Table 3.2 suggest that among the southern provinces, those in the Maritimes have the highest rates of energy poverty (winter heating in these provinces tends to be reliant on more expensive forms of energy, such as fuel oil). Quebec and BC had at the time, the

lowest rates of energy poverty in 2011.

Province	Percentage of total population in EP	Number of households in EP	Standard error of number of EP
Newfoundland and Labrador	39%	81,619	3,323
Prince Edward Island	39%	23,011	1,287
Nova Scotia	36%	141,848	5,978
New Brunswick	36%	112,425	4,460
Quebec	15%	504,216	33,315
Ontario	23%	1,151,561	64,736
Manitoba	19%	89,971	5,823
Saskatchewan	28%	117,323	6,255
Alberta	22%	312,130	19,539
British Columbia	16%	297,415	19,191

Table 3.2: Energy poverty rates (percentage of population in energy poverty) and numbers in each province

3.3 Energy poverty and income poverty

Before expanding on this rough geographical exploration of energy poverty trends, I want to spend some time exploring the ways in which energy poverty is different from and similar to (income) poverty. Of course, conceptually, income poverty and energy poverty are related by virtue of the fact that people with lower incomes may struggle with paying for food, shelter and energy. But energy poverty, especially when defined in the way that I have defined it in this chapter, is not only a function of income and price of energy carriers such as electricity and natural gas, but also the energy efficiency of the house and its appliances. What ultimately determines the how much a household spends on energy is a combination of energy prices (themselves a function of many other factors, including the types of networks of infrastructure they are secured through, as well as regulatory environments), weather, household occupancy patterns, energy needs of the inhabitants, and the efficiency of the house and its appliances in converting a unit of energy to desired services such as heating, cooling, refrigeration, etc. This last variable, as this section will demonstrate, often means that not all those who are in poverty by income measures will

[1]The CCPA study never explicitly suggest a methodology for estimating numbers of households in energy poverty, but instead quote the findings of other studies (McEachern and Vivian, 2010, for example) which seem to use a 10% threshold.

suffer from disproportionately high energy burdens, and conversely, that some households who are not considered in poverty by income measure will be facing high energy burdens.

While Canada has no official definitions of poverty, many anti-poverty advocates use Low Income Cut-off (LICO) value -one of the poverty measures calculated by Statistics Canada- to establish poverty lines. LICOs are calculated for different family sizes and different sizes of towns and cities and are essentially an estimate of income thresholds at which households would spend 20 percentage points more than the average family on food, shelter and clothing. Those would need to spend more than 20% above the average family on securing these essentials of life are deemed low-income (Statistics Canada, 2015b). LICOs are considered a hybrid of absolute and relative measures of poverty: the focus on essentials of food, shelter and clothing (shelter includes energy and water) has echos of absolute measures, while in positioning the percentage of income spent on these essentials relative to an average household it positions itself closer to the relative measures. In this analysis, I also use the LICOs for designating households as above or below a poverty threshold. Table 3.3, below, summarizes the before tax low income cut-offs for 2011.

Size of family unit	Rural areas outside CMA or CA	CA Less than 30,000 inhabitants	CA Between 30,000 and 99,999 inhabitants	CMA Between 100,000 and 499,999 inhabitants	CMA 500,000 inhabitants or more
1 person	16,038	18,246	19,941	20,065	23,298
2 persons	19,966	22,714	24,824	24,978	29,004
3 persons	24,545	27,924	30,517	30,707	35,657
4 persons	29,802	33,905	37,053	37,283	43,292
5 persons	33,800	38,454	42,025	42,285	49,102
6 persons	38,122	43,370	47,398	47,692	55,378
7 or more persons	42,443	48,285	52,770	53,097	61,656

Table 3.3: Before tax LICO values for the year 2011 (Statistics Canada, 2015a)

Having designated households as above or below an energy poverty threshold, as outlined in section 3.2, as well as having designated them as falling above or below low income cut-offs, as discussed above, I construct a two by two matrix of income and energy poverty which would designate households position in terms of both income and energy poverty. Table 3.4 summarizes the percentage of the

(southern) Canadian population that falls within each cell of this matrix.

	Not in energy poverty	In energy poverty
Not low income	68.6%	13.4%
low income	10.5%	7.5%

Table 3.4: Percentage of Canadian population struggling with poverty and/or energy poverty

As this table suggests, almost 70% of Canadians were neither low-income nor energy poor in 2011. However, 13% of the population experienced energy poverty, but not income poverty, where about 11% experienced income poverty but not energy poverty. Furthermore, there is only a 7% overlap between the two categories of low-income and energy poor. In order to further demonstrate the difference between the two categories (and to address concerns over LICO being a conservative measure), Figure 3.1 categorizes those who experience energy poverty and those who don't according to the distance in their income from the poverty line. As this figure suggests, most households in energy poverty have incomes more than 30% above the poverty line.

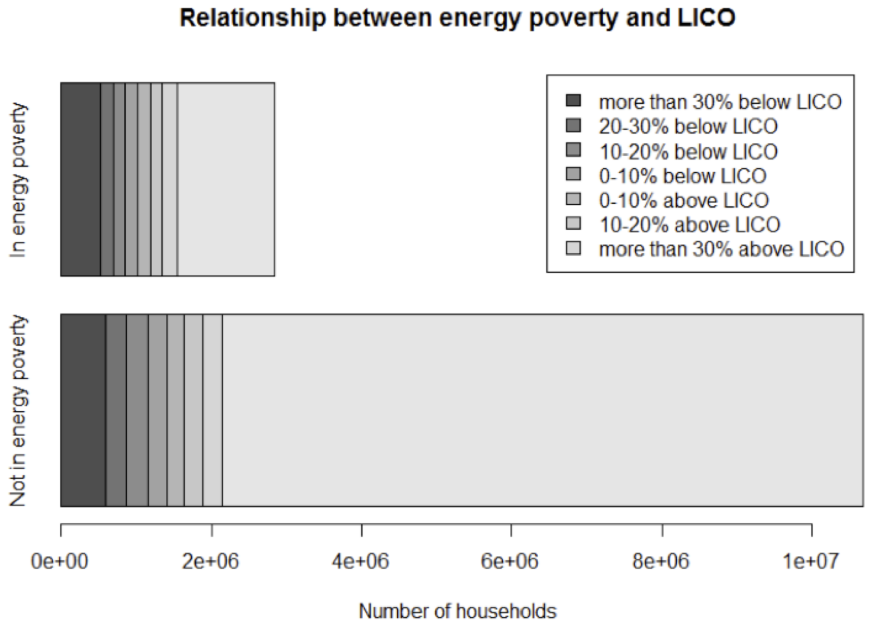

Figure 3.1: Energy poverty and distance from poverty line

To further elaborate on the differences between income and energy poverty, Table 3.5 presents the break down of several demographic categories in each cell in the two by two matrix above. This table

Demographic categories	Total numbers	Neither low-income nor in EP	In EP but not low-income	Low-income but not in EP	Both low-income and in EP
Single Parents	834,333	57%	16%	15%	13%
Couples with children	3,670,064	80%	9%	5%	5%
Households with seniors	3,440,280	60%	21%	11%	7%
Lone senior households	1,244,720	42%	20%	24%	14%
Seniors only households	2,318,654	54%	22%	15%	9%
Renters	4,363,600	58%	5%	29%	9%
Renters whose rent does not include energy bills	1,906,741	61%	11%	13%	16%
Households in government subsidized housing	477,479	19%	5%	62%	15%

Table 3.5: Percentage of households in different demographic categories according to their placement in the 2 x 2 matrix of low-income and energy poverty

suggests that the main differences between those who are in energy poverty or are low-income (but not both) are with regards to seniors, where more seniors tend to be in energy poverty than have low-incomes (with the exception of the lone senior category) and more importantly, with regards to renters, who are more likely to be low-income than in energy poverty. Because renters tend to live in apartment buildings (66% of renters live in high or low rise apartment buildings compared to 8% of non-renters), they tend to use less energy, and thus not find their energy expenses as burdensome as those who live in single detached dwellings (which is the most common type of dwelling in Canada). This last observation reveals housing tenure to be a distinguishing feature of the two categories of 'low-income' and 'facing higher energy burdens' when treated as mutually exclusive categories. In fact, Table 3.6, below, further demonstrates the make up each of the cells in the 2 by 2 matrix according to housing tenure.

What these explorations collectively point to is that when energy poverty is defined as it is here, it distinguishes itself from (income) poverty by becoming a lower-middle class issue (median income for households who are in energy poverty is around $44,000 annually, which is more than double the $17,000 annual income of those who are low-income but not in energy poverty). The majority of those who suffer from energy poverty, then, tend to own[2] their dwellings (which are often larger and single-detached), but spend a disproportionately large portion of their income on maintaining it at comfortable

[2]with or without mortgage

Housing Tenure	Total numbers	Neither low-income nor in EP	in EP but not low-income	low-income but not in EP	both low-income and in EP
Owned with mortgage	4,812,813	79%	15%	1%	5%
Owned without mortgage	4,219,949	69%	21%	2%	9%
Rent	4,363,600	58%	5%	29%	9%
Occupied rent-free	117,647	48%	26%	16%	10%

Table 3.6: Percentage of households in different housing tenure categories according to their placement in the 2 x 2 matrix of low-income and energy poverty

temperatures.

Of course, this is not to suggest that low-income households do not suffer from energy poverty — 1 million households, in fact, are both low-income and in energy poverty. However, addressing the experience of energy poverty for low-income households should primarily focus on increasing incomes, which will reduce the relative burden of securing energy services as well as other necessities. Increasing incomes and reducing inequality will address the part of the problem of energy poverty which is primarily a problem of low incomes. However, to address the part of the problem which is more a function of the energetic performance of the house and its appliances, a different set of actions is, perhaps, recommended. Next section, more specifically explores factors that may contribute to the experience of energy poverty in Canada.

3.4 Energy poverty models

Having identified an appropriate threshold for energy poverty, and having teased it apart from (income) poverty, I develop a logistic model of energy poverty as a function of the key socio-demographic, geographic and household infrastructural variables in this section. I develop this model in three stages, first only accounting for socio-demographic variables, next adding geography, and lastly adding household infrastructural variables. Table 3.7 summarizes the results of the logistic regression models that corelate these various factors to being in energy poverty.

The literature on energy poverty suggests that certain socio-demographic groups are more at risk of being in energy poverty. The study of energy poverty in BC by the Canadian Centre for policy alternatives, for example, suggest that

	model 1: socio-demographics				model 2: model 1 + geography				model 3: model 2 + housing variables			
	Estimate	Std. Error	t value	Pr(> |t|)	Estimate	Std. Error	t value	Pr(> |t|)	Estimate	Std. Error	t value	Pr(> |t|)
Demographic variables												
(Intercept)	1.5E+00	1.7E-01	8.9E+00	<2E-16***	9.4E-01	1.9E-01	5.0E+00	6.8E-07***	-8.2E-02	2.6E-01	-3.2E-01	7.5E-01
Before taxes income	-5.2E-05	3.9E-06	-1.3E+01	<2E-16***	-5.6E-05	4.3E-06	-1.3E+01	<2E-16***	-6.1E-05	4.9E-06	-1.3E+01	<2E-16***
Size of Households	1.8E-01	5.5E-02	3.2E+00	1.3E-03**	1.5E-01	5.9E-02	2.6E+00	9.6E-03**	-5.3E-02	7.2E-02	-7.4E-01	4.6E-01
Single Parents	1.8E-01	1.6E-01	1.1E+00	2.7E-01	1.9E-01	1.6E-01	1.2E+00	2.4E-01	2.0E-01	1.7E-01	1.2E+00	2.3E-01
Couples with children	-4.9E-02	1.7E-01	-3.0E-01	7.7E-01	-1.4E-02	1.8E-01	-7.8E-02	9.4E-01	2.0E-01	1.9E-01	1.0E+00	3.0E-01
Households with children under 3	3.2E-02	1.9E-01	1.7E-01	8.7E-01	8.1E-03	1.9E-01	4.2E-02	9.7E-01	1.4E-01	1.9E-01	7.0E-01	4.8E-01
Households with seniors	-9.1E-02	1.2E-01	-7.7E-01	4.4E-01	-9.4E-02	1.2E-01	-7.5E-01	4.5E-01	-7.5E-02	1.2E-01	-6.1E-01	5.5E-01
Households with a member with a disability	4.3E-01	1.0E-01	4.1E+00	3.9E-05***	3.0E-01	1.1E-01	2.7E+00	6.1E-03**	3.3E-01	1.1E-01	3.0E+00	3.2E-03**
Housing costs	1.4E-05	7.2E-06	1.9E+00	5.5E-02.	1.5E-05	8.0E-06	1.9E+00	6.5E-02.	1.7E-05	8.6E-06	2.0E+00	4.4E-02*
Renters	-3.9E+00	2.3E-01	-1.7E+01	<2E-16 ***	-4.1E+00	2.4E-01	-1.7E+01	<2E-16***	-3.3E+00	2.6E-01	-1.2E+01	<2E-16***
Renters whose rent does not include energy	2.9E+00	2.2E-01	1.3E+01	<2E-16***	3.3E+00	2.3E-01	1.4E+01	<2E-16***	3.1E+00	2.4E-01	1.3E+01	<2E-16***
Households with seniors who rent	-9.2E-01	2.4E-01	-3.8E+00	1.3E-04***	-7.8E-01	2.4E-01	-3.2E+00	1.3E-03**	-6.4E-01	2.4E-01	-2.6E+00	8.3E-03**
Geographic variables (Quebec is reference for province)												
Newfoundland and Labrador					1.3E+00	1.5E-01	8.5E+00	<2E-16***	1.2E+00	1.5E-01	8.0E+00	2.6E-15***
Prince Edward Island					2.0E+00	1.9E-01	1.1E+01	<2E-16***	1.9E+00	2.0E-01	9.8E+00	<2E-16***
Nova Scotia					1.4E+00	1.4E-01	9.9E+00	<2E-16***	1.3E+00	1.5E-01	8.7E+00	<2E-16***
New Brunswick					1.2E+00	1.4E-01	8.9E+00	<2E-16***	1.1E+00	1.4E-01	7.9E+00	1.0E-14***
Ontario					1.1E+00	1.4E-01	8.4E+00	<2E-16***	1.1E+00	1.4E-01	7.6E+00	8.3E-14***
Manitoba					3.5E-01	1.4E-01	2.5E+00	1.4E-02*	1.7E-01	1.5E-01	1.1E+00	2.6E-01
Saskatchewan					1.2E+00	1.5E-01	7.9E+00	1.1E-14***	9.7E-01	1.6E-01	6.1E+00	1.2E-09***
Alberta					1.3E+00	1.6E-01	8.0E+00	3.4E-15***	1.2E+00	1.7E-01	7.0E+00	6.2E-12***
British Columbia					-8.9E-02	1.6E-01	-5.7E-01	5.7E-01	-3.7E-03	1.7E-01	-2.2E-02	9.8E-01
Rural Households					5.2E-01	1.1E-01	4.6E+00	5.0E-06***	2.7E-01	1.2E-01	2.2E+00	2.5E-02*
Housing quality variables												
Number of rooms in the house									5.0E-01	5.9E-02	8.6E+00	<2E-16***
Single-detached houses									7.4E-01	1.3E-01	5.8E+00	1.0E-08***
Dwelling in need of major repairs									4.5E-01	1.4E-01	3.3E+00	9.3E-04***
Period of construction for dwelling									-7.3E-02	2.8E-02	-2.6E+00	9.4E-03**
Over-crowding									-3.9E-02	3.2E-01	-1.2E-01	9.0E-01
Residual Deviance			0.6795				0.6407				0.5991	

Table 3.7: Logistic models of energy poverty

> Energy poverty is more prevalent among certain types of households, including single parents (mostly female), seniors, and young adults, all of whom are more likely to be renters and live in older and less energy-efficient housing stock (Lee et al., 2011, p.13).

However, this claim does not seem to be substantiated by other data or references to other research. In fact, when considering only socio-demographic variables (model 1), with the exception of households where a member lives with a disability none of the household types investigated here are significantly associated with being at an increased risk of energy poverty. What does seem to be significant is income (the higher the income the lower the likelihood of being in energy poverty, obviously), the size of the household (the more members in a household the higher the likelihood of being in energy poverty) and various housing tenure type variables. Higher total housing costs seems to be marginally significant in increasing chances of being in energy poverty. Renters as a whole group are less likely to be in energy poverty than non-renters — however, renters for whom none of the energy costs are included in rent are at an increased risk indeed. The interaction term for the variables 'seniors' and 'renters' also suggests that seniors that rent their accommodations are significantly less likely to be in energy poverty. What this investigation of the socio-demographic variables suggests is that patterns of energy poverty in Canada, at least, do not align with categories of households typically thought to be more vulnerable to the experience.

The addition of geographical variables to the model confirms that rural households are indeed more likely to be in energy poverty than their urban counterparts. Furthermore, this model is in line with the incidents of energy poverty in each province laid out earlier.

Finally, the addition of housing variables suggests that every additional room in the house increases the log-odds of being in energy poverty by 0.5. Furthermore, taking account of this variable (here used as a proxy for the size of the house) does not render the effect of rurality insignificant, but reduces the magnitude of its estimate, suggesting that rural households are at an increased risk of energy poverty at least partially because rural houses tend to be larger. This model also reveals that single detached dwellings as well as those in need of major repairs are, unsurprisingly, at a higher risk of energy poverty. Furthermore, living in newer buildings decreases the odds of being in energy poverty.

Over-crowding[3] seems to have no significant effect on chances of being in energy poverty.

[3] Over-crowding is defined by the Canada Mortgage and Housing Corporation (CMHC), according to the National Occupancy Standard (NOS), as a situation in which not enough bedrooms are available in the house. Enough bedrooms means

3.5 Conclusion: energy poverty in Canada

Given the key exclusions of First Nations communities and Northern Canada, the picture of energy poverty that emerges from this exploration using expenditure-based metrics suggests that energy poverty is a problem somewhat distinct from poverty through the influence of housing infrastructural variables. In fact, based on this analysis it would seem that the majority of those who are suffering from higher energy burdens have incomes more than 30% above the LICO-based poverty lines — these are often households who own their single-detached houses, which tend to bigger, and for some in need of major repairs (though not necessarily older). The often mentioned demographic groups of single parents, seniors and households with small children do not seem to be at a significantly higher risk of energy poverty.

Geographically, incidences of energy poverty are higher in the maritimes, followed by provinces that have deregulated or semi-deregulated electricity markets (Alberta and Ontario). Quebec, British Columbia and Manitoba (incidentally, provinces that primarily rely on large crown corporation owned hydro facilities for the production of their electricity) have the lowest incidences of energy poverty in southern Canada. Rural households, regardless of their home province, have higher chances of experiencing energy poverty.

However, I would like to reiterate that this picture is inherently incomplete. Not only does it exclude communities that we have reason to believe face the highest energy burdens[4], but also in its focus on expenditure-based measures discounts the experience of households who intentionally under-heat their homes to manage their energy bills. The use of consensual measures of energy poverty, such as subjective indicators of whether households feel they can afford to maintain comfortable temperatures in their homes, would improve analyses of energy poverty by giving full weight to the experience of this group. The following chapters aim to expand on this rough analysis by considering non-expenditure based measures and delving deeper into the processes that create energy poverty.

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one bedroom for: "each cohabiting adult couple; each lone parent; unattached household member 18 years of age and over; same-sex pair of children under age 18; and additional boy or girl in the family, unless there are two opposite sex children under 5 years of age, in which case they are expected to share a bedroom. A household of one individual can occupy a bachelor unit (i.e. a unit with no bedroom)" (CMHC, 2014).

[4]For urban First Nations communities, the combination of lower incomes and the reliances on predominantly single-detached homes constitute an exacerbating factor. For, Northern, remote and rural communities the additional cost of energy on a per unit basis, as well as often colder temperatures would increase burdens of access to energy services